

**Understanding how mHealth Tools Can Support Care Coordination between Older Adults,
and Healthcare Providers: A Scoping Study**

by

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Author's Declaration

I hereby declare that I am the sole author of this thesis. This is a true copy of the thesis, including any required final revisions, as accepted by my examiners.

I understand that my thesis may be made electronically available to the public.

Abstract

Background & Objectives: There is growing interest in the use of health information technologies to support care planning and communication between patients and care providers. This study aimed to: i) review the literature for mHealth tools supporting care coordination; and ii) use these data to inform a consultation process with older adults and primary care providers.

Methods: This scoping study used the methodology of Arksey & O'Malley (2005), as supplemented by Levac and colleagues (2010). The consultation included three focus group interviews (n = 11 older adults; n = 6 caregivers) and five individual interviews (n = 4 providers; n = 1 caregiver). Interviews were audio-recorded and transcribed verbatim and analyzed using thematic content analysis (Braun & Clarke, 2006), supported by NVivo 11 software.

Results: Scoping review findings included current mHealth challenges, existing features, and supports for tool implementation and use. The consultation process identified that appointment details, a paper version and training were priorities for older adults and tracking medications, symptoms and goals were important for providers.

Conclusions: This study confirmed that older adults and providers have an interest in using mHealth tools. This study also highlighted the value of engaging older adults and providers in tool development. These data will inform the development of an mHealth tool to support care coordination.

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Dedication

I dedicate my thesis work to my parents, Ronald and Jacqueline Fernandes and brother, Earl Fernandes.

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1. Introduction and Overview

Older adults often see multiple healthcare providers when faced with numerous chronic conditions (Lorig et al., 1999). Though an interdisciplinary approach is often necessary for the care of these conditions, the dynamics among large care teams can become complex (Ruggiano, Shtompel, & Edvardsson, 2015). As older patients receive care from a variety of settings, patients' and their families are often found to be some of the only consistent variables between settings (Spragins and Lorenzetti, 2008). Older patients are often left to deal with issues such as conveying the same information repeatedly, being sent for duplicate tests and last minute changes to appointments or treatments (Spragins & Lorenzetti, 2008). Care coordination practices are important to facilitate the interactions between an older adult and their healthcare providers (Tricco et al., 2012). The Agency for Healthcare Research and Quality (AHRQ) describe care coordination as the process of managing patient care and information and relaying it to those involved in a patient's care team. The goal of care coordination is to deliver high-quality and high-value healthcare by meeting patients' needs and preferences (Agency for Healthcare Research and Quality, 2014). A common example of care coordination practice is communicating between hospital-based physicians and primary care physicians. If care coordination between these settings is unsuccessful, this can lead to adverse events such as medication errors, missed test results and patient harm (Jones et al., 2015). Therefore, care coordination is a complex and challenging process, including multiple phases, requirements, decisions, and levels of engagement (Ruggiano et al., 2015).

There is a push from researchers and policy makers to involve technology to enable older adults to play a greater role in coordinating their care by managing their own conditions and the communication with their care team (Matthew-Maich et al., 2016). Older adults recognize that

technology may help maintain independence and are willing to use technologies for a wide variety of purposes, such as maintaining social connections, seeking information, promoting their health and wellness, and others (Mitzner et al., 2010). There is also a trend of accessing the internet through mobile devices and handheld tablet devices instead of laptops or personal computers (Barnard, Bradley, Hodgson, & Lloyd, 2013).

The World Health Organization (2011) describes mobile health (mHealth) as a component of eHealth that uses mobile devices such as mobile phones, patient monitoring devices, personal digital assistants (PDAs) and other wireless devices to support medical and public health. mHealth has been recognized to have many benefits. The WHO states that mHealth technologies are easy to use, have a broad reach, are accepted widely and can increase access to health information, services and skills. mHealth can also support positive changes in health behaviours and disease management (World Health Organization, 2011). In 2005, the World Health Assembly encouraged their Member States to include eHealth into health systems and services because of its ability to strengthen systems, improve quality, safety and access to care (World Health Organization, 2011). The research to help policy and practice is relatively new, with the increasing new technologies being developed (Matthew-Maich et al., 2016).

This project investigated mHealth technologies that were created for supporting care coordination between older adults and their healthcare providers through a scoping review. The features, barriers and facilitators to implementation were assessed in the scoping review. In addition to the required five steps of a scoping review outlined by Arksey and O'Malley (2005), the optional consultation phase was completed as a sixth step of the scoping study with the key stakeholders of this study: (1) older adults; (2) healthcare providers; and (3) family caregivers.

These findings of this study informed a co-design process of an mHealth tool supporting care coordination through self-management.

1.1 Background

The concept of care coordination has received increasing attention in the research field, with limited focus on what successful care coordination means (Bisantz et al., 2016). To date, care coordination research has largely focused on the role of healthcare providers rather than the older adult or patient (Chumbler, Mann, Wu, Schmid, & Kobb, 2004; Fairchild, Hogan, Smith, Portnow, & Bates, 2002; Ruggiano et al., 2015). Older adults can be active participants in their health and disability services and thus, an increase in self-management practices should be a focus of the healthcare system and research. Self-management practices for chronic diseases are important and often missing from care coordination models for older adults who receive home and community-based services (Ruggiano et al., 2015). Patient and family-centered home-based health care for effectively managing chronic diseases has been promoted by researchers and policy makers (Ruggiano et al., 2015).

The concept of self-management is related to health promotion and patient education programs (Lorig and Holman, 2003). Patients can be active participants in their treatment (Creer et al., 1976). In particular, patients with chronic diseases can be responsible for their daily care. Corbin and Strauss (1988) indicate three sets of tasks that relate to self-management: (1) medical management of the condition, (2) maintaining, changing and creating new meaningful behaviours or life roles, and (3) dealing with emotions associated with having a chronic condition (Lorig and Holman, 2003). Self-management must focus on the specific problems a patient encounters. For instance, a person living with arthritis may have a major concern of pain and therefore a self-management program should focus on pain management. Implementing self-

management programs into the healthcare system is a challenge requiring further exploration (Lorig and Holman, 2003).

Technology adoption among older adults is often a concern (Mercer et al., 2015). In countries such as Canada, Australia and America, older adult use of technologies, such as, computers, mobile phones, tablets and smartphones have been increasing (Research Center Pew, 2015; Statistics Canada, 2013; Australia Bureau of Statistics, 2014). Since technologies are constantly being updated and created, they follow a trend of being used more frequently by younger rather than older people (Barnard et al., 2013). Additionally, most research has focused on the younger populations and this is a poor indicator of older adult use (Free et al., 2013). This trend where developers assume older adults lack technological access and literacy compared to younger populations is known as the digital divide (Grindrod et al., 2014; Olphert & Damodaran, 2013). Older adults often have an intention to learn about technologies, which can lead to a desire to purchase or borrow technologies to experiment (Barnard et al., 2013). This trend could change if older adults are able to receive training in technology to increase their comfort levels with technology (Barnard et al., 2013). Three out of four older adults indicated needing assistance with learning to use mobile devices (Research Center Pew, 2015).

Older adults recognize that technology can play a role in supporting self-management practices. Technologies for research on diseases, healthcare providers, or for, health monitoring and maintenance appeal most to older adults (Mitzner et al., 2010). Additionally, older adults are willing to use technologies for maintaining their independence and for purposes such as, supporting social connections, seeking information, and promoting their health and wellness (Mitzner et al., 2010).

In accordance with the theory of diffusion of innovations by Rogers (2010), older adults may be less likely to adopt new technologies unless the benefits of using them are clear (Vaportzis, Clausen and Gow, 2017). Additionally, the literature reports that older adults may be likely to use technology when the usefulness and usability outweigh feelings of incompetency (Heinz et al., 2013; Vaportzis, Clausen and Gow, 2017). Some other issues to consider include inconvenience, security and reliability issues (Barnard et al., 2013).

Two key aspects of technology use and non-use are: (1) technology acceptance or having the intention to use technology and (2) product usability. The user's attitudes, norms and the perception of control affect the intention to use technologies (Barnard et al., 2013). Product usability considers the users' capabilities and the ease of use of technologies. For instance, a user may be unwilling to engage in the technology if they find it difficult to use and do not like the system (Barnard et al., 2013). Individuals, attitudes and perceptions as well as environmental factors influence technology adoption and use. Environmental factors include hardware, software, people, interactions and context of use (Barnard et al., 2013). To address technology use, the technology acceptance model (TAM) developed by Davis (1989) is an important model to consider for the development of technology and will be discussed further in the methods section.

1.2 Study Rationale

This study was conducted as part of a Canadian Frailty Network-funded project, "Transforming primary health care for older Canadians living with frailty". The transformative grant has a focus on improving primary care for older adults in Canada. A sub-project in this grant is to create an mHealth tool that can assist older adults and their family caregivers in

coordinating their care with their healthcare providers in primary care settings. This study initiated the co-design of the mHealth tool.

Older adults are found to be interested in mobile tools to help prevent and manage disease (Accenture, 2013; Barrett, 2015). However, since much of the research on the digital divide focuses on the younger, generic and ideal user, focusing research on older adults and their practices and perceptions of mHealth is necessary (Mercer et al., 2015).

The literature shows considerable pilot work in the field of mHealth and technology (Matthew-Maich et al., 2016). This study explored this pilot work and added to it by completing additional research. The first step was to build an understanding of what current mHealth tools exist to support care coordination for older adults. The next steps were to identify any gaps current mHealth tools could not fill in the care coordination process and how a new mHealth tool may help fill these gaps.

This study was part of a co-design process undertaken in an effort to increase the usability of the prospective tool. Co-design allows communication and cooperation between different groups, disciplines and organizations (Steen, Manschot, & Koning, 2011). This type of collaboration enables the cooperation between individuals from different disciplines. This project brought together perspectives from academia, older adults, healthcare providers, caregivers and technology design. Benefits of collaboration for the purpose of innovation include the potential to create higher satisfaction with the end product. (Steen et al., 2011). The creative process is iterative, meaning that the refining of ideas at every stage will be common as a part of good design practice. The stages from a service design perspective are: (1) Discover; (2) Define; (3) Develop; and (4) Deliver (Design Council, 2007). This project focused on the first phase, representing the start of the project. In the Discover phase, designers find the user needs and lay

the foundation for the next three stages (Design Council, 2007). User research is one way to carry out the Discover phase. In user research, researchers assess current uses of products and services, areas for improvement and innovation, as well as opportunities for new products and services to meet the needs of the user (Design Council, 2007). Therefore, this study carried out user research as the Discover phases to identify current mHealth tools, gaps and how these gaps can be filled with the creation of a new tool.

1.3 Study Objectives and Research Question

The purpose of this study was to initiate a co-design process for an app to support care coordination between older adults and healthcare providers. This was done through a scoping review and consultation phase consisting of individual and focus group interviews. The research question addressed was: *What mHealth tools currently exist to support care coordination for older adults living in the community and what are their existing and desired features and implementation issues?*

The following were objectives of this study:

1. Identify existing mHealth tools that support care coordination between older adults and their healthcare providers and any present gaps in the literature through a scoping review.
2. Identify and compare the features, barriers and facilitators to the implementation of the mHealth tools found in the literature.
3. Prioritize features of existing mHealth tools found in the literature and discover what key stakeholders would find useful in an mHealth tool using a consultation with older adults, healthcare providers and caregivers.

2. Methods

2.1 Study Design

This study used the scoping review study design outlined by Arksey and O'Malley (2005) as supplemented by Levac and colleagues (2011). Arksey and O'Malley were some of the first researchers to develop a framework for scoping studies and they encouraged other researchers to supplement their framework (Daudt, VanMossel, & Scott, 2013). Scoping studies involve mapping key ideas in a research area, its main sources, and types of available evidence (Arksey & O'Malley, 2005). This definition was originally created by Mays and colleagues (2001) and was the basis of Arksey and O'Malley's framework.

There are four purposes for conducting a scoping review. This study focused on three of these purposes: (1) to look at the extent, range and nature of research areas; (2) to summarize and disseminate research findings; and (3) to identify any research gaps within the literature (Arksey & O'Malley, 2005). This project summarized the literature on current tools to inform the development of an mHealth tool and to identify any gaps that can be addressed in the later parts of this project. For the purpose of this project, a gap was defined as barriers to implementation identified in the literature. Barriers to implementation can include cost or design that prevent user adoption.

Scoping studies identify all relevant literature regardless of study design (Arksey & O'Malley, 2005). The steps outlined by Arksey and O'Malley (2005) include: (1) identifying the research question; (2) identifying relevant studies; (3) study selection; (4) charting the data; (5) collating, summarizing and reporting the results and (6) an "optional extra" consultation with stakeholders. While Arksey and O'Malley (2005) suggest that the sixth step is optional, other

researchers, such as, Levac and colleagues (2011) and Daudt and colleagues (2013) consider it essential to the scoping study methodology. This thesis project included consultation to add rigour and enrich the data from the scoping review.

This thesis project involved: (1) scoping review of the literature, and (2) qualitative consultation. For simplicity in this document, mHealth and app are used interchangeably.

Phase 1: Scoping Review

2.1.1 Identifying the Research Question

This study investigated the research question: *What mHealth tools currently exist to support care coordination for older adults living in the community and what are their existing and desired features and implementation issues?*

The research question defined its parameters as the features and implementation issues of the mHealth tools (Arksey & O'Malley, 2005). Levac and colleagues suggest that researchers keep the scoping study purpose in mind when developing the research question in order to provide a clear rationale to complete the study and support the subsequent scoping study steps (Levac, Colquhoun, & O'Brien, 2010). Accordingly, the purpose of this project was to identify existing mHealth tools and their implementation issues. Developing an understanding of the existing tools, along with their barriers, facilitators and features provided a foundation for the subsequent steps of this project.

2.1.2 Identifying Relevant Studies

This study searched both academic and grey literature. Arksey and O'Malley (2005) suggest using different sources to identify primary studies and reviews that answer the research question. In order to be comprehensive, studies should include research evidence in electronic

databases, reference lists, hand-searching of key journals, existing networks, relevant organizations and conferences. Study limitations must be clearly outlined and should not compromise the ability to answer the study's research question or meet the study purpose (Levac et al., 2010).

This project used a systematic search strategy to identify relevant literature to mHealth solutions that support care coordination for community based older adults. The search strategy was developed by the student researcher and supported by the expertise of the research librarians at the University of Waterloo. The keywords were based on the research questions main concepts: (1) mHealth; (2) coordination of care; and (3) older adults (see Appendix A for full search strategy). The databases searched were: PubMed, EMBASE, CINAHL, Scopus, Cochrane Database of Systematic Reviews, CHI (Human Computer Interaction (HCI)) and PsycINFO. The search included articles in English published between January 2004 and May 2017. Peer-reviewed scientific journals were also included in this review.

To supplement the academic literature, grey literature search was conducted. Grey literature often includes policy and research relevant information from accessible authoritative sources and can offer valuable information about a topic. Grey literature is important for a comprehensive review to account for lag periods between research and publications, unpublished research, and to limit bias. There is no 'gold standard' for a rigorous systematic grey literature search (Godin, Stapleton, Kirkpatrick, Hanning, & Leatherdale, 2015). In this study, grey literature search methodologies included targeted website browsing and searching. The keywords from the systematic search strategy used were: mHealth, coordination of care and older adults. Grey literature was searched in the following resources: CADTH Grey Matters and Google search (See Appendix A for grey literature search methods). In CADTH Grey Matters, the health

technology assessment section was used for all countries to find relevant articles. The first eight pages of Google results were searched for relevant articles.

This study included a search of English language articles with a time frame of January 2004 to May 2017 to fulfill the criteria of appropriate time span and language (Arksey & O'Malley, 2005). This time frame was chosen as mHealth was becoming more prominent with the World Health Organization's (WHO) global survey on eHealth in 2005 (World Health Organization, 2011). In addition, a similar scoping study to this project conducted by Matthew-Maich and colleagues (2016) included a search with a date range of 2005 to 2016. The time frame incorporated the data included in the initial global survey and widened the scope of the work done by Matthew-Maich and colleagues (2016).

2.1.3 Study Selection

Arksey & O'Malley recommend developing a procedure to eliminate articles that do not answer the study's research question. The research question outlined specific inclusion and exclusion criteria to ensure consistency in decision-making. Inclusion criteria can relate to the intervention type, care recipient group and carer group. During the study selection step, the title and abstracts were screened first to look for the inclusion and exclusion criteria. Furthermore, in the study selection step, a group of at least two researchers are recommended to discuss the inclusion and exclusion criteria and review relevant abstracts that arise from the search (Daudt et al., 2013; Levac et al., 2010).

This study used inclusion and exclusion criteria developed by the researcher and reviewed by the researcher's supervisor. Inclusion criteria were developed based on the research question before the search began. Inclusion criteria included mHealth or eHealth tools, which

were on a smartphone, mobile device, tablet or web-based software. The target population was male and female adults aged 65 and older. Studies with the mean age of 60 or older were also included in this study if the technologies were relevant to care coordination and have been trialed on older adults over the age of 65. This study included articles that mentioned older adults who were living in the community. Articles published from January 2004 to May 2017 were included, as outlined above. Last, this study included peer reviewed English articles only within the databases indicated.

Exclusion criteria were developed as the search took place (Arksey & O'Malley, 2005). Studies were excluded if the study population was younger than the age of 65 or mean age of 60, or if the article focused on older adults living in long-term care homes or hospitals. For purposes of this study, telehealth or mHealth solutions used for diagnostics, imaging or monitoring purposes were not included; these include home technologies or technologies specifically for exercise promotion (See Appendix B for the chart of inclusion and exclusion criteria).

The search strategy was used in each of the identified databases (see appendix A for individual search strategies). Articles that appeared in the search were imported into the RefWorks software. Duplicates were removed first and then the inclusion and exclusion criteria were applied during the title and abstract search. The articles that met the inclusion criteria from the title and abstract review underwent a full text review for a full representation of the articles. The search criteria were subject to modification based on the review phase (Levac et al., 2010).

2.1.4 Charting the Data

This study organized the data in Microsoft Excel as suggested by Daudt and colleagues (2013). Two charts were used to support the organization of the data. The data were synthesized

by charting the material according to key issues and themes. This included a mixture of general and specific information about the study and research question. This enabled the information to be understood and contextualized by the readers (Arksey & O'Malley, 2005). The first chart included general information about the articles and contained the following headings: (1) author(s) and year of publication; (2) publication type or study design; (3) study location; (5) disease/condition; (6) device used (tablet/smartphone or computer); (7) innovation end-user (8) older adult involvement in the development; and (9) stage in which the end user was involved in the study. The second chart included information more specific to the research question and included the following headings: (1) author and year of publication; (2) barriers to development or implementation; (3) facilitators to development or implementation; (4) features of the tool (Table 2 for first chart and appendix U for second chart).

2.1.5 Collating, Summarizing and Reporting the Results

Since this was a scoping study, it differed from systematic reviews by presenting an overview of the literature rather than appraising the literature. The extracted information from the literature went through an analysis. This study applied Levac and colleagues (2010) suggested three steps of analysis: (1) analyzing data, which can include descriptive and thematic analysis with software; (2) reporting results to address the research study's purpose; and (3) applying meaning to results to a broader context. This study applied the results to a broader context of the CFN transformative grant by informing the co-design and development of an mHealth tool.

In the first step, a descriptive analysis and thematic analysis was completed, as outlined by Levac and colleagues. The descriptive analysis incorporated the first chart's data, which included study location, publication type/study design, disease/condition, end-user, device used

and if older adults were involved in the development. The thematic analysis covered the data in the second chart including barriers to development or implementation, facilitators to development or implementation, and features. The excel spreadsheet was imported into NVivo 11 which was then coded and then themed. The second step summarized the findings in accordance with the study's outlined purposes. In this step, relevant mHealth tools that support care coordination for older adults and healthcare providers were identified. Next, these data were used to inform a consultation phase with key stakeholders to confirm the data in the literature.

Phase 2: Consultation

2.1.6 Consultation with Stakeholders

Arksey and O'Malley classify the sixth step of a scoping review – consultation with stakeholders - as optional, however, researchers such as Levac and Daudt with their colleagues argue this step is essential because it adds methodological rigour (Daudt, Mossel, & Scott, 2013; Levac et al., 2010). A formal consultation methodology does not exist and therefore, Levac and colleagues (2010) recommend that if researchers choose to consult about their findings, they must be clear on the purpose. Levac and colleagues (2010) suggest using preliminary findings from stage five to develop a framework, themes or list of findings to share with key stakeholders to build on the evidence and to offer a deeper understanding of the study topic. Other considerations are recruitment strategies and methods for data collection and analysis. Data collection methods can include individual or focus group interviews, surveys or other methods. By taking on a consultation, this prepares researchers for knowledge translation of preliminary findings, which may ultimately assist with the development of dissemination strategies with key stakeholders (Levac et al., 2010).

Some purposes of the consultation phase include sharing preliminary findings with stakeholders, validating findings, or informing upcoming research (Levac et al., 2010). The purpose of the consultation phase in this study was to gather insight from key stakeholders to inform and initiate a co-design process for a novel mHealth tool. Preliminary findings from the systematic search were shared with all the participants through a questionnaire and interviews. Researchers interviewed stakeholders from three perspectives: (1) older adults, (2) family caregivers, and (3) healthcare providers.

2.2 Sampling and Recruitment Strategy

2.2.1 Study Sample

A purposive sampling approach was used to recruit participants for this study. The aim of purposive sampling was to include participants with a particular set of characteristics that can help develop an understanding of the specific research topic (Etikan, Musa & Alkassim, 2016). Purposive sampling can identify an information-rich sample in qualitative research. This includes selecting individuals or groups that are knowledgeable about the topic of interest and willing to participate and communicate their opinions and experiences for the study (Etikan et al., 2016).

The purposes of this project sample were to: (1) gather perspectives from older adults, healthcare providers, family caregivers and technology experts, (2) include both urban and rural perspectives, and (3) capture a perspective of those with cognitive impairment. The target population for this mHealth tool was older adults living in the community. Older adults were defined as persons aged 65 or older, spoke English, provided their own consent, and were living in the community accessing primary care services. Family caregivers were persons of any age who have taken on the role of caring for an older adult living in the community. Healthcare providers included persons of any age who had the role of primary care provider, such as family

doctors, nurse practitioners or specialists. This study also included the perspective from a technology expert at the eHealth Centre of Excellence.

This study conducted focus group interviews with older adults and caregivers, and individual interviews with healthcare providers and a technology expert. Individual interviews were conducted with healthcare providers because they often have time restrictions. It was a challenge to get multiple providers free at the same time. Therefore, individual interviews were found to be most fitting for this study. This study included individual interviews with five healthcare providers, one caregiver and one technology expert and four focus group interviews (four to six participants each) with older adults and caregivers (Krueger & Casey, 2000). This totalled 26 participants. The researcher recruited from both urban and rural sites. The Waterloo-Wellington region served as the urban site and Kawartha Lakes was the rural site. This sample size is similar to that of a previous consultation done as a part of a scoping study by O'Brien and colleagues (2010), which was adequate for the information needs of that study. Additionally, this was also realistic to complete within the timeframe of a Master's level Thesis.

2.2.2 Participant Recruitment

The recruitment strategy included key gatekeepers or contacts to help recruit peers (Green & Thorogood, 2013). Gatekeepers helped in the recruitment process by facilitating access to participants. In this study, the gatekeepers were program coordinators from the recruitment sites. The program coordinators organized the meetings with groups of individuals and informed them that a researcher was attending one of their meetings. Study details were provided to the gatekeepers through the information letter and a recruitment poster to help explain the project to interested participants. Participants were from the study sites involved in the overall CFN transformative grant. This specifically included Kawartha Lakes Community Care Health & Care

Network, Waterloo-Wellington Dementia Advisory Group, NewVision Family Health Network, Seniors Helping as Research Partners Group and the eHealth Centre of Excellence. Since the researcher was connected to these locations due to the grant, the researcher worked with the organizers of each group to identify interested participants who were willing to participate in the study. This involved a recruitment poster and recruitment script. The recruitment poster was used at each study site and interested participants were asked to contact the researcher or gatekeeper (Appendices E, F & G). The researcher followed the recruitment script when contacted by interested participants (Appendices H, I and J).

2.3 Qualitative Methods

Individual and focus group interviews are the most common qualitative research methods (Gill, Stewart, Treasure, & Chadwick, 2008). Interviews and focus groups with healthcare providers, family caregivers and older adults were used for the consultation data collection step in this project. Individual interviews allowed for detailed data collection about their participants' thoughts, attitudes, beliefs, and knowledge (Lambert & Loiselle, 2008). A focus group allowed for interactions between participants to form data through discussion. Focus group interviews enable a range of perspectives to emerge (Hollander, 2004).

The semi-structured method of interviewing was used because it has flexibility. Semi-structured interviews involve several questions that help define areas to be explored and leaves room for the participants to add their own insight to the interview (Gill et al., 2008). This helped develop an understanding of some of the current practices used for care coordination and what types of features participants are looking for in an mHealth tool (Gill et al., 2008). The semi-structured interview guides for this project are included in Appendices K & L. These consisted of open-ended, neutral, sensitive and understandable questions (Gill et al., 2008). The interview

guide began with a question to get the participants comfortable and then moved into more detailed questions, as suggested by Gill and colleagues (2008).

2.3.1 Interview Procedure

Individual interviews were conducted either face-to-face in a convenient and comfortable location for the participant, or on the phone. Interviews should be carried out in a place that is free from distractions and at a time and location suitable for participants (Gill et al., 2008). All interviews were conducted by the student researcher along with a member of the research team for any anticipated support. The student researcher worked with the gatekeeper to determine a location to carry out the focus groups that was accessible and agreed upon by the participants. Prior to conducting the individual and focus group interviews, informed consent was obtained. The interviews started with distributing letters of information and a consent form (Appendices M, N, O, P, Q and R). The researcher went through the letter of information with the participants to outline details about the study and notify the participants that they were to be audio recorded. Interviews and focus group data were audio recorded and transcribed verbatim. Field notes were taken in each interview or focus group. In this project, both individual interviews and focus groups were semi-structured. At the end of the interviews, interested participants received a feedback letter with contact information of the researcher (Appendix S). The participants filled out the feedback letter to provide their contact information if they were interested in receiving the study's results at the end of the study.

2.3.2 Individual Interviews

Individual interview methodology outlined by Gill and colleagues (2008) was followed. The researcher oriented themselves with the interview guides so that the interview flowed

naturally. They listened actively, were mindful of body language and gave feedback to understand the full experience of the participants. At the end of the interview, the interviewer thanked the participants (Gill et al., 2008).

2.3.3 Focus Group Methodology

This study used the focus group methodology outlined by Krueger and Casey (2000). Small focus groups, also known as mini-focus groups (four to six participants), were used for this study. The advantages of smaller groups are that it is easier to recruit and host and they are more comfortable for participants. The disadvantage is the small group may limit the total range of experiences. To address this disadvantage, this study used multiple small focus groups to account for the varying perspectives.

Each focus group began with orienting the participants to the topic and creating a positive environment. This study used Krueger and Casey (2000) recommendation of the following steps in the introduction: (1) the welcome; (2) the overview of the topic; (3) the ground rules; and (4) the first question. The interview guide for this study started with an introduction to the study in simple language that was easy for the participants to understand and was followed by going around the room with an opportunity for participants to introduce themselves to get comfortable (Krueger & Casey, 2000)(Appendix G). Throughout the focus group, the interviewer was prepared for breaks in the flow of the discussion, being able to pause and probe the participants and give cues such as head nods and short responses. The end of the focus group asked a final question to investigate if anything was missed and a cue card was handed out so participants could anonymously write any additional thoughts down (Krueger & Casey, 2000).

2.3.4 Qualitative Data Analysis

The thematic content analysis approach described by Braun and Clarke (2012) was used to analyze the qualitative data. Thematic analysis identifies, analyzes and reports patterns within data. Additionally, the themes that come from the data can be used to organize and describe the data set in rich detail. Braun and Clarke (2006) describe thematic analysis as the first qualitative analysis method that researchers should learn with its ability to offer transferable skills for other qualitative analysis methods. In this context, this helped a student researcher build a valuable knowledge base on qualitative research that will assist in future research. Additionally, thematic analysis is a flexible method as it can be applied in many approaches and brings forth rich, detailed and complex data. This approach can be used within different theoretical frameworks, as it is not bound to a pre-existing theory. Thematic analysis can be essentialist, realist, constructionist or contextualist (Braun & Clarke, 2006). The most fitting method for this thesis project was contextualist since is in between essentialism and constructionism to account for reality and making meaning of participants' experiences and the influence social context has on these. This project looked to understand participants' experiences with care coordination and technology in order to build an app that will meet their needs.

The six-phase process of thematic analysis outlined by Braun and Clarke (2006) was used in this study. The six phases include (1) familiarizing yourself with the data, (2) generating initial codes, (3) searching for themes, (4) reviewing themes, (5) defining and naming themes, and (6) producing the report.

Step 1: Familiarizing yourself with your data

The researcher transcribed the data and then read the transcripts over. During this process, initial themes were recorded. These are present in Appendix W.

Step 2: Generating initial codes

The researcher imported all transcripts into NVivo 11, which were then coded systematically. Figure 1 represents a code extract from the coding process in NVivo 11.

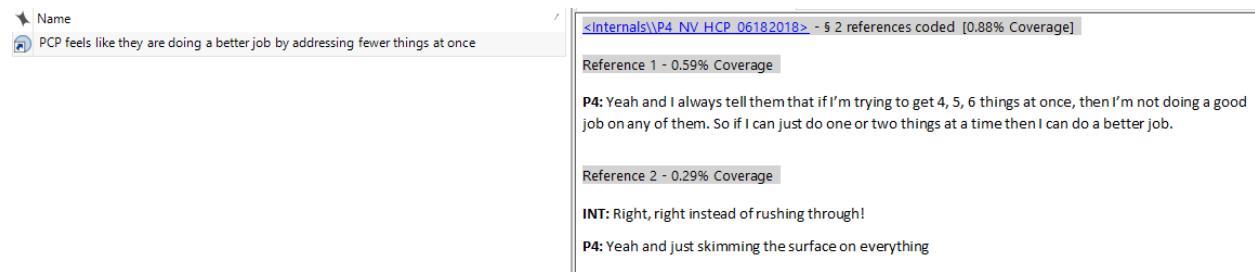


Figure 1: Code extract from step 2 of Braun and Clarke's (2006) thematic analysis

Step 3: Searching for themes

Once all the transcripts were coded, a node summary from NVivo 11 was printed out, laid out on a large table and searched for patterns in the codes. The codes were then organized into themes based on similarities of the data.

Step 4: Reviewing themes

In this step, the initial themes were confirmed by summarizing their encompassed codes and represented the data set with another researcher. Thematic “maps” were created for each of the codes. Figure 2 shows an example of one thematic map, the remaining thematic maps can be found in Appendix W.

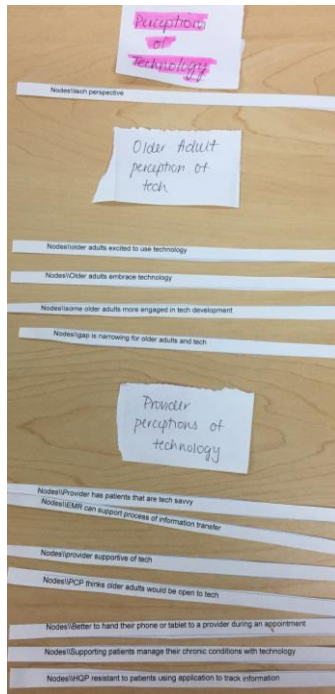


Figure 2: Example of a thematic map [Braun and Clarke, 2006 adapted from Braun and Wilkinson, 2003]

Step 5: Defining and naming themes

After the themes were finalized, a definition of each theme and a summary table were developed, which appears in appendix Y.

Step 6: Producing the report

The report is presented in the format of this thesis document. Themes and quotes are explained in the results section of this thesis.

2.4 Quantitative Methods

2.4.1 Questionnaire Methodology/Rationale

Additional data collection included a questionnaire that also acted as a summary of the scoping review findings (Appendices R & S). The questionnaire included features identified in the literature and asked the participants to rate them on a 5-point scale, 1 being not interested and

5 being very interested. A 5-point scale was used as it is the most common Likert scale (Lehmann & Hubert, 1972) and participants would likely be familiar with this format. 5-point scales offer more internal reliability and extra discriminating power than a 3-point scale (Croasmun and Ostrom, 2011). A 5-point scale also allows for a mid-point which may reduce response bias (Fernandes & Randall, 1991). Although a 7-point scale may increase reliability, since the questionnaire was 55 questions, a 5-point scale may have been less intimidating to study participants. At the end of the interview, participants were given 10 minutes to complete this questionnaire. For those who choose to do a phone interview (n = 4), an online version was available for participants to complete. This was given to the participants after the interview questions were completed to limit bias in their answers to the interview questions.

2.4.2 Quantitative Data Analysis Plan

The data from the questionnaire was entered into an Excel spreadsheet and each of the 11 sections and 60 questions were averaged then ranked based on mean ratings. Standard deviations were calculated based on sample variance and reported as an indicator of consensus. If there was a missing data point for a question, it was excluded from the analysis. The ranked features were considered priorities to include in an app.

2.5 Technology Acceptance Model (TAM)

This project drew upon the technology acceptance model (TAM) by Davis (1989) to support the development and implementation of this tool. The TAM is a widely used model to predict use and acceptance of information systems and technologies from an individual user perspective (Surendran, 2012). The TAM is based on the social psychological model, Theory of Reasoned Action (TRA) by Fishbein and Ajzen (1975). The TRA is a general model that

explains a person’s behaviour and is determined by his or her behavioural intention. A person’s behaviour is a function of a person’s attitude and subjective norm in relation to the behaviour (Davis, 1993). Two constructs exist in the TRA: (1) attitude toward the object and (2) attitude toward the behaviour (Fishbein and Ajzen, 1975). The TAM focuses on the attitude towards the behaviour of using a system (Davis, 1993). As shown in Figure 3, a user’s attitude toward using a system relates to whether or not they use it. Attitude in the TAM forms two key beliefs, perceived usefulness and perceived ease of use. These two components determine users’ attitudes, intentions and actual system adoption behaviours (Davis, 1993). Perceived usefulness is “the extent to which a person believed that using the system will enhance his or her job performance,” whereas perceived ease of use is, “the extent to which a person believes that using the system will be free of effort.” (Davis, 1993 p. 477). Davis (1993) found that perceived usefulness has a strong effect on attitude toward a behaviour. Additionally, the effect from perceived ease on attitude is mostly from its impact on perceived usefulness (Davis, 1993). This project looked at older adult adoption of an mHealth tool through finding themes that fit within the model’s constructs, increasing perceived usefulness and perceived ease of use.

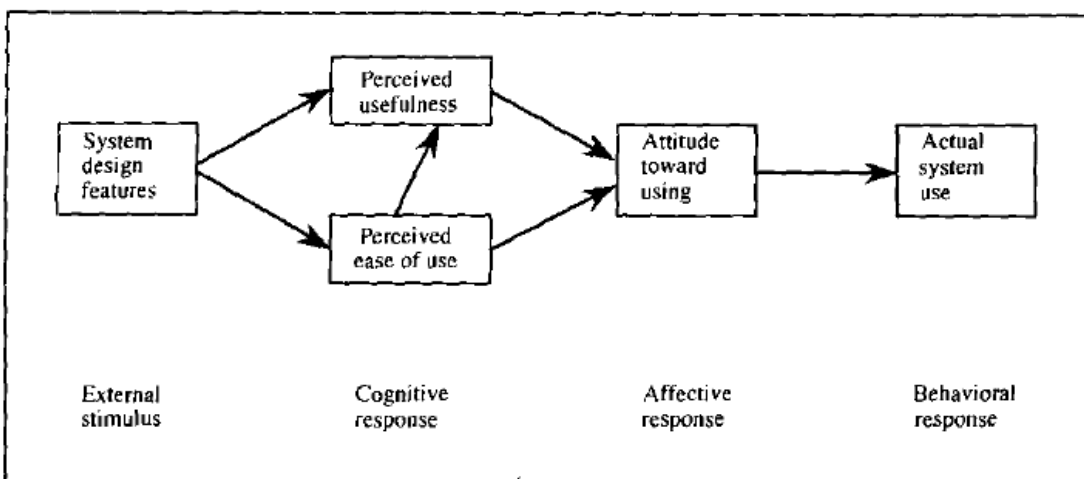


Figure 3: Technology Acceptance Model [From Davis 1993, adapted from Davis 1989]

2.6 Ethical Considerations

The study obtained ethics clearance from the University of Waterloo Research Ethics Committee, ORE #22515 (Appendix T).

The researchers for this study were mindful of ethical issues that arose throughout the study. Informed consent was obtained from all participants in this project (i.e., family caregivers, older persons and healthcare providers). This procedure aligned with the Tri-Council Policy Statement on Ethical Conduct for Research Involving Humans (Canadian Institutes of Health Research, Natural Sciences and Engineering Research Council of Canada, & Social Sciences and Humanities Research Council of Canada, 2010). The consent process ensured participants were informed about the nature of the study in their decision to participate. The consent forms were handed out at the beginning of the interviews, focus group or workshop (See Appendices N, O and P). Participants were able to withdraw from the study without any implications.

Special consideration was given to the focus group that involved participation of persons with Dementia in the Waterloo-Wellington Dementia Advisory Group. To ensure that proper consent was attained from these participants, extra caution was taken. The researcher attempted to gain consent from the individuals themselves first. They started an initial conversation to understand the participant's sense of the study's aims, and their appreciation for the risks and benefits of their participation in the study. Each consent form also had space for a proxy signature in case they required their caregiver to sign on their behalf. This group consisted of persons with dementia and their caregivers. The questionnaire was given to each patient and caregiver so that they could work together to understand the content of the questionnaire. Additionally, for people that were unable to provide their own consent, verbal assent was requested.

Information and data collected during the interviews will remain confidential. The audio recorded data, verbatim transcripts and field notes were locked in a filing cabinet or on a secured network and will remain anonymous. The data are only accessible to members of the research group. Names of the participants are not disclosed in the data. Information will be destroyed after five years.

The researcher worked to be respectful of the participant's perspectives throughout the study and to ensure their views were accurately represented. A feedback letter was provided to the all participants in this study (See Appendix Q).

2.7 Data Saturation

Starks and Trinidad (2007) explain saturation as when the data fully represent the range of perspectives. This means the codes or themes that emerge from the data exemplify the theory under study rather than using the data to develop or refine a theory. This study did not have the purpose of developing a theory but rather understanding mHealth tools through the literature and consultation. Another perspective explains data saturation as the point during interviews where the researcher feels the participants' perspectives are fully captured (Saunders et al., 2018). This can be identified through information redundancy or hearing the same points repeatedly during data collection (Legard et al., 2003). This study used these two perspectives to accomplish data saturation through incorporating a rich and thick sample and data triangulation.

The researcher aimed to provide a rich and thick sample, which relates to saturation (Dibley, 2011). Rich means quality of data and thick is quantity of data (Fusch and Ness, 2015). The researcher aimed to reach a rich and thick sample through a purposive sampling approach. A rich sample was achieved through incorporating the perspectives of older adults, healthcare

providers, caregivers and a technology expert. To achieve a thick sample, the study included perspectives from 26 participants. While interviewing this sample, the researcher noticed that the same comments were being heard from the participants, indicating that saturation had been reached for this phase of the project (Saunders et al., 2018).

This study also used data triangulation through using multiple methods to collect and analyze data (Denzin, 2009). Data triangulation is directly linked to data saturation (Fusch and Ness, 2015). In this study, the researcher used a scoping review with descriptive and thematic analysis and a consultation with quantitative analysis and thematic analysis. Using multiple methods of data collection and analysis in this project helped to build an understanding of the data and it was found that there were a number of overlapping themes in each stage of the project. After data collection and analysis, the researcher felt that the data fully supported the purpose of this study.

The researcher felt that through employing multiple approaches, that data saturation had been achieved. The consultation revealed eight main themes that overlapped with the preceding literature review. Some overlapping themes that emerged were types of health variables to track, the need for training and education, and implementation strategies. Each theme presented in the consultation was informative and helped to answer the research question. Including a rich and thick sample in the consultations helped the researcher achieve saturation through information redundancy (Saunders et al., 2018). This project was able to provide a knowledge base and understanding to set up a co-design process for creation of an app.

2.8 Reflexive Standpoint

An important part of qualitative research is reflexivity during the data collection and analysis processes (Russell & Kelly, 2002). Birks and colleagues (2014) describe reflexivity as how a researcher's prior assumptions and experiences may shape the data collected during the research process. Since research is an iterative process, it requires reflexivity. Reflexivity involves looking at how research can be impacted at all points of the research process and how the researcher may be influenced as well (Russel & Kelly, 2002).

My interest in exploring technology supporting care coordination in primary care comes from other projects I had the opportunity to explore in my master's program. Since starting my Master's degree in 2016, I have been involved in a project that focused on patient engagement for older adults in both primary and community care settings. In this role, I learned the importance of older adults being involved in making decisions surrounding their healthcare. Additionally, working with the Geriatric Health Systems research group, I became aware of the lack of communication and coordination between older adults in the community and health care providers. I had to be aware of my experiences knowing about the care coordination and patient engagement processes in this thesis project.

In this project, I brought the perspectives of a student coming from a public health background with previous experience in health care systems, research methods, and health sciences. Research methods and health science knowledge stems from my undergraduate studies in the Health Studies program as well as course work in my Master's studies. Knowledge in health care system research comes from my role as a research assistant in the Geriatric Health Systems (GHS) research group run by Dr. Stolee. Here, I participated in various projects that

involve older adults and their experiences with health care. As a knowledge facilitator, I had the opportunities to present my research at workshops, conferences and student training programs.

In this project, I was conscious of the perspectives I was bringing to the research and how it may have affected the results. The knowledge I brought to this project served to strengthen my methods. It also played a role in my interest in pursuing this research. Additionally, learning about technology has not been something I had prior experience with so I had to go into that aspect with a blank slate. In order to help mitigate these biases, I had frequent meetings with the project managers, and research team involved. During the data analysis process, I thoroughly read all transcripts and took a step back from putting my biases onto the data by involving other researchers in the process. I also had the opportunity to run the themes by other members to identify how my biases were affecting my interpretation of the data. This helped me stay true to what the participants were telling me to build an understanding of what should go into an mHealth tool.

2.9 Methodological Rigor

There are four domains of rigour and trustworthiness: *credibility, dependability, confirmability, and transferability* (Lincoln and Guba, 1985). However, not all can be ensured in each research study (Hadi & Closs, 2016). In order to ensure rigour and trustworthiness, Creswell (2006) recommends that at least two strategies should be used in a qualitative research study. This study will concentrate on audit trail, prolonged engagement and peer debriefing.

Audit Trail

In order to support confirmability, an audit trail was used during the research process. An audit trail is a detailed description of the entire research process (Lincoln & Guba 1985). This

allows for a reader or second researcher to follow along with the research process as well as to understand and confirm the logic and decision-making (Cacary, 2009). The researcher documented all research activities aligning with the six categories of an audit trail. Table 1 displays the six categories discussed by Halpern (1983) and how each were completed throughout this study.

Table 1: Locations of supporting documents for audit trail

Category	Category achieved through
Raw data	<ul style="list-style-type: none"> • Extraction table • Transcriptions • Excel spreadsheet of questionnaire data
Data reduction and analysis products	<ul style="list-style-type: none"> • Appendix W – Thematic analysis process
Data reconstruction and synthesis products	<ul style="list-style-type: none"> • Appendix W – Thematic analysis process
Process notes	<ul style="list-style-type: none"> • Appendix W - Thematic analysis process • Methods (Chapter 2)
Materials relating to intentions and dispositions	<ul style="list-style-type: none"> • Reflexive standpoint (2.8)
Instrument development information	<ul style="list-style-type: none"> • Appendices A to W (e.g. search strategies, inclusion/exclusion criteria, interview guides, questionnaires, thematic analysis etc.)

Prolonged Engagement

The process of prolonged engagement enables a researcher to increase rapport with their study participants. This allows for the researcher to achieve more in-depth information from respondents and to identify pertinent characters in the community concerning the issues studies and to ensure the topic is explored comprehensively. Prolonged engagement promotes credibility (Hari & Closs, 2016). This study had prolonged engagement with older adults from the Seniors

Helping as Research Partners (SHARP) group in Waterloo. This group includes older adults and caregivers that the partner with the Geriatric Health Systems research group on their research.

The SHARP group will have a chance to participate in this project's next steps.

Peer Debriefing

Peer debriefing is known as “analytic triangulation” and is where the researcher discusses their research process with a peer that is not directly involved in the research project (Hadi & Closs, 2016). Having a peers input can assist meaningful questioning of the researchers interpretations, provoke critical thinking and provide a different perspective to the study. This enhances credibility and trustworthiness (Hadi & Closs, 2016). For research students, a peer debriefing can exist between the student and their supervisor, presentation of research findings at conferences, regular discussions with qualitative experts and presenting preliminary findings to interested groups (Hadi & Closs, 2016). Peer debriefing in this project was completed through discussions with the researcher's supervisor, mentors, and research colleagues not involved in the project as well as presentation at conferences.

3. Results

The results are presented first with the scoping review results followed by the consultation results. The scoping review results include a PRISMA diagram (figure 4), an extraction table of the numerical data (table 2), followed by summaries of the descriptive data and thematic analysis (table 3). The consultation includes a summary of the questionnaire data (tables 4 and 5) followed by a summary of the thematic analysis (table 6).

3.1 Phase 1: Scoping Review

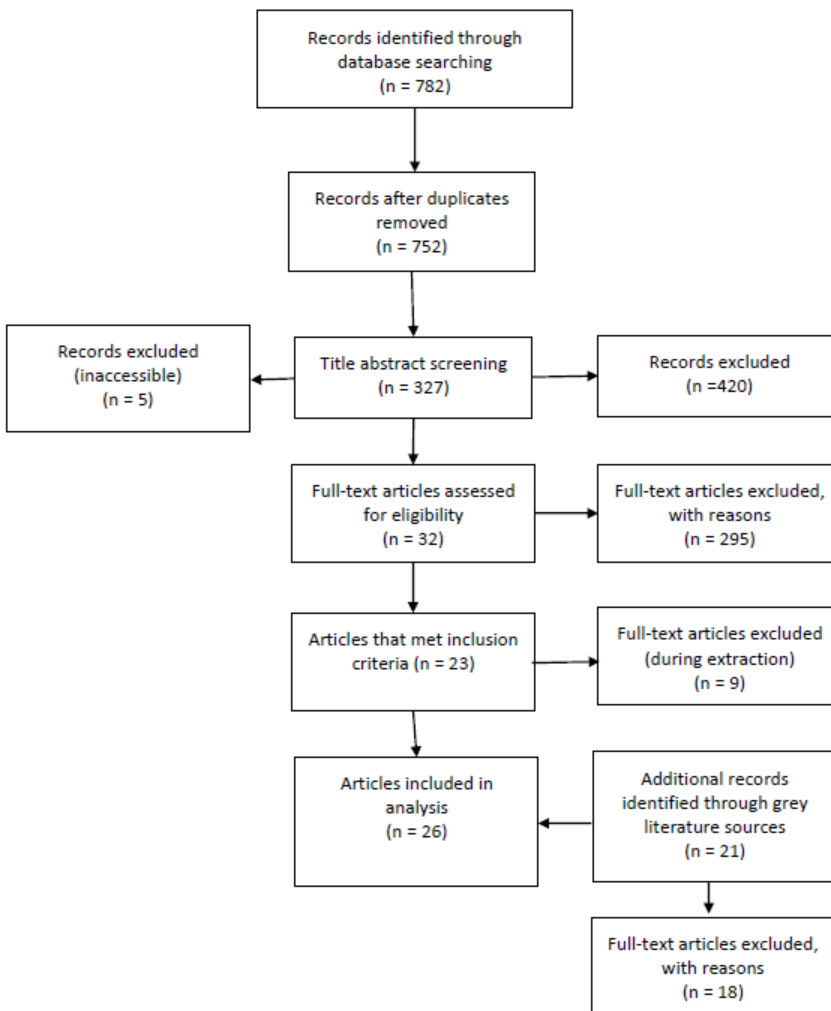


Figure 4: PRISMA Diagram for Scoping Review Process [Adapted from: Moher et al., 2009]

Table 2: Descriptive data from scoping review on mHealth technologies supporting care coordination for older adults

Author, Year	Publication Type/Study Design	Study Location	Disease/Condition	Device used (tablet/phone/computer)	End-User	Older adult involved in development	Stage of involvement
SYSTEMATIC DATABASE SEARCH							
Clemmensen et al., 2005	Clinical Trial	Denmark	Myocardial infarction	Handheld computer	Cardiologist	No	N/A
Nguyen et al., 2013	Randomized clinical trial	US	COPD	Computer or smartphone	Older adult	Yes	Testing stage
Villani et al., 2014	Randomized, parallel open study	Italy	Heart failure	Handheld PDA	Older adult	Yes	Testing stage
Ho et al., 2016	RCT	Taiwan	COPD	Computer	Older adult	Yes	Testing stage
Nazi et al., 2014	Cross sectional survey (randomized)	US	Not specified	Computer (website)	Older adult	Yes	Testing stage
Logan et al., 2017	Prospective, randomized open, blinded trial	Canada	Diabetes and hypertension	Smartphone (Blackberry) & website	Older adult	Yes	Testing stage
Faria et al., 2014	Clinical trial	Portugal	Chronic respiratory disease	Smartphone and computer	Older adult and provider	Yes	Testing stage
Stellefson et al., 2013	Systematic review	US	Chronic disease (general)	Computer (website)	Older adult	Yes	Testing stage
Robben et al., 2012	Mixed methods cohort study	Netherlands	Frailty	Computer	Older adult/caregiver and provider	Yes	Testing stage
Stroulia et al. 2012	Case study	Canada	Chronic disease (general)	Tablet	Healthcare aide	No	N/A

Steele-gray et al., 2016	Pragmatic cluster RCT & embedded case study	Canada	Chronic disease (general)	Smartphone and computer	Older adult and caregiver	Yes	Design stage
Klein et al., 2015	Cross sectional (qualitative)	US	Not specified	Computer	Older adult and provider	Yes	Testing stage
Quinn et al., 2013	Cohort study (qualitative follow-up)	Ireland	Chronic venous ulcers	Smartphone	Providers (GP and Nurse)	No	N/A
Makai et al., 2014	Cohort study (mixed methods)	Netherlands	Frailty	Computer	Older adult/caregiver and provider	Yes	Testing stage
Williams et al., 2014	Cohort study (qualitative)	UK	COPD	Tablet	Older adult	Yes	Testing stage
Ammenwerth et al., 2015	Descriptive/evaluation study	Austria	Coronary heart disease	Smartphone	Persons with CHD	yes	Testing stage
de Jong et al., 2016	Descriptive study	Netherlands	Chronic disease (general)	Smartphones, tablets or computers; (web based)	Healthcare professionals	No	N/A
Makai et al., 2014	Observational controlled before-after study	Netherlands	Frailty	Computer	Older adults, informal caregivers and healthcare professionals	Yes	Design stage
Mertens et al., 2016	Clinical trial (crossover design)	Germany	Coronary heart disease or previous	Apple iPad (tablet)	Older adult	Yes	Design stage

			MI				
Park, Cho, Kim, 2016	Clinical trial	South Korea	Chronic disease (general)	Smartphone (android)	Older adult	Yes	Design stage
Robben et al., 2015	Cohort study	Belgium and Netherlands	Health status	Tablet	Older adult, informal caregivers and providers	Yes	Testing stage
de A Melo et al., 2016	Case study	Brazil	Health status	Smartphone and tablet	Older adult	Yes	Testing stage
GREY LITERATURE							
Hall, Stellefson & Bernhardt, 2012	Not Mentioned	US	Chronic disease (general)	Computer			Not mentioned
Center for Technology and Aging, 2011	Not Mentioned	US	Chronic disease and health status	Smartphone and computer	Older adult and healthcare provider		Not mentioned
Wicklund, 2015	Not Mentioned	US	COPD	Smartphone	Older adult		Not mentioned

3.1.1 Descriptive Data

The scoping review literature search identified 782 articles and 26 met the inclusion criteria. Refer to figure 5 for the PRISMA diagram of this process. Of the 26 articles that met the inclusion criteria and went through data extraction, 23 were from academic databases and the other three were from grey literature sources.

Study Location

Studies included in this scoping review ranged from across the world. The US had the most mHealth tools (n = 6), followed by Brazil (n = 3) and Canada (n = 2). The countries are displayed in Table 1 and Figure 5.

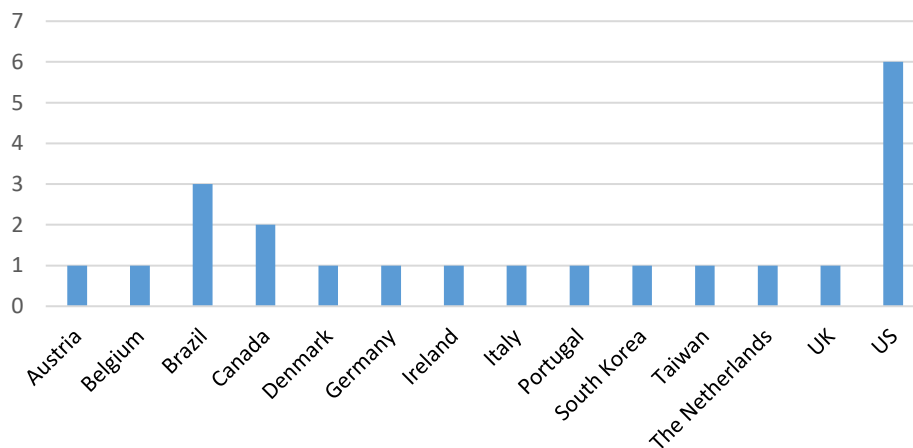


Figure 5: mHealth/eHealth tools based on study location

Disease or Condition

mHealth tools were created for a variety of chronic conditions, ranging from respiratory disease to general chronic disease. Seven articles mentioned mHealth tools developed for general chronic diseases whereas others identified mHealth tools for specific conditions. This is represented in table 1 and shown in figure 6.

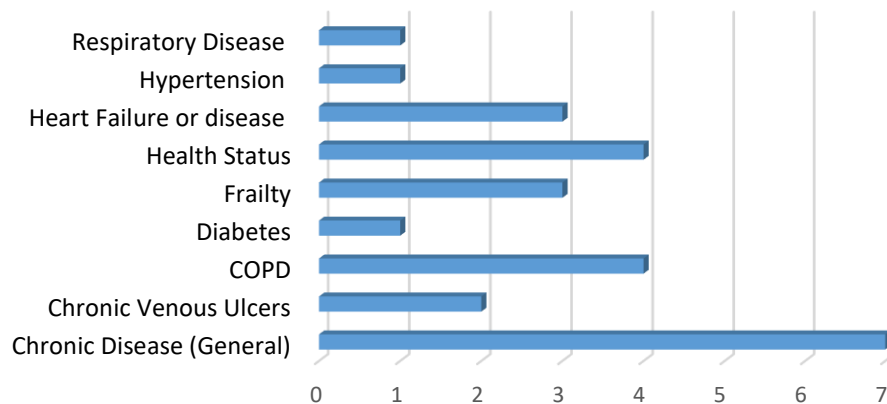


Figure 6: mHealth/eHealth tools by disease or condition

Devices

This scoping review identified mHealth tools created for a range of devices such as computers, smartphones and tablets. The most common devices were a computer or smartphone.

See Table 1 and figure 7.

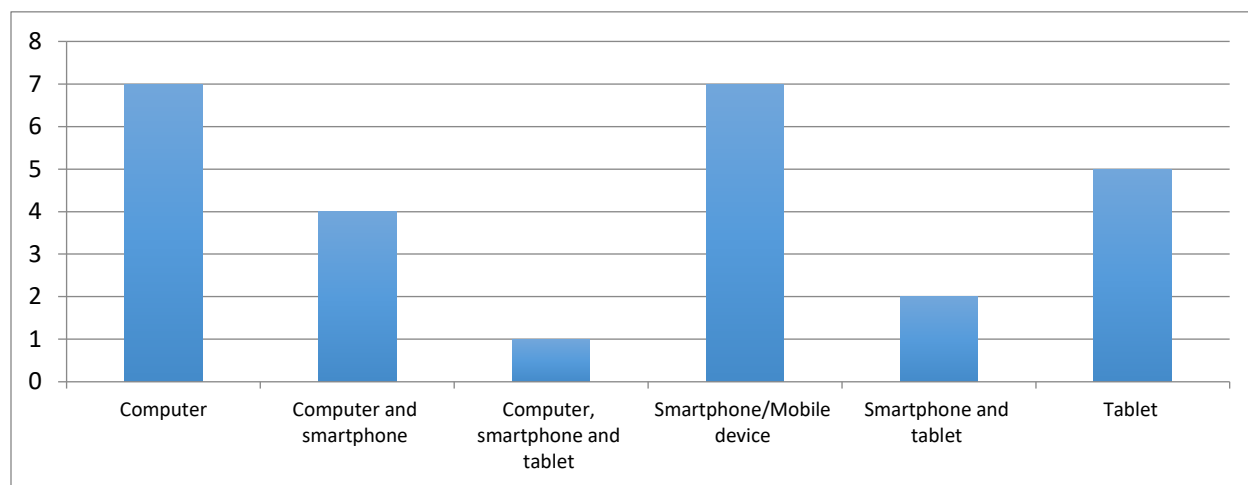


Figure 7: mHealth/eHealth tool by devices

mHealth End-User

The end-users for the mHealth tools identified in the literature ranged from either one or a combination of healthcare providers, older adults or caregivers. The most common end-user

was older adults (n = 13) and the least common was a combination of older adult and caregiver (n=1). Table 1 and figure 8 represent these data.

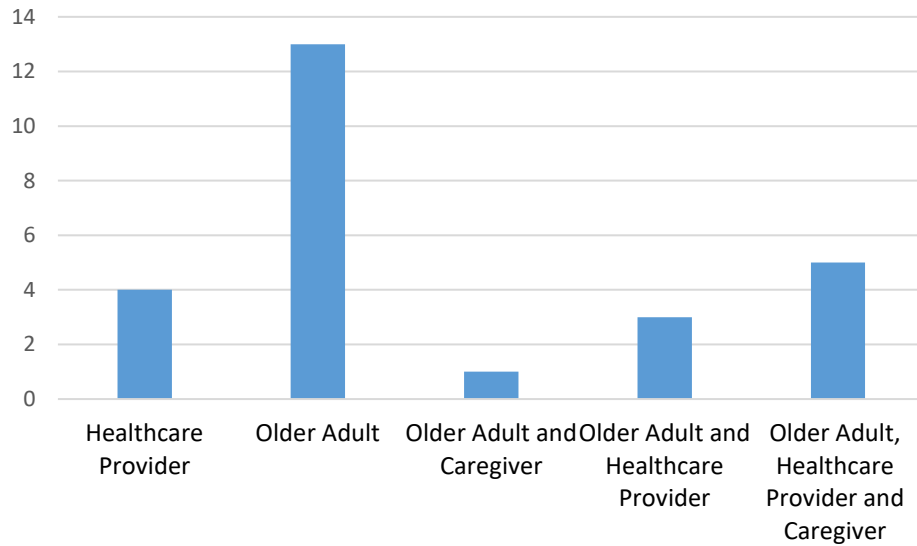


Figure 8: mHealth/eHealth tools from the literature by end-user

Older Adults Involved in the Development

Since this study utilized a co-design framework, the literature was reviewed for the involvement of end-users in the development of the mHealth tool. Nineteen tools involved end-users in their development, but the involvement was at different stages. Twelve out of the 19 tools involved the end-user in the testing stage, whereas seven involved them from the initial design stages. Table 1 and figure 9 show a summary of end-user involvement.

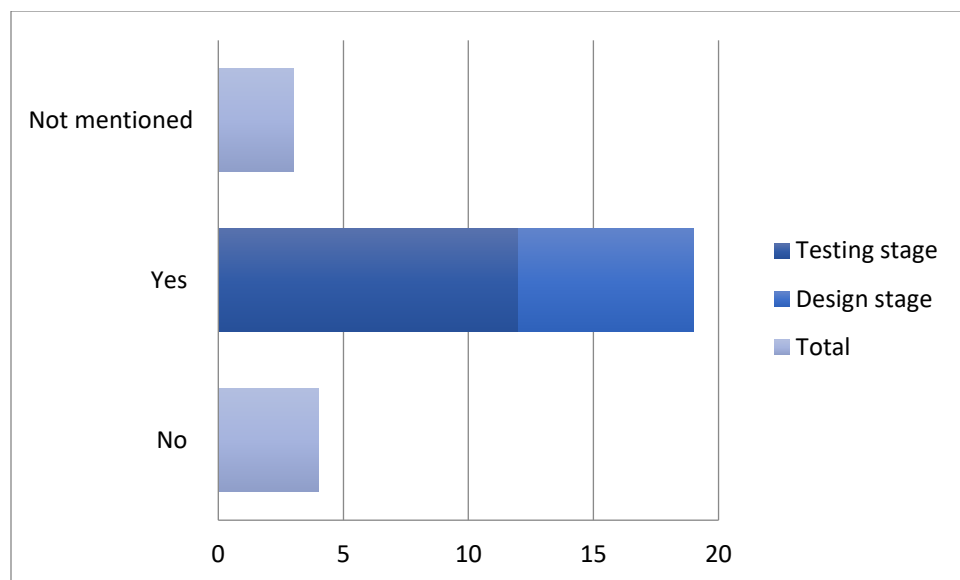


Figure 9: Involvement of older adults in the development of mHealth/eHealth tools

The descriptive analysis of the data helped build an understanding of the tools and processes involved in developing and implementing the mHealth tools. This data showed a variety of mHealth tools created for many devices. Ten articles discussed mHealth tools created for smartphones but some were limited to android or blackberry devices.

In terms of end-user involvement, seven articles mentioned having the end-user involved in the design phase, whereas the rest involved them in the later testing stages or did not mention their involvement.

3.1.2 Theme Summary

After undergoing a thematic analysis of the literature, four thematic constructs emerged. Table 3 provides a summary of the main themes and subthemes. See Appendix V for a detailed description of the themes, subthemes and nodes.

Table 3: Summary of main themes and subthemes from scoping review on mHealth technologies supporting care coordination for older adults

Theme	Description	Node Examples
Current mHealth challenges		
Gaps of existing tools	Researchers identified gaps within the literature of existing tools	<ul style="list-style-type: none"> • High development cost
System challenges in creating mHealth tools	Challenges within the system in creating mHealth tools	<ul style="list-style-type: none"> • Difficult to standardize procedures
Difficulties for patients to adopt mHealth technologies	Users identified difficulties for patients to start using an mHealth tool	<ul style="list-style-type: none"> • Difficult to target desired population
Barriers to providers adopting a mHealth tool	Some aspects of mHealth tools prevented healthcare providers from using current tools	<ul style="list-style-type: none"> • Providers not responsive to tool
Support for tool implementation /use		
Facilitators to adopting tech	End-users felt supported to adopting technology	<ul style="list-style-type: none"> • Previous experience or interest in using tech
Positive feedback/outcomes of tools	Current mHealth tool had positive aspects	<ul style="list-style-type: none"> • Flexible tool for user
Facilitators to mHealth tool development		<ul style="list-style-type: none"> • Older adult involved in development
Supplemental resources to support patient adoption	mHealth tools have supports that exist outside of the tool	<ul style="list-style-type: none"> • Training to use tool
Positive outcomes of tool use	End users had positive experiences with current tools	<ul style="list-style-type: none"> • Improvements in workload, productivity and efficiency
System support for implementation of tool	mHealth tools have strategies that support implementation of tools on the system level	<ul style="list-style-type: none"> • Included an implementation strategy
Features		
Outputs of tool for patient/user	mHealth tools give patients resources to better understand their health or facilitate self-management	<ul style="list-style-type: none"> • Medication reminders
Resources within the mHealth tool to support patient's use of the tool and their care	mHealth tools have features that support the user's ability to use the tool	<ul style="list-style-type: none"> • Alarm to remind user to input the data
Tool links to external platforms/devices	mHealth tools can connect to other devices and systems to facilitate information transfer	<ul style="list-style-type: none"> • Tool can link to EMR
Variables/health	Users can record data with an mHealth	<ul style="list-style-type: none"> • Track medications,

information patient can input in existing mHealth tools	tool	blood pressure, oxygen, symptoms, etc.
Supporting patients and their relationships		
Support for care circle	mHealth tools support patients and those in their care circle	<ul style="list-style-type: none"> • Live chats with other users and providers
Facilitating patient-provider relationships	mHealth tools can support patient-provider relationships	<ul style="list-style-type: none"> • Send data to provider before appointment
Patient autonomy	Patient autonomy can influence using an mHealth tool for self-management	<ul style="list-style-type: none"> • Patient's desire to understand health status

Current mHealth Challenges

The main theme of current mHealth challenges describes mHealth identified in the literature and the challenges that were encountered from an individual to a systems perspective. There were four subthemes present in current mHealth challenges: (1) negative feedback of existing tools, (2) system challenges in creating mHealth tools, (3) challenges for older adult patients to adopt mHealth technologies, and (4) barriers to providers adopting an mHealth tool.

Gaps of existing tools: Studies identified a number of negative aspects to existing mHealth tools. These contained characteristics such as unfit alerts, too much information in a tool, network issues, high development cost, among others (Center for Technology and Aging, 2011; Ho et al., 2016; Klein et al., 2015; Nazi et al., 2014; Stellefson et al., 2013).

System challenges in creating mHealth tools: The literature described system issues that caused difficulties in creating mHealth tools. These were a lack of evidence to support adoption, no formal evaluation process, issues with information sharing between settings and a difficulty with standardizing procedures (Center for Technology and Aging, 2011; Clemmensen et al., 2005; Klein et al., 2015; Makai et al., 2014; Stellefson et al., 2013).

Challenges for older adult patients to adopt mHealth technologies: This sub-theme describes factors that made the use of mHealth tools difficult for older adult patients. Challenges of

mHealth tools were varying user abilities, and preferences and difficulties targeting the desired population. User abilities and preferences were the users' preference for face-to-face contact, privacy concerns and fatigue effect (Robben et al., 2012; Logan et al., 2017). Some challenges with targeting the desired population included inaccessibility related to socioeconomic status (SES) or that mHealth tools may not be suited for older adults (Ammenwerth et al., 2015; Center for Technology and Aging, 2011; de A Melo et al., 2016; Ho et al., 2014; Makai et al., 2014; Robben et al., 2012; Stroulia et al., 2012; Villani et al., 2014).

Barriers to providers adopting an mHealth tool: The literature indicated some aspects that prevented healthcare providers from using mHealth tools. Specifically, providers were unfamiliar with a tool's existence or providers felt that an older patient would not understand the mechanism of an mHealth tool (Nazi et al., 2014; Faria et al., 2014).

Challenges to mHealth/eHealth tools were apparent from the level of the end-user to the level of the overall system. These data show that from an individual perspective, users are concerned about privacy issues and low levels of comfort with technology. From a systems perspective, it may be difficult to standardize a practice using mHealth tools or providers may not be supportive if they see that it complicated their current practice. This indicates that mHealth tools must be simple and fit within current practices. These challenges are important to consider and explore in greater depth through the consultation phase in order to specify which concerns need to be focused on in the development of a new mHealth tool.

Support for tool implementation and use

Supports for implementation and use of mHealth tools came up in the literature as subthemes. There were six subthemes including (1) facilitators to adopting technology, (2)

positive feedback/outcomes of tools, (3) facilitators to mHealth tool development, (4) supplemental resources to support patient adoption, (5) positive outcomes of tool use, and (6) system support for implementation of tool.

Facilitators to adopting technology: Some general aspects that helped users with technology included previous experience with technology, family caregiver support for computer literacy, an interest in technology and the care team advocating for the use of technology (Ammenwerth et al., 2015; Center for Technology and Aging, 2011; Makai et al., 2014; Park, Cho, Kim, 2016; Robben et al., 2015; Villani et al., 2014).

Positive feedback/outcomes of tools: The literature identified some positive aspects of existing mHealth tools as being accessible to the end-user, a convenient way to access health information, easy to use, and flexible (de A Melo et al., 2014; Faria et al., 2014; Ho et al., 2016; Nazi et al., 2014; Quinn et al., 2013; Robben et al., 2014; Villani et al., 2014; Williams et al., 2014;).

Facilitators to mHealth tool development: Some facilitators to mHealth tool development were the involvement of older adults and providers in the tool's development and receiving feedback during development (Makai et al., 2014 Robben et al., 2014).

Supplemental resources to support patient adoption: Some supplemental resources that helped users with mHealth tools included a paper-based version, device modifications, support line, support manual, training to use tool, and online education modules (Center for Technology and Aging, 2011; de Jong et al., 2016; Ho et al., 2016; Logan et al., 2017; Makai et al., 2014; Mertens et al., 2016; Nazi et al., 2014; Nguyen et al., 2013; Robben et al., 2012; Stroulia et al., 2012; Villani et al., 2014; Williams et al., 2014).

Positive outcomes of tool use: End-users had some positive experiences with mHealth tools including using devices in real practice, support for older patients in health improvement and shorter time for hospital admittance (Clemmensen et al., 2005; Klein et al., 2015, Stellefson et al., 2013).

System support for implementation of tool: In order to support the implementation of mHealth tools on a system level, some tools included an implementation strategy when planning the tool, international scalability, patient stratification, prioritization and population management and evidence based guidance for integration (Center for Technology and Aging, 2011; de Jong et al., 2016; Makai et al., 2014; Robben et al., 2012; Steele-gray et al., 2016;).

These data suggest ways to implement tools from the individual to the system level. The literature identified ways to support end-users to adopt and use mHealth tools. Having positive outcomes from using current mHealth tools and involving end-users in development supports a focus on the end-user when developing an mHealth tool. mHealth may also be easier to use for those with previous experience with technology. This confirmed the importance of a co-design process with the end-users. Additionally, implementation strategies are important to consider at the system level in order to fit the tool within current practices. The consultation used these data to exploring specific strategies for implementation and use for this study.

Features

mHealth tool features were classified into four different categories: (1) outputs of tool for patient/user, (2) resources within the mHealth tool to support patient's use of the tool and their care, (3) tool links to external platforms/devices, and (4) variables or health information patient can input in existing mHealth tools.

Outputs of tool for patient/user:

- Web-based electronic health record/personal health record (Centre for Technology and Aging, 2011; Makai et al., 2014; Nazi et al., 2014)
- Patient coach tools (Centre for Technology and Aging, 2011)
- Real-time coaching for patients (Centre for Technology and Aging, 2011)
- Patient stratification and prioritization and population management (Centre for Technology and Aging, 2011)
- User can view, download and print electronic file of health information (Nazi et al., 2014)
- User has control of who has access (Makai et al., 2014; Robben et al., 2012; Steele-gray et al., 2016)
- Symptom graphs for patient (Mertens et al., 2016; Nguyen et al., 2013)
- Patient-centered care plan (de Jong et al., 2016)
- Electronic diary via website for patient (Ho et al., 2016)
- Care plan support for patient (Centre for Technology and Aging, 2011)
- Case management integration (Centre for Technology and Aging, 2011)
- Audio alarm (de A Melo et al., 2016)
- Multi-disease platform management (Centre for Technology and Aging, 2011)
- Patient can buy health insurance (Centre for Technology and Aging, 2011)
- Annotation (de A Melo et al., 2016)

Resources within the mHealth tool to support patient's use of the tool and their care:

- Device modifications (Mertens et al., 2016)
- Hard copy/paper based option (Makai et al., 2014; Robben et al., 2012)
- Online education modules (Nazi et al., 2014; Nguyen et al., 2013; Robben et al., 2012; Stroulia et al., 2012; Williams et al., 2014)
- Support line offered (Center for Technology and Aging, 2011; de Jong et al., 2016; Makai et al., 2014; Robben et al., 2012)
- Training to use tool (Ho et al., 2016; Logan et al., 2017; Makai et al., 2014; Mertens et al., 2016; Nguyen et al., 2013; Robben et al., 2012; Villani et al., 2014)
- User manual for support (Mertens et al., 2016)

Tool links to external platforms/devices:

- Bluetooth to connect monitoring devices (Ammenwerth et al., 2015; Faria et al., 2014; Logan et al., 2017)
- Collects data from multiple Personal Health Devices (Park, Cho, Kim, 2016)
- Google navigation for provider (Stroulia et al., 2012)
- Integrated with electronic health record (EHR) (Klein et al., 2015; Robben et al., 2012; Park, Cho, Kim, 2016)
- Remote transmission of variables (Villani et al., 2014)
- Tool can link to google health (Center for Technology and Aging, 2011)

- Tool can link to Microsoft HealthVault (Center for Technology and Aging, 2011)

Variables/health information patient can input in existing mHealth tools:

- Record Variables such as
 - Blood pressure (Ammenwerth et al., 2015; Mertens et al., 2016; Park, Cho & Kim., 2016; Steele-gray., 2016)
 - Physiological data (Ammenwerth et al., 2015; Park, Cho & Kim, 2016)
 - Sleep patterns (Steele-gray et al., 2016)
 - Social situation (Makai et al., 2014; Robben et al., 2012)
 - Well-being (Ammenwerth et al., 2015)
 - Exercise (Nguyen et al., 2013; Steeke-gray et al., 2016)
 - Symptoms (Nguyen et al., 2013; Steele-gray., 2016; Wicklund, 2015; Williams et al., 2014)
 - Weight (Park, Cho & Kim, 2016; Steele-gray., 2016)
 - Oxygen (Park, Cho & Kim, 2016)
 - Mood (Steele-gray et al., 2016)
 - Illnesses (Center for Technology and Aging, 2011)
 - Medication (Ammenwerth et al., 2015; Center for Technology and Aging, 2011)
 - Glucose (Park, Cho & Kim, 2016; Steele-gray et al., 2016)
 - Functioning (Robben et al., 2012)
 - Immunizations (Center for Technology and Aging, 2011)
 - Vital signs (Park, Cho & Kim, 2016)
- Goal setting for patient (Makai et al., 2014; Nguyen et al., 2013; Robben et al., 2012; Steele-gray et al., 2016)
- Patient can input appointments (Center for Technology and Aging, 2011)
- Record images and files (Center for Technology and Aging, 2011; Stroulia et al., 2012)
- Tasks for caregivers (Robben et al., 2015)
- User can set metabolic target ranges (Center for Technology and Aging, 2011)
- User progress tracking (Stellefson et al., 2013)
- User records insurance information (Center for Technology and Aging, 2011)
- View member card (Center for Technology and Aging, 2011)

The list of features that emerged from the literature had a large range of functions. Some mHealth tools were able to generate outputs from the data users' inputs, such as graphs or printouts. There were a variety of supports such as training manuals and tutorials within the tools and external to the tools. Some tools were able to connect with other apps such as Google Maps or utilize Bluetooth to connect to monitoring devices. Additionally, there was a variety of information that could be tracked using the mHealth tools. These data helped create the questionnaire that was used in the consultation phase to help prioritize features in which end-

users would be most interested.

Supporting patients and their relationships

mHealth tools from the literature supported patients and their relationships through facilitating: (1) support for the care circle, (2) patient-provider relationships, and (3) patient autonomy.

Support for care circle: mHealth tools supported older adults and their care circle through features such as holding care circle contact information, a communication tool and providing alerts and supports for caregivers (Center for Technology and Aging, 2011; de Jong et al., 2016; Makai et al., 2014; Nazi et al., 2014; Nguyen et al., 2013; Robben et al., 2012; Stellefson et al., 2013; Stroulia et al., 2012).

Facilitating patient-provider relationships: Some ways mHealth tools supported a relationship between older adults and their providers included the ability to find provider information, sending data to the provider before an appointment, ability for providers to input information into the tool and an option to fill or renew prescriptions (Center for Technology and Aging, 2011; Faria et al., 2014; Logan et al., 2017; Nazi et al., 2014; Steele-gray et al., 2016; Stroulia et al., 2012).

Patient autonomy: The literature identified some ways patient autonomy influenced using an mHealth tool for self-management. These included older adults' interest and sense of control in understanding their health status and information (Nazi et al., 2014; Robben et al., 2012).

The literature indicated that mHealth has a role in supporting patients and their relationships with their providers and caregivers. mHealth supports patients and providers ability to organize health information as well as self-management practices. This shows the potential for

a new mHealth tool to support care coordination through assisting with self-management.

Therefore, the consultation interviews extended this information to investigate specific ways to support patients and their relationships with their caregivers and providers.

The scoping review identified features, supports, and negative aspects of current mHealth/eHealth tools. The negative feedback of existing tools such as high development cost, alerts not being useful or too much information in the tool are considerations that the researcher accounted for and investigated further through the consultation exercise. A consultation exercise is important to explore before development begins. System challenges show that there needs to be additional support for the implementation of the tool, such as, getting providers on board with patients and caregivers using this tool. These results informed the development of an interview guide and questionnaire to identify whether there is consistency with the literature and the interests and needs of this study's participants.

3.2 Phase 2: Step 6 Consultation

3.2.1 Questionnaire Results

Table 4 represents the questionnaire data from the consultation phase. The means of patient and caregiver ratings are compared to the mean ratings of healthcare providers. There were 11 feature categories in the questionnaire. The means were calculated for each of the 11 categories along with a mean and standard deviation value for each question, which are reported in the table.

These data show that healthcare provider and patient/caregiver priorities differed for the top three sections. Healthcare providers were most interested in the sections “my well-being” (4.67 ± 0.24), “how I will communicate with people involved in my care” (4.55 ± 0.76) and “reminders to help support memory” (4.50 ± 0.77). Patients and caregivers were most interested in “things to help use the app” (4.2 ± 1.21), “how to will I communicate with those involved in my care” (3.89 ± 1.57) and “reminders to help support memory” (3.62 ± 1.54). The commonalities between these two groups were the sections “how will I communicate with people involved in my care” and “reminders to support my memory”. The groups differed in their top choices. Healthcare providers were most interested in tracking well-being variables whereas patients and caregivers were looking for support to use the app. Both groups were least interested in the section: “I will be able to record whether or not I attended the appointment and the reasons such as...” Healthcare providers had a mean rating of 3.13 ± 1.50 whereas patients and caregivers had a mean rating of 2.43 ± 1.31 .

Table 4: Feature preference questionnaire mean ratings from participant groups

Feature	HCP (Mean, SD)	PTCG (Mean, SD)
My well-being	4.67 (0.24)	3.57 (1.58)
1. I will have the ability to document my medication list and dosage	4.80 (0.45)	3.75 (1.71)
2. I will have the ability to track my symptoms	4.60 (0.55)	3.60 (1.64)
3. I will be able to create personal health goals	4.60 (0.55)	3.31 (1.60)
I will be able to keep track of...	4.40 (0.74)	3.45 (1.31)
4. My blood pressure	4.40 (1.34)	3.80 (1.79)
5. My heart rate	4.40 (1.34)	3.69 (1.80)
6. My immunization records	5.00 (0.00)	3.65 (1.63)
7. My illnesses	5 (0.00)	4.00 (1.47)
8. My exercise	4.20 (0.84)	3.55 (1.36)
9. My friends and family involved in my care	4.40 (0.55)	3.65 (1.39)
10. My glucose levels	4.20 (1.30)	2.90 (1.89)
11. My oxygen levels	4.40 (1.34)	2.70 (1.72)
12. My general well-being/feelings	4.60 (0.55)	3.20 (1.67)
13. My health insurance information	3.80 (1.30)	3.32 (1.63)
Some things I would like to see the app do...	4.40 (0.69)	3.42 (1.45)
14. I can view a graph of my recorded symptoms	4.00 (1.00)	3.26 (1.59)
15. I will have the ability to view, download and print an electronic file of health information	4.40 (0.89)	3.26 (1.69)
16. I will be able to connect other devices to the app through Bluetooth (e.g. blood pressure monitor, scale)	4.40 (0.89)	3.06 (1.60)
17. I will be alerted if my data falls out of target range (e.g. if my blood pressure is too high)	4.40 (0.89)	3.68 (1.63)
18. I will be have the ability to give access to others (healthcare provider(s) or caregivers)	4.8 (0.45)	3.89 (1.52)
Reminders to support my memory	4.50 (0.77)	3.62 (1.54)
19. I will receive a pop-up reminder to take my medication(s)	4.60 (0.89)	3.63 (1.57)

20. I will receive a pop up reminder to input my health data into the app	4.60 (0.55)	3.68 (1.73)
21. I will receive a reminder to pop up when I choose (E.g. Talk to my (doctor, nurse, specialist, etc.) about (blood pressure, blood sugar, etc.)	4.40 (0.89)	3.58 (1.61)
22. I will receive e-mail notifications as a reminder (e.g. your cardiologist appointment is today at 12:00pm)	4.40 (0.89)	3.58 (1.61)
My Appointments	3.73 (1.42)	3.30 (1.43)
23. I will have the ability to reschedule missed appointments	3.60 (1.67)	3.26 (1.48)
24. I will have the option to rebook easily	3.60 (1.67)	3.44 (1.42)
25. I will have the ability to track who created the appointment	4.00 (1.00)	3.11 (1.53)
How to prepare for appointment	3.80 (1.03)	3.54 (1.33)
26. Wear certain clothes	3.40 (1.14)	3.32 (1.60)
27. Limit eating or drinking	3.40 (1.14)	3.68 (1.45)
28. Bring medications	4.80 (0.45)	4.16 (1.50)
29. Bring health documentation	4.60 (0.55)	4.12 (1.56)
30. Form(s)	3.60 (1.67)	3.72 (1.60)
31. Others	3.67 (2.31)	3.14 (1.88)
I will be able to request feedback after their appointment has occurred such as...(32-36)	3.76 (1.30)	2.85 (1.47)
32. I like this service	3.60 (1.34)	3.11(1.64)
33. This service is helping me	4.20 (1.30)	3.11 (1.64)
34. I don't like this service	3.80 (1.30)	2.76 (1.52)
35. I don't think this service is helping me	3.80 (1.30)	2.82 (1.47)
36. Option to enter in "other" reason	3.80 (1.30)	2.56 (1.50)
I will be able to record whether or not I attended the appointment and the reasons such as... (37-42)	3.13 (1.50)	2.43 (1.31)
37. Bad weather	2.80 (1.79)	2.56 (1.42)
38. I didn't have a way to get there	2.80 (1.79)	2.58 (1.54)
39. I was not feeling well	3.60 (1.67)	2.32 (1.42)
40. I had to take care of someone else	3.60 (1.67)	2.37 (1.34)
41. It was closed	2.80 (1.79)	2.37 (1.46)
42. Option to enter in "other" reason	3.20 (1.48)	2.47 (1.59)

I will be able to input information about the appointment such as...(43-50)	4.40 (0.77)	3.80 (1.45)
43. Appointment name (e.g. Cardiologist appointment, Dr. _____)	5.00 (0.00)	4.22 (1.52)
44. Appointment type – (e.g. referral, service)	4.20 (1.79)	3.79 (1.69)
45. Date and time	4.80 (0.45)	4.00 (1.73)
46. Location (e.g. 123 King Street West, Grand River Hospital)	4.60 (0.89)	4.06 (1.70)
47. Reason for visit (e.g. I am experiencing a lot of fatigue)	4.20 (1.10)	3.63 (1.74)
48. Notes for parking (e.g. Parking available at the back)	4.20 (1.10)	3.73 (1.69)
49. Notes for travel time (e.g. It takes 15 minutes to drive there)	4.00 (1.00)	3.63(1.68)
50. Important phone numbers (e.g. Phone number of the cardiologist is 123-456-7890)	4.20 (1.10)	4.33 (1.51)
How I will communicate with people involved in my care	4.55 (0.76)	3.89 (1.57)
51. I will be able to keep a contact list and information of all those involved in my care team (e.g. Doctor, Nurse, Specialists, etc.)	5.00 (0.00)	4.11 (1.66)
52. I will have the option to send health data to my providers before appointments	4.60 (0.89)	3.84 (1.71)
53. I will be able to give verbal instructions to the app instead of typing it	4.60 (0.89)	3.84 (1.80)
54. Online communication with my providers, caregivers and other patients (e.g. live chat, texting or e-mail)	4.00 (1.41)	3.89 (1.57)
Things that will help me use the app	3.88 (0.81)	4.20 (1.21)
55. There will be a tutorial within the app to explain to me how to set-up and use it	4.40 (0.89)	4.22 (1.44)
56. Having the option of a paper-based or hard copy version rather than online version	4.00 (0.71)	4.12 (1.27)
57. I will be able to call a telephone support line if I need help using the app or setting it up	3.80 (0.84)	4.44 (1.34)
58. I will be given a user manual with written instructions of how to use the app	3.80 (0.84)	4.28 (1.41)
59. I will be given a face-to-face training session on how to use the app	4.2 (1.10)	4.39 (1.42)
60. I will have access to an online user manual with instructions on how to use the app	3.60 (0.89)	3.83 (1.65)

Questions 61 to 65 were blank spaces for participants to record their own suggestions.

The following are suggestions from this study's participants:

- Attempt to have ALL medical information centralized by OHIP
- Tutorial must be easy to understand
- Keeping track of transfers of reports from Dr. to Dr.
- Insurance coverage (health plan) copies of payments, etc.
- Large Font
- Safety Case
- Upload excel document of current info
- Have very clear and large print
- Printable version generated by the app
- Access to view what each medication prescribed is for
- Reminder of why medication is being taken
- Contact list would allow email or text messaging - such as family members in case of emergencies
- Ability to enter tracking of food - eating habits
- Summary or results of the appointment or visit to Dr. or specialist - attached to appointment with any key details such as follow up/results in case family needs to be aware
- Link to their pharmacy
- Ideally goals of care and what to actually monitor reflects what is relevant for the patient, and that should be mutually agreed upon with the care team
- Goal attainment scaling (mutually agreed upon goals)
- Might think about a common set of options for common conditions like heart failure, warfarin dosing, blood sugars
- INR/Coumadin dosage - daily
- BG level - up to 6 times daily
- Weight - as often as twice daily
- Oxygen saturation (for those on oxygen therapy) up to twice daily

Table 5 displays the top ten mHealth feature priorities of healthcare providers in comparison to older adults and caregivers. These priorities were identified based on the mean averages from each question in the questionnaire (table 4). Older adults and caregivers were most interested in training and support to use the tool, keeping a contact list of their care team,

reminders to bring items to appointments and the ability to track their illnesses. In contrast, healthcare providers were interested in older adults bringing their medications, appointment details, contact list of the older patient’s care team, goal setting, tracking exercise, alerts if their health data is out of range, and reminders to track health information.

Table 5: mHealth feature priorities from scoping review consultation questionnaire

Rank	Healthcare provider	Mean (SD)	Older Adult/Caregiver	Mean (SD)
1	My immunization records	5.00 (0.00)	I will be able to call a telephone support line if I need help using the app or setting it up	4.44 (1.34)
2	My illnesses	5.00 (0.00)	I will be given a face-to-face training session on how to use the app	4.39 (1.42)
3	Appointment name (e.g. Cardiologist appointment, Dr. ___)	5.00 (0.00)	I will be given a user manual with written instructions of how to use the app	4.28 (1.41)
4	I will be able to keep a contact list and information of all those involved in my care team (e.g. Doctor, Nurse, Specialists, etc.)	5.00 (0.00)	Appointment name (e.g. Cardiologist appointment, Dr. _____)	4.22 (1.52)
5	My medication	4.8 (0.45)	There will be a tutorial within the app to explain to me how to set-up and use it	4.22 (1.44)
6	I will be have the ability to give access to others (healthcare provider(s) or caregivers)	4.8 (0.45)	Prepare for appointments - Bring medications	4.16 (1.50)
7	Prepare for appointments - Bring medications	4.8 (0.45)	Having the option of a paper-based or hard copy version rather than online version	4.12 (1.27)
8	Appointment details - Date and time	4.8 (0.45)	Prepare for appointments - Bring health documentation	4.11 (1.56)
9	I will have the ability to track my symptoms	4.6 (0.55)	I will be able to keep a contact list and information of all those involved in my care team (e.g. Doctor, Nurse, Specialists, etc.)	4.11 (1.66)
10	I will be able to create personal health goals	4.6 (0.55)	Appointment details - location (e.g. 123 King Street West, Grand River Hospital)	4.06 (1.70)

3.2.2 Thematic analysis results

The thematic analysis yielded eight main themes, presented in table 6. A description of each theme follows table 6.

Table 6: Summary of themes from qualitative consultation with key stakeholders

Theme	Sub Themes
System level gaps impact care coordination and self-management	<ul style="list-style-type: none"> ● Problems with information transfer between providers/settings ● Lack of standardization in care coordination practices ● Lag periods between appointments ● Short appointment times with providers ● Challenges with navigating the system
Micro-level issues impact/prevent self-management	<ul style="list-style-type: none"> ● No standard tracking method ● Patients' needs vary from simple to complicated conditions ● No equipment at home to monitor own health ● Lack of understanding of health conditions ● Provider doesn't provide all information to the patient/caregiver ● Caregiver feels burdened managing information
Older adults currently self-manage their health in various ways	<ul style="list-style-type: none"> ● Tools patients use to keep track of their health information <ul style="list-style-type: none"> ○ Spouse/caregiver ○ Memory ○ Diary/notebook ○ Pill boxes ○ Paper copies of documents
Positive experiences empower older adult patients to self-manage health	<ul style="list-style-type: none"> ● Importance of self-advocacy to get information ● Understanding health status ● Building trust/relationships with patients/providers
Technology can support self-management practice in various ways	<ul style="list-style-type: none"> ● Monitoring via devices ● Phone reminders ● Memo/notepad on phone ● Online lab results ● Phone calendar
Apps/technology can support current practices for older adults	<ul style="list-style-type: none"> ● Participants vision of using apps ● Suggested app features

and caregivers	<ul style="list-style-type: none"> • Suggested design aesthetics
Technology can be a barrier to adopting/accepting self-management practices	<ul style="list-style-type: none"> • Limited access to technology • Privacy concerns • Reluctance for older adults to change • Financial barriers • Negative attitude toward technology • Age as a barrier • Cognitive impairment • Technology illiteracy • Cultural differences • Transition from paper to technology • Negative attitudes to tracking health
Considerations for implementing technologies for patients and providers	<ul style="list-style-type: none"> • Training and education for <ul style="list-style-type: none"> ○ Providers on the technology and how it is used ○ Helping patients understand condition ○ Helping end-users use the technology • Developing an implementation strategy for patients and providers • Need for discussions to be had on what information patients need to track

System level gaps impact care coordination and self-management

System level gaps described through the interviews included problems with information transfer between settings, lack of standardization in care coordination practices, lag periods between appointments, short appointment times and challenges with navigating the system.

Many participants from each group vocalized their concern with the current information sharing between different providers and settings. It is difficult for patients, caregivers or providers to ensure that the patient’s documents are successfully transferred to another setting, which can cause issues such as unnecessary prescriptions. A caregiver said,

“So the problem is that Holter report went to my family doctor, who in the process of moving towards retirement, somehow didn't get to him, or he didn't

request it. I was the one who had the report, and if I hadn't carried it with me ... Because then he turned to us and he said, "No, no." He said just go on as you are. ...But, you see, he was ready to prescribe something that wasn't needed because he didn't get the report. So I think that what we need to do ...– Caregiver 1

Caregiver 1 kept track of her husband's documents, which helped her in this situation.

However, some older adults and caregivers may find this challenging or feel like they should not be responsible for managing this information. Caregiver 1 went on to say,

"... occasionally, you run into the problem where these people are not informed with each other. They're not getting reports from the family doctor. So I have to depend on the nurse if I want to transfer information. That should not be my job!" – Caregiver 1

Caregiver 1 noticed the communication issues with information transfer and voiced her frustration. She took responsibility of asking for all her husband's documents from each provider in case it was required by another provider that did not get a report.

The consultation showed that there was no standardized way to coordinate care. From a provider's standpoint, there is no standardized EMR, which can make their practice more difficult,

"...and there are some not so good EMRs and you couldn't interface with anything." – Healthcare provider 1

An older adult also voiced this concern,

"She's up in City X and some things she cannot transmit to other parts of the province because the systems don't match." – Older Adult 1

Since there is no standardized EMR system in place, this makes it challenging for providers to ensure a patient's health information successfully transfers over to a specialist. Ideally, a standardized EMR would be able to link to an app to help facilitate patients and providers working together.

Providers also stated that between a patient seeing them and a specialist, there is a limbo period, meaning that information could be lost between appointments,

“I usually send the specialist a little note saying, “What’s going on? What do you think?” But between the time you refer them and they actually see them is a no-man’s-land. ...So anything that happens to them before they’ve seen the patient for the first time is sometimes not [recognized]” – Healthcare Provider 2

When providers are referring their patients to a specialist to find out more information about a condition, lag periods are common. Healthcare Provider 2 felt this lag period when they referred their patients and they felt that there was a need to follow-up with the specialist. This emphasizes why only specific information is relevant to providers as they are looking for answers to their questions that another provider or specialist can answer.

A caregiver also voiced this concern when dealing with seeing multiple providers for his wife,

“Dr. X has something, another doctor has something, your specialist has something, another specialist got something, another bone specialist has got something, the OPP¹ has something, the fire department's got something from my wife. Everybody's got something, but what do you do with it all?” – Caregiver 2

This also shows the difficulties older adults and caregivers have with navigating the system. Since patients are often seeing multiple healthcare providers, it is difficult to ensure that they all have the same information. Caregivers also noticed this trend but find it difficult to coordinate the information that all the providers have.

This theme describes gaps that impact care coordination between settings and self-management practices. There is a problem with information transfer between settings and this impacts providers as well as patients and caregivers. This information suggests that providers need a standardized procedure to transfer information between settings to avoid confusion and

¹ Ontario Provincial Police

losing information. Patients and caregivers may also benefit from standardization if they are able to see when and the type of information transferred to another healthcare setting.

Micro-level issues that impact/prevent self-management

Micro-level issues that affect or prevent self-management are practices that work on the individual level between patients, caregivers and providers. These include no standard way for patients to track their health, varying needs of patients, not having access to monitoring devices, lack of understanding of health conditions, providers not giving their patients information and caregivers feeling burdened managing information.

A provider expressed that patients' needs vary depending on how severe their condition is:

“And with Chronic lung disease your FEV 1 could be, for somebody it could be you know, below 30% and they're not too symptomatic and other people will be really symptomatic with an under 40 so ... that is why they have to be really engaged with their internist about, you know its not about the numbers, it is “how much of this can I tolerate?” And this also goes along with comorbidities too.” – Healthcare Provider 3

Healthcare Provider 3 suggested that patients should have a sense of when they feel like something is wrong. A factor is having an understanding of their health condition. In particular, understanding what is normal versus what is not. Additionally, it is important to work with the patient and their caregiver.

Caregivers managed older adult's health and medical appointments. This included information transfer, appointments and connecting to resources. A caregiver described their frustration with managing information,

“So I'm in the position of going to the doctor's office and say, “Would you please give me a copy of this and a copy of this and a copy of that?” It's not my

job. On the other hand, if we had some way of making sure, if I had some way of telling the doctor at the memory clinic, before we went, "Do you have this, this, and this?" he would have been in a less embarrassing situation, and we would not have been in a position of telling him what was going on." Caregiver 2

Caregiver 2 found it burdensome to constantly have to ask for reports from their spouse's providers but found it necessary in appointments. Caregivers seemed burdened ensuring they had to manage all the necessary information for their family member.

This theme identified that a conversation between caregivers, patients and providers is important to have so they can set parameters on what they should track, and explain their health status and illness. Older adults or caregivers may not be aware of how they can or should track their health due to no standard tracking method or varying needs. Therefore, they need options that providers can give them to meet those specific needs that each of them may have, such as a choice in a tracking method that works best with their capabilities. Furthermore, providers may not give all health information to their patient or caregiver. Providers also do not feel as though it is necessary for their patients to have all their health data.

Older adults currently self-manage their health in various ways

Current strategies for self-managing appointments and information included relying on a spouse or caregiver, memory, diary or notebook, paper copies of documents, calendars and pillboxes. A healthcare provider described the process of some of their patients,

"It's usually a notebook or logbook with blood sugars or blood pressures. Or else, I have one particular lady that you know, has high anxiety, so she will bring a med list every time and the adjustments that we are making... She will bring in a notebook with everything she has written down, with regards to questions and we'll write down my answers" – Healthcare Provider 3

This theme showed that older adults and caregivers are capable of self-management of health. The interviews showed a range of tools older adults and their caregivers used to manage

their health information. Providers understood that there is no one size fits all approach to their patients tracking their health. Some patients relied on their notebooks to record relevant health information. Healthcare Provider 3 was willing to work with their patient's notebook, understanding that this is what was required to have a successful appointment.

Positive experiences can empower older adult patients to self-manage health

This theme described patients becoming empowered to self-manage their health through their positive experiences in their healthcare. Patients were empowered through self-advocacy, understanding their health status and building trust and relationships with their providers. Older adults emphasized the importance of speaking up at their appointments,

“...you have a say to say no I'm not ok. You have to speak up when you go to the doctor.” Older Adult 2

Older Adult 2, among others, was a self-advocate and voiced their concerns when they saw their doctor. When older adults were not able to advocate for themselves, they often trust that their caregiver would do so. This older adult felt comfortable knowing that they were able to share their information with their providers.

Older adults described the importance of having a positive relationship with providers involved in their care. As one participant said,

“I don't have to phone the hospital; they won't answer any questions anyway. But he's there and I think it's very important especially for seniors to have a pharmacist that cares, a doctor that cares.” – Older Adult 1

Older Adult 1 not only trusted their doctor and also their pharmacist. They were assured that if their doctor was busy, they could reach out to their pharmacist for answers to their questions and truly valued this relationship.

Generally, healthcare providers were willing to give their patients any information they asked for. A healthcare provider said they were open to give their patients' health information and were willing work with them to give information that they both find useful and relevant,

“...I always say to people they're welcome to have anything but I'm not sure it's super helpful for them to have copies of their raw lab data and that kind of thing. I will write things down for them if they want, I'll write a summary of things, or instructions. I write down specific disease names.” – Healthcare Provider 4

Healthcare providers and patients voiced their concerns of the danger of patients tracking too much health information. As this healthcare provider said it was not necessary for a patient to have their raw lab data. Instead, summaries and specific instructions that the patient could understand were more meaningful. This theme explained the importance of positive perceptions to a patient's care might relate to being comfortable with their providers. The quotes exemplify that some patients are comfortable with speaking up to their providers or being able to contact someone when necessary. Providers, such as, Healthcare Provider 4, that are willing to work with their patients may help to elicit that confidence to speak up during appointments.

Technology can support self-management practices in various ways

Older adults used technologies such as devices to monitor health variables, phone reminders, memos or notepads on a phone, online lab results, and phone calendars. One older adult said,

“Something that happened, not too long ago was I got some low blood pressure readings, and I'm wondering “what the heck?” and the thing is that before I take a reading, I sort of have an idea “how am I feeling?” and I say, “Well I'm feeling a little off today.” So I'll say, “is my blood pressure a little off today, so I'll take a reading” ‘cause I don't do this every day.” – Older Adult 2

This showed the importance of an older adult taking charge of their health and utilizing technology such as a monitoring device to check their blood pressure to help understand their health better. The importance of self-advocacy was a prominent theme in the interviews and the literature review. Those who took charge of their health and spoke up for himself or herself or a family member were the most interested in the idea of an mHealth solution to manage their care coordination. Healthcare providers also stated this interest when asked about their patients.

Apps/technology can support current practices for older adults and caregivers

The consultation identified ways an app can be used to support older adults and caregivers' current processes. This included how participants envisioned an app supporting them, features, design aesthetics, and perceptions of technology. Below is a list of this study's participants' vision of an app supporting older adults and caregivers.

App use for older adults

- Apps can support patients in keeping their information organized in one place
- An app can replace the paper method of organizing health information
- Older adults are interested and open to the idea of an app
- Older adults can benefit from an app
- Apps are the next best things to having a person reminding them

App use for caregivers

- Caregiver wants support from provider to input notes into the app
- Caregiver wants an app to support them connect to resources
- App would benefit caregivers or future generations

The data described how older adults and caregivers would use a prospective app. One healthcare provider explained that an app would be applicable to those who already had a detailed system for tracking their information,

“If these people keep a very good paper chart, quite likely they’d be the ones that would embrace the app, but, other people don’t...it’s sort of the internal, whatever motivates, right?” – Healthcare provider 1

As mentioned previously, patients had multiple methods of tracking their health information, which may prove beneficial to an app to support their current practices.

Other healthcare providers mentioned that the caregiver or younger generations would benefit more from an app. One expressed that caregivers would most likely adopt the app rather than older adults,

“A lot of my patients have great caregivers, daughters, sons who come to appointments with them. They would be more likely to adopt the app like that and keep it up to date and they have their own busy life.” – Healthcare provider 4

Since many patients had caregivers that support them, an app may help the caregiver organize the patient’s health information. Providers seemed generally open to the idea of an app that will help their patients and caregiver and could envision them using this proposed app.

This study’s participants were interested in the idea of an app that can support patients and caregivers organize information and connect to resources. After raising the idea of an app to participants, older adults and caregivers expressed that they could benefit from using it to manage their health. Older adults that are comfortable managing their health may be at an advantage in using an app. Furthermore, participants said that the app might benefit caregiver or those of the future generations, as they are more comfortable with using different technologies.

App features: From interviewing all perspectives, a list of potential app features emerged.

List of suggested app features to include:

- Education
- Patient history
- Links to external resources
- Information transfer/sharing

- Reminders
- Compatibility with other technologies
- Tools for difficult conversations
- Connection to current health records
- Operating systems
- Caregiver information
- Medications
- Recording medications/supplements
- Medication changes
- Notifications/reminders for medication
- Prescription renewals
- Patient goals
- Health variables

In general, participants were interested in tools compatible with different devices such as Android and Apple devices. The app should support information transfer between settings, link to external education resources (e.g., support lines, tools for end of life conversations), link to health records (e.g., EMR), and track patient history and caregiver information, reminders, goals, and health variables relevant to a condition (e.g., blood pressure). Additionally, the app should have a systematic way to track medications that goes beyond just the name, but rather their history, notifications and ability to get renewals.

Design aesthetics: When participants were asked about design of the app, a list of aesthetics emerged. These included aspects displayed in table 7: font, colour, graphics and layout.

Table 7: Suggested design aesthetics to consider in the app

DESIGN AESTHETIC	SUGGESTED DETAILS
FONT	<ul style="list-style-type: none"> • Font and contrast important considerations for app • Small print is a problem, therefore should include large font
COLOURS	<ul style="list-style-type: none"> • Colour blindness should be a consideration • Black and white colour scheme • White background with black text • Limit colours
GRAPHICS	<ul style="list-style-type: none"> • Big icons preferable

LAYOUT

- Use icons for app
- Individualize the what features and layout users can see
- Minimal detail in visual layout
- Simple design, not cluttered

When asked about design priorities, an older adult said,

“...the biggest issues are the font and the contrast”. – Caregiver 2

Participants voiced their preferences for large fonts with a lot of contrast. The best combination that was easiest for participants was black font with a white background.

Other participants with prior experience with apps suggested,

“I’ve worked on an app for someone else and I said it has to be easy and simple and easy to navigate.” – Caregiver 3

In general, the design of the app should have a layout that is not cluttered so that the users can navigate it easily and get the most out of it. Some participants had previous experience with working with technologies, which was valuable input. Participants noted that design is very influential to whether they would use an app.

Perceptions of technology: Older adults, caregivers and healthcare providers have expressed their feelings about health related technologies for older adults use to their providers or other professionals. One healthcare provider described witnessing an older family member, who embraced technology,

“Of course and we are in that day and that time when people are more in tune and more tech savvy. I mean my mother in law, I thought that she would never look at a computer and she’s online and she has email and she’s this and she’s that and she’s 88 so I think it makes sense to you know. Times change and we have to change with them.” – Healthcare provider 6

Technology is becoming more prevalent and healthcare providers saw this trend in their patients. Providers also said that their patients were excited to use technology and they were tech savvy. Overall, providers and older adults seemed open to the idea of current technologies.

Technology can be a barrier to adopting/accepting self-management practices

The data suggested some barriers to older adult technology use or adoption, including:

- Limited access to technology
- Privacy concerns
- Reluctance for older adults to change
- Financial barriers
- Negative attitude toward technology
- Privacy concerns
- Age as a barrier
- Cognitive impairment
- Technology illiteracy
- Cultural differences
- Transition from paper to technology
- Negative attitudes to tracking health

An older adult voiced their concern over the impacts of technology on simple tasks,

“A lot of these students we find, it, clerks at stores, if the computers are down, they don’t know how to add or subtract money. And they don’t, we’ve come across that. And now what we feel, our way of learning is far superior that what you are because you are lost without this equipment. We’re not, it’s in here [points to head].” – Older adult 4

Some older adults were against technology, as they were not used to it. They felt as though the younger generations relied on it too much. This prevented them from trying to use technologies.

A healthcare provider described finances as a barrier to older adults adopting technology,

“They may not have the finances as well, which can be a barrier.”

– Healthcare Provider 3

Some older adults or caregivers may not have the finances to purchase a computer, tablet or smartphone, which may be barrier to using apps. With many interventions, specifically technology, it cannot meet everyone's needs. Barriers are important to consider so the users and non-users of an app can be identified. These data can be used to explore more in depth in the next phases of development.

Considerations for implementing technologies for patients and providers

The data suggested that training and education were necessary to support the implementation of technology. Below is a list of the types of training that participants suggested would support the adoption and implementation of the app.

Technology implementation could be supported by:

- Team working together to implement tech into primary care practice
- Importance of knowing users' capabilities
- Patients need to be trained to know what information is relevant to provider
- Importance of educating patients on their conditions
- Patients should be aware of their responsibilities
- Importance of learning about and addressing the barriers to tech adoption
- Develop a communication strategy for technology
- Taking the time to follow up with end user on their experience with tech
- Older adults have varying technological abilities
- Education may help sooth some older adults concerns about privacy
- Training a clinic's staff to support tech adoption

Some older adults spoke about their challenges with accessing education resources for technology. An older adult described that they looked for resources to learn how to use technology but it was too expensive,

“But I wish they would do a community course to teach us how to use this. I have an older one, which I just do games and I always want to do more on it... when they require 80 dollars an hour... to teach someone, I'm not willing to do that...” Older adult 3

Older adults were open to the idea of technology. However, a major barrier is that they found it could be a challenge to use. There was difficulty in finding and accessing resources that

provided training, which prevented participants from using technology. For this reason, training is very important to encourage older adults to use technology.

In terms of education, a provider explained the importance of patients coming to them and asking what information they should track,

“Yeah I think that’s part of the thing is just you need to sit down with the physician and say, “What should I be tracking?” “What is important?” otherwise people are guessing and you’re in trouble.” Healthcare provider 5

Providers emphasized that patients and their caregivers should have some sort of education on their disease. This included what is important to track and what their goals are. The questionnaire data and consultation interviews both revealed the importance of having training and education available. These data show that the current healthcare system for care coordination must be explored to see how best to implement the app.

4. Discussion

4.1 Phase 1: Scoping Review

The purpose of this study was to initiate a co-design process for an app to support care coordination between older adults and healthcare providers. This study had three objectives, first, to identify existing mHealth tools that support care coordination between older adults and their healthcare providers and any present gaps in the literature through a scoping review. Second, to identify and compare the features, barriers and facilitators to the implementation of the mHealth tools found in the literature. Last, to prioritize features of existing mHealth tools found in the literature and discover what key stakeholders would find useful in an mHealth tool using a consultation with older adults, healthcare providers and caregivers.

The scoping review addressed the first two study objectives. The scoping review identified 26 articles discussing mHealth tools that support care coordination. The literature identified mHealth tools' key features such as, a place to organize important health information, contact information, design suggestions and provided an understanding of mHealth tools' barriers and facilitators. These data showed a variety of mHealth tools created for many devices. In this study, a gap was defined as barriers to implementation and end-user use that the literature identified. The literature review identified gaps in the themes: current mHealth challenges, support for tool implementation and use, and lack of end-user involvement in designing the tools. These formed the topics the consultation phase explored further. This included features such as the types of alerts participants found useful (Ho et al., 2016). Robben and colleagues (2012) identified a need to ensure that the technology does not take away from patients' relationships with their providers, that appropriate development time is budgeted for implementation, and that the tool can easily fit into the everyday practice of the current system. Software bugs should be

ironed out before implementation to help ease the usability of the tool (Robben et al., 2012). The consultation also investigated the amount of information that should be included in the tool to improve efficiency for patients and providers (Klein et al., 2015; Nazi et al., 2014). Additionally, not all articles involved the end-users from the initial design stages; this involvement has been shown to create higher satisfaction with the end product (Steen et al., 2011). Therefore, consultation interviews were used to investigate the design criteria.

The second objective was addressed through the themes: current mHealth challenges, support for tool implementation and use, features and supporting patients and their relationships. The Center for Technology and Aging (2011) highlighted their challenges to adoption were limited clinical evidence to support adoption of technologies and financial barriers. The proposed app should be cost effective and have some evidence to support its uptake. Tools created for providers presented difficulties related to standardizing mHealth tools in current procedures and sharing information between settings (Clemmenson et al., 2005; Stroulia et al., 2012). Creating tools for providers can present more of a challenge by adding to their responsibilities. The proposed app should also account for the end-users' abilities and preferences and target the appropriate population. Some challenges the literature presented were privacy concerns, low literacy rates among users, lack of flexibility in the tool and fatigue effect (Faria et al., 2014; Logan et al., 2017; Makai et al., 2014; Nguyen et al., 2013; Robben et al., 2015). Therefore, the co-design process should investigate these issues as well as from the consultation. This may also help target the desired end-user population. Employing a co-design process has been presented in the literature as a means to elicit a positive response to the tools (Makai et al., 2014; Robben et al., 2015).

The literature identified a list of features that supported patients, providers and caregivers. The mHealth tools ranged from a variety of functions from tracking variables to connecting to resources. The literature indicated that mHealth tools go beyond tracking variables such as blood pressure or glucose levels (Ammenwerth et al., 2015; Mertens et al., 2016; Park, Cho & Kim., 2016; Steele-gray., 2016). Therefore, it is important to investigate other potential functions of the mHealth tool. The consultation explored the output types to include in an mHealth tool. For example, the literature revealed a variety of outputs such as generating symptom graphs for patients or the ability to create alarms (de A Melo et al., 2016; Mertens et al., 2016; Nguyen et al., 2013). Additionally, most literature indicated existing support or resources that assisted the end-users with using the tool. Robbins and colleagues (2012) included paper-based versions of the tool, a support line and training. Mertens and colleagues (2016) spoke about a user manual, device modifications and training. The types of support for this prospective app will need to be explored in the consultation to understand how to meet the needs of the end-users. Other resources that mHealth tools offered were linking to external devices or monitoring devices (Ammenwerth et al., 2015; Faria et al., 2014; Logan et al., 2017). The consultation aimed to investigate which devices the end-users were using and would like this app to connect to. The researcher hoped to use the literature and consultation to inform the development of an app through exploring specific needs of the end-users.

The literature indicated that having access to apps supported patients in their autonomy and their relationships with care providers and caregivers. Features, such as, communication tools for patients and providers, the ability for patients to send information to their providers and allowing patients to engage in self-management supported this process (Center for Technology and Aging, 2011, Nazi et al., 2014; Robben et al., 2012). The consultation was intended to

confirm whether these features are important to include in a prospective app and discover additional ways to support patients and their relationships. The literature provided a basis of where the consultation should start and the topics investigated.

4.2 Phase 2: Consultation

To supplement the scoping review, consultations were completed with key stakeholders to better understand mHealth preferences and priorities. This helped to meet the third objective: to prioritize features of existing mHealth tools found in the literature and discover what key stakeholders would find useful in an mHealth tool. The data from this study had common themes that appeared in the scoping review, questionnaire and interviews. These included how technology supports self-management and current practices of older adults and caregivers, how technology can hinder self-management or uptake, and implementation strategies.

This study aligned with Ruggiano and colleagues' (2015) findings that older adults partake in self-management. Older adults in this study were active participants in their healthcare through monitoring their health variables through tools such as notebooks, phone reminders, and calendars. The wide range of variables patients tracked from the literature and those suggested by participants in the questionnaire and consultation reflected this. Providers indicated how vital it was to look at patients needs on a case-by-case basis for patient and family-centered health care.

The literature and consultation showed that technologies had a role in supporting older adults and caregivers in self-management of their health. The literature revealed that older adults and caregivers used technologies in these studies. Klein and colleagues (2015) found that through using an electronic personal health record, both patients and providers felt that patients

that shared health information and patient-generated data were advantageous. Patients also had a desire to self-manage their health (Klein et al., 2015). The consultation added to this, showing that patients do self-manage through technologies such as monitoring devices, phone reminders, phone notebook/notepad or online lab results. This may have suggested a market for technology to support self-management, as participants had awareness of technologies and their functionalities. The consultation added to the literature by investigating other self-management practices. Interviews identified that mHealth can be used to support older adults organize their information through being replacement for paper-based methods and can play a role in caregivers' processes as well.

There was a considerable discussion during the interviews on what health information would be most relevant to the healthcare providers. This was consistent to Klein and colleagues' (2015) findings, that patients want to share their health information in a way that is meaningful to their providers but it is unclear to patients what meaningful actually means. This could be because some patients had minimum experience self-managing if they relied on the system to manage information (Klein et al., 2015). The consultation suggested that older adults and caregivers kept all their health information because they were unsure what the provider would ask for. This shows a clear miscommunication between older adults, healthcare providers and caregivers on the types of information that should be tracked. An app that is flexible enough to track variables based on an individual's condition should be created in the next steps of this project. The app should also ensure that providers' information successfully transfers to other settings. This was a priority for all stakeholder groups.

Participants suggested a need to ensure that patients and providers are discussing what a patient should be tracking. In addition, caregivers seemed burdened ensuring they had all the

necessary information for their family member. If the older adult is not able to keep track of their information, then the caregiver must support to do so in a systematic way. The app must not only cater to older adults but those managing their care, such as their family members. Many healthcare providers said they are open to give their patients any information they ask for but want to work with them to find out what will be the most beneficial to them and other providers. This may be through a goal setting feature or prompt for patients and caregivers to ensure they discuss it with their provider.

This study accounted for the digital divide presented by Grindrod and colleagues (2014) and Olphert and Damodaran (2013) by focusing on older adults and how to meet their needs. This study also confirmed Mitzner and colleagues' (2010) findings that older adults have a willingness to use technologies for communications, seeking information and health promotion. Older adults and caregivers had current practices of using technologies for taking or storing pictures, or emailing people in their care circle. On the other hand, older adults that were not comfortable with the idea of technology or did not know how to use it were less interested in the idea of technologies and adopting it without some support.

The themes of current mHealth challenges paralleled with how apps and technology can hinder current practices or self-management. The literature overlapped with the consultation, and pointed out that older adults have varying abilities and preferences, such as privacy concerns (Matthew-Maich et al., 2016; Robben et al., 2015). Additionally, low socioeconomic status was an issue that Ammenwerth and colleagues (2015) identified and some older adults and providers said were a concern to accessibility. This study investigated some of the barriers and solutions that will help to address unanticipated consequences. For instance, investigating how to securely

store the patients' data in order to keep it safe. To address SES, the app should be free to mitigate cost but those without devices may not be able to have access to it, which would be a limitation.

The researcher developed an understanding of some considerations for implementing a tool for older adults. The literature indicated that there is a general interest in technology but there are some supports necessary for adoption such as involving the end-user in the initial stages, training to use the tool from the individual level and having an implementation strategy for adoption (Robben et al., 2012; de Jong et al., 2016; Makai et al., 2014; Steele-gray et al., 2016; Center for Technology and Aging, 2011). Implementation was also discussed in the interviews. This included the subthemes of developing an implementation strategy for both patients and providers, training and education for providers on the technology and use, and a need for discussions on what information patients' need to track. A number of resources that supported patients' tool use and their care emerged from the literature. These included aspects such as device modifications, online education and a support line or training (Center for Technology and Aging, 2011; de Jong et al., 2016; Ho et al., 2016; Logan et al., 2017; Mertens et al., 2016; Nguyen et al., 2013; Makai et al., 2014; Robben et al., 2012). The consultation questionnaire identified that training was a priority of older adults and caregivers as this was the top rated category. The researcher recommends that members of the research team assist end-users in downloading and walking them through the tool in the pilot phase to involve face-to-face training. Additionally, a tutorial should be incorporated in the mHealth tool to help give a background on all of the features inside the tool. The interviews suggested that training and education must help patients understand their condition, help end-users learn how to use the technology, and help providers understand the technology and how it can be used.

This study explored the concept of self-management and its role in care coordination by focusing on the behaviours of older adults or their caregivers. Since self-management practices are often a missing part of care coordination models, this is a priority for further exploration (Ruggiano et al., 2015). The scoping review and consultation confirmed that older adults and caregivers are active members in managing their medications and their behaviours, as indicated by Lorig and Holman (2003). Additionally, the consultations confirmed that self-management supported by an app should focus on the individual problems of a patient (Lorig and Holman, 2003). For instance, healthcare providers in this study indicated the importance of treating patients on a case-by-case basis and understanding that they will have different health variables to track. This information needs to be clearly relayed to patients and caregivers by providers.

This study also expanded on the scoping review work done by Matthew-Maich and colleagues (2016). This study added to their work through using their findings and recommendations to guide research, development and implementation of the mHealth tool. Some key takeaways that stemmed from their work are that a good understanding of the end-users' context is critical, less can be more on a mobile device, a strategy for multidisciplinary collaboration should be used, and an implementation team and plan should be developed and used. This informed that a consultation and co-design approach could help to understand the end-users context. The researcher must also keep in mind that the app should be as simple as possible in terms of design and functionality when sifting through the suggested features.

4.3 Technology Acceptance Model

As mentioned earlier in the background section, this study drew upon the Technology Acceptance Model by Davis (1989). This model was used as a guide to help increase the adoption of the technology by targeting the end-users attitudes towards the app. In accordance

with the TAM, adoption of technology is determined by an individual's attitude towards using a new technology. This study was found to have themes that fit within the TAM, i.e., perceived usefulness and perceived ease-of-use.

Perceived usefulness

Perceived usefulness is the degree to which a person believes that using the technology will enhance their practice (Davis, 1993). Both the literature and interviews included data about perceived usefulness. The literature mentioned positive outcomes of current mHealth tools such as applicability into real practice, support for older patients in health improvement and shorter time for hospital admission (Clemmensen et al., 2005; Klein et al., 2015, Stellefson et al., 2013). In addition, there were positive feedback/outcomes of the tools such as being accessible to the user (Robben et al., 2014; Villani et al., 2014).

In the consultation, older adults and caregivers described that they can see a use for an mHealth tool if they have the appropriate training and education for the app. To address this, older adults, providers and caregivers were asked what types of features would be most useful for them. A list of useful features was developed from this research. However, barriers must be considered such as older adults being reluctant to change because the current paper based system they are using is working for them. Additionally, it may not be useful if an older adult does not have access to a device that can use this app. If the tool facilitates patients' relationships with their providers and care circle, and gives them autonomy, as indicated in the literature and consultation, it may also increase perceived usefulness. The tool could address current self-management practices and current technology used such as phone reminders to improve its usefulness.

The importance of self-advocacy and supporting relationships were prominent themes in the interviews and the scoping review. Those who took charge of their health and spoke up for himself or herself or a family member were the most interested in the idea of an mHealth solution to manage their care coordination. Healthcare providers also voiced this trend. Technology was used by older adults, which showed its potential to be a solution to care coordination. Patient provider-relationships were supported through current mHealth tools from the literature (Center for Technology and Aging, 2011; Faria et al., 2014; Logan et al., 2017; Nazi et al., 2014; Steele-gray et al., 2016; Stroulia et al., 2012). Some literature highlighted that mHealth tools supported patient autonomy (Nazi et al., 2014; Robben et al., 2012). An app that supports autonomy and relationships may be an important piece of the implementation strategy because participants wanted to preserve this.

Perceived ease-of-use

Perceived ease-of-use is the freedom of effort involved in using a technology (Davis, 1993). This aspect of the TAM was also addressed in both phases of the study. In the scoping review, some tools were classified as easy-to-use or flexible (Villani et al., 2014; Robben et al., 2014; Ho et al., 2016; Nazi et al., 2014; Faria et al., 2014; Quinn et al., 2013; Williams et al., 2014; de A Melo et al., 2014). In the consultation phase, perceptions of technology from all stakeholder groups mentioned that older adults were excited about using technology and providers had observed older adults being tech savvy. Participants indicated the design and layout of the app that they would find most appealing to simplify the app for them, as presented in table 6. The barriers identified in this study's consultation must also be considered in designing the app. Additionally, the mHealth tool may not be easy to use for someone who is cognitively impaired. Training and education are additional factors that may increase perceived

ease-of-use. Both the literature and consultation emphasized the importance of training through various mediums to cater to the range of users' abilities and preferences (Robben et al., 2015).

By addressing these themes and domains, the researcher hopes to understand attitudes towards using technologies to help with the creation of a usable tool.

4.4 Study Strengths and Limitations

A limitation of scoping reviews is that they do not incorporate an assessment of the quality of the literature. However, this is not feasible when there are many novel technologies being created and which may not be published or are in their pilot stage. In the consultation phase, the questionnaire was subject to non-response bias for missed questions. This may have been due to the length of the questionnaire (55 questions). Additionally, the questionnaire was completed at the end of the interview, which could have influenced the responses. The questionnaire was long to allow a comprehensive reflection of the literature results.

Strengths of this study were that the scoping review included grey literature and a consultation to help with rigour and to compensate for not assessing the quality of the literature. This helped to capture new technology perspectives and to initiate a co-design process. This study involved key informants/end-users from these initial stages of the project, which is key for a scoping study and uncommon in other literature. This will facilitate the creation of an app that the researcher hopes will aid older adults and caregivers in their care coordination practices. Additionally, since there were multiple methods of data collection (scoping review, questionnaire and key informant interviews) these data complemented each other to guide future directions for an mHealth tool/app.

4.5 Knowledge Translation and Dissemination Plan and Next Steps

The findings from this study will be the focus of knowledge translation through several approaches. The scoping review will be submitted to an academic journal and results will be presented at academic conferences through posters and oral presentations. Further, since this project is part of a larger study, the results will be used in the latter three stages of the service design model: define, develop and deliver (Design Council, 2007). This will lay the foundation of a co-design process and will be relayed to an app developer to create a prototype of an mHealth application for supporting care coordination. This app is to undergo user testing and refinement and will be available on the Apple App Store and Google Play for the public to use.

5. Conclusions

This study reviewed the literature for existing mHealth tools and was able to initiate a co-design process through a consultation phase. This study confirmed that older adults and providers have an interest in using mHealth tools and discovered the features that should go into an mHealth tool to support care coordination. This study also highlighted the value of engaging older adults and providers in tool development. Next steps include using the data discovered in this study to create an mHealth tool that will go through phases of co-design and testing with older adults and family caregivers.

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References

- Accenture. Accenture; 2013. [2015-01-13]. website Insight Driven Health: Silver Surfers are Catching the eHealth Wave
<http://www.accenture.com/SiteCollectionDocuments/PDF/Accenture-Silver-Surfers-Are-Catching-The-eHealth-Wave.pdf>.
- Adami, MF. (2005). The use of triangulation for completeness purposes. *Nurse Researcher*, 12(4), 19-29.
- Agency for Healthcare Research and Quality. (2014, 2016). Care Coordination *Prevention & Chronic Care* Retrieved April 10, 2018, from
<https://http://www.ahrq.gov/professionals/prevention-chronic-care/improve/coordination/index.html>
- Ammenwerth, E., Woess, S., Baumgartner, C., Fetz, B., van der Heide, A., Kastner, P., . . . Poelzl, G. (2015). Evaluation of an Integrated Telemonitoring Surveillance System in Patients with Coronary Heart Disease. *Methods Inf Med*, 54(5), 388-397. doi: 10.3414/ME15-02-0002
- Ando, H., Cousins, R., & Young, C. (2014) Achieving saturation in thematic analysis: development and refinement of a codebook. *Comprehensive Psychology*, 3, 4.
- Arksey, Hilary, & O'Malley, Lisa. (2005). Scoping Studies: Towards a Methodological Framework. 8(1), 19-32. doi: <https://doi.org/10.1080/1364557032000119616>
- Australia Bureau of Statistics. Australia Bureau of Statistics; 2014. [2015-01-13]. website Household use of information technology, Australia 2012-13
<http://www.abs.gov.au/ausstats/abs@.nsf/Lookup/8146.0Chapter32012-13>.

- Barnard, Yvonne, Bradley, Mike D., Hodgson, Frances, & Lloyd, Ashley D. (2013). Learning to use new technologies by older adults: Perceived difficulties, experimentation behaviour and usability. *Computers in Human Behavior*, 29(4), 1715-1724. doi: 10.1016/j.chb.2013.02.006
- Barrett, L . AARP Research and Strategic Analysis. AARP Research and Strategic Analysis; [2015-01-13]. webcite Health and Caregiving among the 50+: Ownership, Use and Interest in Mobile Technology <http://assets.aarp.org/rgcenter/general/health-caregiving-mobile-technology.pdf>.
- Baysari, M. T., & Westbrook, J. I. (2015). Mobile Applications for Patient-centered Care Coordination: A Review of Human Factors Methods Applied to their Design, Development, and Evaluation. *Yearb Med Inform*, 10(1), 47-54. doi: 10.15265/IY-2015-011
- Birks, Yvonne, Harrison, Reema, Bosanquet, Kate, Hall, Jill, Harden, Melissa, Entwistle, Vikki, . . . Roberts, David. (2014). An exploration of the implementation of open disclosure of adverse events in the UK: a scoping review and qualitative exploration. *Health Services and Delivery Research*.
- Bisantz, Ann M., Carayon, Pascale, Miller, Anne, Khunlertkit, Adjhaporn, Arbaje, Alicia, & Xiao, Yan. (2016). *Using Human Factors And Systems Engineering To Improve Care Coordination*. Paper presented at the Proceedings of the Human Factors and Ergonomics Society Annual Meeting
- Braun, Virginia, & Clarke, Victoria. (2006). Using thematic analysis in psychology. *Qualitative Research in Psychology*, 3(2), 77-101. doi: 10.1191/1478088706qp063oa

- Carcary, M. (2009). The Research Audit Trial--Enhancing Trustworthiness in Qualitative Inquiry. *Electronic Journal of Business Research Methods*, 7(1).
- Center for Technology and Aging. (2011). *mHealth Technologies: Applications and Benefits for Older Adults*. United States: Public Health Institute
- Chumbler, Neale R., Mann, William C., Wu, Samuel, Schmid, Arlene, & Kobb, Rita. (2004). The Association of Home-Telehealth Use and Care Coordination with Improvement of Functional and Cognitive Functioning in Frail Elderly Men. *Telemedicine Journal and e-Health*, 10(2). doi: <https://doi.org/10.1089/tmj.2004.10.129>
- [Corbin, J. M., & Strauss, A. \(1988\). Unending work and care: Managing chronic illness at home. Jossey-Bass.](#)
- Creer, T. L., & Christian, W. P. (1976). *Chronically ill and handicapped children, their management and rehabilitation*. Research Press (IL).
- Creer, T. L., Renne, C. M., & Christian, W. P. (1976). Behavioral contributions to rehabilitation and childhood asthma. *Rehabilitation Literature*.
- Creswell, John W. (1998). *Qualitative inquiry and research design: Choosing among five traditions*: thousand oaks, ca: Sage
- Croasmun, J. T., & Ostrom, L. (2011). Using Likert-Type Scales in the Social Sciences. *Journal of Adult Education*, 40(1), 19-22.
- Daudt, Helena ML., Mossel, Catherine van., & Scott, Samantha J. (2013). Enhancing the scoping study methodology: a large, inter-professional team's experience with Arksey and O'Malley's framework. *BMC Medical Research Methodology*, 13(48). doi: <https://doi.org/10.1186/1471-2288-13-48>

- Davis, F.D. Perceived Usefulness, Perceived Ease of Use, and User Acceptance of Information Technology. *MIS Quarterly*. 13(3) (1989), 319-340
- Davis, F. D. (1993). User acceptance of information technology: system characteristics, user perceptions and behavioral impacts. *International journal of man-machine studies*, 38(3), 475-487.
- de A. Melo, Josias E., Rodrigues, Sandra Souza, Martins, Guilherme A., Antonelli, Humberto Lidio, Fortes, Renata P. M., & Castro, Paula Costa. (2016). An analysis of application usage for notes and reminders by older persons-ElderNote Case study. 339-345. doi: 10.1145/3019943.3019992
- de Jong, C. C., Ros, W. J., van Leeuwen, M., & Schrijvers, G. (2016). How Professionals Share an E-Care Plan for the Elderly in Primary Care: Evaluating the Use of an E-Communication Tool by Different Combinations of Professionals. *J Med Internet Res*, 18(11), e304. doi: 10.2196/jmir.6332
- Denzin, N. K. (2009). *The research act: A theoretical introduction to sociological methods*. New York, NY: Aldine Transaction.
- Design Council (2007). A study of the design process. *Eleven lessons: managing design in eleven global brands*. Retrieved from [https://http://www.designcouncil.org.uk/sites/default/files/asset/document/ElevenLessons_Design_Council_\(2\).pdf](https://http://www.designcouncil.org.uk/sites/default/files/asset/document/ElevenLessons_Design_Council_(2).pdf)
- Dibley, L. (2011). Analyzing narrative data using McCormack's lenses. *Nurse Researcher*, 18(3), 13-19. Retrieved from <http://nurseresearcher.rcnpublishing.co.uk/news-andopinion/commentary/analysing-qualitative-data>

- Etikan, I., Musa, S. A., & Alkassim, R. S. (2016). Comparison of convenience sampling and purposive sampling. *American Journal of Theoretical and Applied Statistics*, 5(1), 1-4.
- Fairchild, DG, Hogan, J, Smith, R, Portnow, M, & Bates, DW. (2002). Survey of primary care physicians and home care clinicians. *J Gen Intern Med*, 17(4), 253-261. doi: 10.1046/j.1525-1497.2002.10717.x
- Faria, I., Gaspar, C., Zamith, M., Matias, I., das Neves, R. C., Rodrigues, F., & Barbara, C. (2014). TELEMOLD project: oximetry and exercise telemonitoring to improve long-term oxygen therapy. *Telemed J E Health*, 20(7), 626-632. doi: 10.1089/tmj.2013.0248
- Fusch, P. I., & Ness, L. R. (2015). Are we there yet? Data saturation in qualitative research. *The qualitative report*, 20(9), 1408-1416.
- Fishbein, M. & Ajzen, I. (1975). *Belief, Attitude, Intention and Behaviour: An Introduction to Theory and Research*. Reading, MA: Addison Wesley.
- Free C, Phillips G, Galli L, Watson L, Felix L, Edwards P, Patel V, Haines A. The effectiveness of mobile-health technology-based health behaviour change or disease management interventions for health care consumers: a systematic review. *PLoS Med*. 2013;10(1):e1001362. doi: 10.1371/journal.pmed.1001362. <http://dx.plos.org/10.1371/journal.pmed.1001362>.
- Gill, P., Stewart, K., Treasure, E., & Chadwick, B. (2008). Methods of data collection in qualitative research: interviews and focus groups. *Br Dent J*, 204(6), 291-295. doi: 10.1038/bdj.2008.192
- Glaser, B. G., & Strauss, A. L. (1967) *The discovery of grounded theory: strategies for qualitative research*. New York, NY : Aldine De Gruyter .

- Godin, K., Stapleton, J., Kirkpatrick, S. I., Hanning, R. M., & Leatherdale, S. T. (2015). Applying systematic review search methods to the grey literature: a case study examining guidelines for school-based breakfast programs in Canada. *Syst Rev*, 4, 138. doi: 10.1186/s13643-015-0125-0
- Gray, Carolyn Steele, Wodchis, Walter P, Upshur, Ross, Cott, Cheryl, McKinstry, Brian, Mercer, Stewart, . . . Collaborators, Project. (2016). Supporting goal-oriented primary health care for seniors with complex care needs using mobile technology: evaluation and implementation of the health system performance research network, Bridgepoint electronic patient reported outcome tool. *JMIR research protocols*, 5(2).
- Green, J, & Thorogood, N. (2013). *Qualitative Methods for Health Research* (3rd ed.): SAGE.
- Grindrod, K. A., Li, M., & Gates, A. (2014). Evaluating User Perceptions of Mobile Medication Management Applications With Older Adults: A Usability Study. *JMIR mHealth and uHealth*, 2(1), e11. <http://doi.org/10.2196/mhealth.3048>
- Guest , G . , Bunce , A . , & Johnson , L . (2006) How many interviews are enough?: an experiment with data saturation and variability . *Field Methods* , 18 , 59 - 62 .
- Hadi, Muhammad Abdul, & Closs, S José. (2016). Ensuring rigour and trustworthiness of qualitative research in clinical pharmacy. *International journal of clinical pharmacy*, 38(3), 641-646.
- Hall, A. K., Stellefson, M., & Bernhardt, J. M. (2012). Healthy Aging 2.0: The Potential of New Media and Technology. *Preventing Chronic Disease*. doi: 10.5888/pcd9.110241
- Halpern, E. S. (1983). Auditing Naturalistic Inquiries: Some Preliminary Applications. Part 1: Development of the Process. Part 2: Case Study Application.

- Heinz, M., Martin, P., Margrett, J. A., Yearns, M., Franke, W., Yang, H. I., ... & Chang, C. K. (2013). Perceptions of technology among older adults. *Journal of Gerontological Nursing, 39*(1), 42-51.
- Ho, T. W., Huang, C. T., Chiu, H. C., Ruan, S. Y., Tsai, Y. J., Yu, C. J., . . . Group, Hint Study. (2016). Effectiveness of Telemonitoring in Patients with Chronic Obstructive Pulmonary Disease in Taiwan-A Randomized Controlled Trial. *Sci Rep, 6*, 23797. doi: 10.1038/srep23797
- Hollander, JA. (2004). The social contexts of focus groups. *Journal of contemporary ethnography, 33*(5), 602-637.
- Jones, C. D., Vu, M. B., O'Donnell, C. M., Anderson, M. E., Patel, S., Wald, H. L., . . . DeWalt, D. A. (2015). A failure to communicate: a qualitative exploration of care coordination between hospitalists and primary care providers around patient hospitalizations. *J Gen Intern Med, 30*(4), 417-424. doi: 10.1007/s11606-014-3056-x
- Klein, Dawn M, Fix, Gemmae M, Hogan, Timothy P, Simon, Steven R, Nazi, Kim M, & Turvey, Carolyn L. (2015). Use of the Blue Button online tool for sharing health information: qualitative interviews with patients and providers. *J Med Internet Res, 17*(8).
- Krosnick, Jon A., & Presser, Stanley. (2010). Question and Questionnaire Design *Handbook of Survey Research 2nd Edition* (pp. 263-313): Emerald Group Publishing.
- Krueger, Richard A., & Casey, Mary Anne. (2000). *Focus Groups. A Practical Guide for Applied Research 3rd Edition* (3rd ed.). Thousand Oaks, CA: SAGE Publications.
- Lambert, Sylvie D., & Loiselle, Carmen G. (2008). Combining individual interviews and focus groups to enhance data richness. *Journal of Advanced Nursing, 62*(2), 228-237. doi: <https://doi.org/10.1111/j.1365-2648.2007.04559.x>

- Legard, R., Keegan, J., & Ward, K. (2003). In-depth interviews (S. 138–169). *Qualitative research practice. A guide for social science students and researchers*
- Lehmann, Donald R., & Hulbert, James. (1972). Are Three-Point Scales Always Good Enough? *Journal of Marketing Research*, 9(4), 444-446. doi: 10.2307/3149313
- Levac, D., Colquhoun, H., & O'Brien, K. K. (2010). Scoping studies: advancing the methodology. *Implement Sci*, 5, 69. doi: 10.1186/1748-5908-5-69
- Lincoln YS, Guba EG. *Naturalistic inquiry*. Beverly Hills: Sage; 1985.
- Logan, A. G., Irvine, M. J., McIsaac, W. J., Tisler, A., Rossos, P. G., Easty, A., . . . Cafazzo, J. A. (2012). Effect of home blood pressure telemonitoring with self-care support on uncontrolled systolic hypertension in diabetics. *Hypertension*, 60(1), 51-57. doi: 10.1161/HYPERTENSIONAHA.111.188409
- Lorig, Kate R., Sobel, David S., Stewart, Anita L., Byron William Brown, Jr., Bandura, Albert, Ritter, Philip, . . . R.Holman, Halsted. (1999). Evidence Suggesting That a Chronic Disease Self-Management Program Can Improve HealthStatus While Reducing Hospitalization: A Randomized Trial. *Medical Care*, 37(1), 5-14.
- Lorig, K. R., & Holman, H. R. (2003). Self-management education: history, definition, outcomes, and mechanisms. *Annals of behavioral medicine*, 26(1), 1-7.
- Makai, P., Perry, M., Robben, S. H., Schers, H., Heinen, M., Olde Rikkert, M. G., & Melis, R. J. (2014). Which frail older patients use online health communities and why? A mixed methods process evaluation of use of the Health and Welfare portal. *J Med Internet Res*, 16(12), e278. doi: 10.2196/jmir.3609
- Matthew-Maich, Nancy, Harris, Lauren, Ploeg, Jenny, Markle-Reid, Maureen, Valaitis, Ruta, Ibrahim, Sarah, . . . Isaacs, Sandra. (2016). *Designing, Implementing, and Evaluating*

- Mobile Health Technologies for Managing Chronic Conditions in Older Adults: A Scoping Review. *MJMIR Mhealth Uhealth*, 4(2)(e29). doi: 10.2196/mhealth.5127
- Mays, N., Roberts, E. and Popay, J. (2001) Synthesising research evidence. In N. Fulop, P. Allen, A. Clarke and N. Black (eds) *Studying the Organisation and Delivery of Health Services: Research Methods* (London: Routledge), pp. 188-220.
- Mercer, K., Baskerville, N., Burns, C. M., Chang, F., Giangregorio, L., Tomasson Goodwin, J., ... Grindrod, K. (2015). Using a Collaborative Research Approach to Develop an Interdisciplinary Research Agenda for the Study of Mobile Health Interventions for Older Adults. *JMIR mHealth and uHealth*, 3(1), e11. <http://doi.org/10.2196/mhealth.3509>
- Mertens, A., Brandl, C., Miron-Shatz, T., Schlick, C., Neumann, T., Kribben, A., . . . Becker, S. (2016). A mobile application improves therapy-adherence rates in elderly patients undergoing rehabilitation: A crossover design study comparing documentation via iPad with paper-based control. *Medicine (Baltimore)*, 95(36), e4446. doi: 10.1097/MD.0000000000004446
- Michie, Susan, Van Stralen, Maartje M, & West, Robert. (2011). The behaviour change wheel: a new method for characterising and designing behaviour change interventions. *Implementation science*, 6(1), 42.
- Mitzner, T. L., Boron, J. B., Fausset, C. B., Adams, A. E., Charness, N., Czaja, S. J., . . . Sharit, J. (2010). Older Adults Talk Technology: Technology Usage and Attitudes. *Comput Human Behav*, 26(6), 1710-1721. doi: 10.1016/j.chb.2010.06.020
- Moher D, Liberati A, Tetzlaff J, Altman DG, The PRISMA Group (2009). Preferred Reporting Items for Systematic Reviews and Meta-Analyses: The PRISMA Statement. *PLoS Med* 6(7): e1000097. doi:10.1371/journal.pmed1000097

- Nazi, K. M., Turvey, C. L., Klein, D. M., Hogan, T. P., & Woods, S. S. (2015). VA OpenNotes: exploring the experiences of early patient adopters with access to clinical notes. *J Am Med Inform Assoc*, 22(2), 380-389. doi: 10.1136/amiajnl-2014-003144
- Nguyen, H. Q., Donesky, D., Reinke, L. F., Wolpin, S., Chyall, L., Benditt, J. O., . . . Carrieri-Kohlman, V. (2013). Internet-based dyspnea self-management support for patients with chronic obstructive pulmonary disease. *J Pain Symptom Manage*, 46(1), 43-55. doi: 10.1016/j.jpainsymman.2012.06.015
- O'Brien, K., Wilkins, A., Zack, E., & Solomon, P. (2010). Scoping the field: identifying key research priorities in HIV and rehabilitation. *AIDS Behav*, 14(2), 448-458. doi: 10.1007/s10461-009-9528-z
- Park, H. S., Cho, H., & Kim, H. S. (2016). Development of a Multi-Agent m-Health Application Based on Various Protocols for Chronic Disease Self-Management. *J Med Syst*, 40(1), 36. doi: 10.1007/s10916-015-0401-5
- Quinn, Edel Marie, Corrigan, Mark A, O'Mullane, John, Murphy, David, Lehane, Elaine A, Leahy-Warren, Patricia, . . . Fulton, Greg J. (2013). Clinical unity and community empowerment: the use of smartphone technology to empower community management of chronic venous ulcers through the support of a tertiary unit. *PloS one*, 8(11), e78786.
- Randall, D. M., & Fernandes, M. F. (1991). The social desirability response bias in ethics research. *Journal of business ethics*, 10(11), 805-817. Research Center Pew. Accessed April 4, at. 2014. [2015-01-13]. webcite Older Adults and Technology Use (April 2014) <http://www.pewInternet.org/2014/04/03/older-adults-and-technology-use/>
- Robben, Sarah HM, Perry, Marieke, Huisjes, Mirjam, Nieuwenhuijzen, Leontien van, Schers, Henk J, Weel, Chris van, . . . Melis1, René JF. (2012). Implementation of an innovative

- web-based conference table for community-dwelling frail older people, their informal caregivers and professionals: a process evaluation. *BMC Health Services Research*, 12(251). doi: 10.1186/1472-6963-12-251.
- Robben, Saskia, Bosch, Lilian, Wiggers, Pascal, Decancq, Jasmien, & Kanis, Marije. (2015). Managing flexible care with a context aware system for ageing-in-place. doi: 10.4108/icst.pervasivehealth.2015.259229
- Robles, R. J., & Kim, T. H. (2010). Applications, Systems and Methods in Smart Home Technology: A Review. *Int. Journal of Advanced Science And Technology*, 15.
- Rogers E. M. (2010). *Diffusion of Innovations*. New York, NY: Free Press.
- Ruggiano, N., Shtompel, N., & Edvardsson, D. (2015). Engaging in Coordination of Health and Disability Services as Described by Older Adults: Processes and Influential Factors. *Gerontologist*, 55(6), 1015-1025. doi: 10.1093/geront/gnt208
- Russell, Glenda M, & Kelly, Nancy H. (2002). Research as interacting dialogic processes: Implications for reflexivity. Paper presented at the Forum Qualitative Sozialforschung/Forum: Qualitative Social Research.
- Saunders, Benjamin, Sim, Julius, Kingstone, Tom, Baker, Shula, Waterfield, Jackie, Bartlam, Bernadette, . . . Jinks, Clare. (2018). Saturation in qualitative research: exploring its conceptualization and operationalization. *Quality & Quantity*, 52(4), 1893-1907. doi: 10.1007/s11135-017-0574-8
- Smith, AC. (2012). Home care and technology: A case study. *Global Telehealth 2012: Delivering Quality Healthcare Anywhere Through Telehealth: Selected Papers from Global Telehealth 2012 (GT2012)*, 182, 142.

- Spragins, W., Lorenzetti, D. (2008). "Public Expectation and Patient Experience of Integration of Health Care: A Literature Review". Toronto: The Change Foundation.
- Starks, H., & Brown Trinidad, S. (2007). Choose your method: A comparison of phenomenology, discourse analysis, and grounded theory. *Qualitative health research, 17*(10), 1372-1380.
- Statistics Canada . Individual Internet use and e-commerce. The Daily; 2013. Aug 28, [2015-01-13]. website <http://www.statcan.gc.ca/daily-quotidien/131028/dq131028a-eng.pdf>.
- Steen, Marc, Manschot, Menno, & Koning, Nicole De. (2011). Benefits of Co-design in Service Design Projects. *International Journal of Design, 5*(2).
- Stellefson, M., Chaney, B., Barry, A. E., Chavarria, E., Tennant, B., Walsh-Childers, K., . . . Zagora, J. (2013). Web 2.0 chronic disease self-management for older adults: a systematic review. *J Med Internet Res, 15*(2), e35. doi: 10.2196/jmir.2439
- Stroulia, Eleni, Nikoladis, Ioanis, Liu, Lili, King, Sharla, & Lessard, Lysanne. (2012). Home Care and Technology: A Case Study. IOS Press. doi: 10.3233/978-1-61499-152-6-142
- Surendran, P. (2012). Technology acceptance model: A survey of literature. *International Journal of Business and Social Research, 2*(4), 175-178.
- Tricco, AC, Ivers, NM, Grimshaw, JM, Moher, D, Turner, L, Galipeau, J, . . . Shojania, K. (2012). Effectiveness of quality improvement strategies on the management of diabetes: a systematic review and meta-analysis. *The Lancet, 379*(9833), 2252 - 2261. doi: [https://doi.org/10.1016/S0140-6736\(12\)60480-2](https://doi.org/10.1016/S0140-6736(12)60480-2)
- Vaportzis, E., Clausen, M. G., & Gow, A. J. (2017). Older Adults Perceptions of Technology and Barriers to Interacting with Tablet Computers: A Focus Group Study. *Frontiers in Psychology, 8*, 1687. <http://doi.org/10.3389/fpsyg.2017.01687>

Villani, A., Malfatto, G., Compare, A., Della Rosa, F., Bellardita, L., Branzi, G., . . . Parati, G.

(2014). Clinical and psychological telemonitoring and telecare of high risk heart failure patients. *J Telemed Telecare*, 20(8), 468-475. doi: 10.1177/1357633X14555644

Wicklund, Eric. (2015). New Apps Target Care Coordination for COPD Patients. Retrieved from <https://mhealthintelligence.com/news/new-apps-target-care-coordination-for-copd-patients>

Williams, V., Price, J., Hardinge, M., Tarassenko, L., & Farmer, A. (2014). Using a mobile health application to support self-management in COPD: a qualitative study. *Br J Gen Pract*, 64(624), e392-400. doi: 10.3399/bjgp14X680473

World Health Organization. (2011). eHealth at WHO. Retrieved April 1, 2018, from <http://www.who.int/ehealth/about/en/>

Appendix A: Systematic Search Strategy for Scoping Review

Section 1: Scoping Review keyword search strategy

Concepts	mHealth	Coordination of care	Older adults
Author Keywords:	mHealth eHealth e-health m-health m health e health mobile technology mobile health mobile phone smartphones mobile application	Care coordination Coordination of care Patient centered care Patient care team Healthcare team Health care team Continuity of care	Senior Elderly Older patients Aging Aged Geriatric Gerontology
Subject Headings: MeSH EMTREE CINAHL terms	Telemedicine	Patient care team Continuity of patient care (exp)	Aged (exp)

Section 2: Specific Database Search Statements

Pubmed Search Statement

(mHealth[tw] OR “m health”[tw] OR eHealth[tw] OR “e Health”[tw] OR “telemedicine”[mesh] OR telemedicine[tw] OR mobile application*[tw] OR mobile applications[mesh] OR mobile apps OR Mobile phone* OR Smartphone* OR mobile phone* OR “Mobile health”) AND (older adult*[tw] OR older patient*[tw] OR senior*[tw] OR aging[tw] OR gerontology[tw] OR geriatric*[tw] OR elderly[tw] OR aged [mesh]) AND (care coordination OR coordination of care OR patient care team[mesh] OR healthcare team*[tw] OR health team*[tw] OR continuity AND care OR continuity of patient care[mesh])

CINAHL & Other database Search Statement

(mHealth[tw] OR “m health”[tw] OR eHealth[tw] OR “e Health”[tw] OR “telemedicine”[mesh] OR telemedicine[tw] OR mobile application*[tw] OR mobile applications[mesh] OR mobile apps OR Mobile phone* OR Smartphone* OR mobile phone* OR “Mobile health”) AND (older adult*[tw] OR older patient*[tw] OR senior*[tw] OR aging[tw] OR gerontology[tw] OR geriatric*[tw] OR elderly[tw] OR aged [mesh]) AND (care AND coordination OR coordination

of care OR patient care team[mesh] OR healthcare team*[tw] OR health team*[tw] OR continuity AND care OR continuity of patient care[mesh])

OVID/EMBASE

(mHealth[tw] OR "m health"[tw] OR eHealth[tw] OR "e Health"[tw] OR "telemedicine"[mesh] OR telemedicine[tw] OR mobile application*[tw] OR mobile applications[mesh] OR mobile apps OR Mobile phone* OR Smartphone* OR mobile phone* OR "Mobile health") AND (older adult*[tw] OR older patient*[tw] OR senior*[tw] OR aging[tw] OR gerontology[tw] OR geriatric*[tw] OR elderly[tw] OR aged [mesh]) AND (care AND coordination OR coordination of care OR patient care team[mesh] OR healthcare team*[tw] OR health team*[tw] OR continuity AND care OR continuity of patient care[mesh])

EBSCOhost

mHealth OR "m health" OR eHealth OR "e Health" OR "telemedicine" OR telemedicine OR "mobile application\$" OR "mobile applications" OR "mobile apps" OR "Mobile phone*" OR "Smartphone*" OR "mobile phone*" OR "Mobile health"

AND

"older adult*" OR "older patient*" OR senior* OR aging OR gerontology OR geriatric* OR elderly OR aged

AND

care AND coordination OR "coordination of care" OR "patient care team" OR "healthcare team*" OR "health team*" OR continuity AND care OR "continuity of patient care"

SCOPUS

(mhealth OR "m health" OR ehealth OR "e Health" OR "telemedicine" [mesh] OR telemedicine OR "mobile application\$" OR "mobile applications" OR "mobile apps" OR "Mobile phone*" OR "Smartphone*" OR "mobile phone*" OR "Mobile health") AND ("older adult*" OR "older patient*" OR senior* OR aging OR gerontology OR geriatric* OR elderly OR aged[mesh]) AND (care AND coordination OR "coordination of care" OR "patient care team" OR "healthcare team*" OR "health team*" OR continuity AND care OR "continuity of patient care")

Cochrane Library

mHealth OR "m health" OR eHealth OR "e Health" OR "telemedicine" OR telemedicine OR "mobile application\$" OR "mobile applications" OR "mobile apps" OR "Mobile phone*" OR "Smartphone*" OR "mobile phone*" OR "Mobile health"

AND

"older adult*" OR "older patient*" OR senior* OR aging OR gerontology OR geriatric* OR elderly OR aged

AND

care AND coordination OR "coordination of care" OR "patient care team" OR "healthcare team*" OR "health team*" OR continuity AND care OR "continuity of patient care"

PsycINFO

mHealth OR "m health" OR eHealth OR "e Health" OR "telemedicine" OR telemedicine OR "mobile application\$" OR "mobile applications" OR "mobile apps" OR "Mobile phone*" OR "Smartphone*" OR "mobile phone*" OR "Mobile health"

AND

"older adult*" OR "older patient*" OR senior* OR aging OR gerontology OR geriatric* OR elderly OR aged

AND

care AND coordination OR "coordination of care" OR "patient care team" OR "healthcare team*" OR "health team*" OR continuity AND care OR "continuity of patient care"

CHI (Human-Computer Interaction (HCI))

Gerontechnology

Older Adult AND Care Coordination

Mobile health 4

Section 3: Grey Literature Search Plan

Organization name	Keywords in search	# items identified for full screening (uploaded to bibliographic software)
CADTH Grey Matters	mHealth telehealth aging "older adult"	9
Google Search	(mHealth OR "mobile health" OR "telemedicine") AND ("continuity of care" OR "care coordination") AND (senior OR "older adult" OR Aging)	12

Appendix B: Scoping Review Inclusion/Exclusion Criteria

Inclusion Criteria

- Older adults both males and females (Mean age of 60- 65 is acceptable)
- Living in the community setting
- Mentions care coordination/patient experience, patient centered care
- Articles from January 2004-May 2017
- Relevant articles from search strategy started appearing at this time onwards
- English articles only
- Peer-reviewed (Academic articles only)
- Mention of Information transfer between settings
- Mention of Database for patient information storage

Exclusion Criteria

- Participants are less than 65 years/less than mean age of 60
- The study does not discuss mHealth tools
- Older adults that do not live in the community
- Does not mention care coordination
- mHealth solutions for monitoring devices
- technology in the health of developing countries
- non-English publications
- Smart home technologies
- Focus on exercise promotion
- No intervention – preliminary work
- Follow up only
- Telemedicine – only to do calls, no care planning information sharing



Appendix C: Study Recruitment Poster

(Caregiver)



Understanding how mHealth tools can support care coordination between older adults and healthcare providers: a scoping study

School of Public Health and Health Systems University of Waterloo

PARTICIPANTS NEEDED FOR RESEARCH IN OLDER ADULTS CARE COORDINATION

We are looking for caregiver volunteers to take part in a study of
Building a mHealth Tool to Support Care Coordination: A Co-design Process with Older Adults, Caregivers and Healthcare Providers

As a participant in this study, you would be asked to **participate in a focus group**

Your participation would involve **1** session,
each of which is approximately **45 to 60** minutes.

There are no known or anticipated risks associated with your participation.

You will not receive remuneration for participation in the study.

For more information about this study, or to volunteer for this study,
please contact:

Paul Stolee, PhD
School of Public Health and Health Systems

at
519-888-4567 Ext. 35879 or
Email: stolee@uwaterloo.ca

**This study has been reviewed by, and received ethics clearance
through a University of Waterloo Research Ethics Committee.**

(Older Adult)

Understanding how mHealth tools can support care coordination between older adults and healthcare providers: a scoping study

**School of Public Health and Health Systems
University of Waterloo**

**PARTICIPANTS NEEDED FOR
RESEARCH IN OLDER ADULTS CARE COORDINATION**

We are looking for older adult volunteers to take part in a study of
Building a mHealth Tool to Support Care Coordination: A Co-design Process with Older Adults, Caregivers and Healthcare Providers

As a participant in this study, you would be asked to **participate in a focus group and/or workshop**

Your participation would involve **1-2** sessions,
each of which is approximately **45 to 60** minutes.

There are no known or anticipated risks associated with your participation.

You will not receive remuneration for participation in the study.

For more information about this study, or to volunteer for this study,
please contact:

Paul Stolee, PhD
School of Public Health and Health Systems
at
519-888-4567 Ext. 35879 or
Email: stolee@uwaterloo.ca

**This study has been reviewed by, and received ethics clearance
through a University of Waterloo Research Ethics Committee**

(Healthcare Provider)

Understanding how mHealth tools can support care coordination between older adults and healthcare providers: a scoping study

**School of Public Health and Health Systems
University of Waterloo**

**HEALTHCARE PROVIDERS NEEDED FOR
RESEARCH IN OLDER ADULTS CARE COORDINATION**

We are looking for volunteers to take part in a study of
Building a mHealth Tool to Support Care Coordination: A Co-design Process with Older Adults, Caregivers and Healthcare Providers

As a participant in this study, you would be asked to **participate in an interview**

Your participation would involve **1** session,
each of which is approximately **30 to 45** minutes.

There are no known or anticipated risks associated with your participation.

You will not receive remuneration for participation in the study.

For more information about this study, or to volunteer for this study,
please contact:

Paul Stolee, PhD
School of Public Health and Health Systems
at

519-888-4567 Ext. 35879 or
Email: stolee@uwaterloo.ca

**This study has been reviewed by, and received ethics clearance
through a University of Waterloo Research Ethics Committee.**

(Older Adult)

Understanding how mHealth tools can support care coordination between older adults and healthcare providers: a scoping study

Good morning/afternoon,

My name is Paige Fernandes, a Master's student working under the supervision of Dr. Paul Stolee in the Geriatric Health Systems research group at the University of Waterloo School of Public Health and Health Systems.

We are looking for participants for a study on developing a mHealth tool to support care coordination between older adults, family caregivers and healthcare providers. Participation in this study is voluntary. If you want to participate you would be asked to take part in a face-to-face focus group with other older adults. With your consent, interviews will be audio recorded, and names or any identifying materials will not be reported. You may or may not choose to participate in the focus group with no consequence.

There are no known or anticipated risks to your participation in this study. The questions in the interview quite general (for example, is there a routine you follow before an appointment with your healthcare provider?). You may decline answering any questions you feel you do not wish to answer, and you can stop your participation at any time. Further, you will not be identified by name in any report or publication resulting from this study. If you have any questions about this study, or would like additional information to assist you in reaching a decision about participation, please feel free to contact **Dr. Paul Stolee** at 519-888-4567, Ext. 35879.

This study has been reviewed and received ethics clearance through a University of Waterloo Research.

Thank you for your assistance with this project.



Appendix G: Study Recruitment Script

(Healthcare Provider)



Understanding how mHealth tools can support care coordination between older adults and healthcare providers: a scoping study

Good morning/afternoon,

My name is Paige Fernandes, a Master's student working under the supervision of Dr. Paul Stolee in the Geriatric Health Systems research group at the University of Waterloo School of Public Health and Health Systems.

We are looking for participants for a study on developing a mHealth tool to support care coordination between older adults, family caregivers and healthcare providers. Participation in this study is voluntary. If you want to participate you would be asked to take part in a face-to-face interview. With your consent, interviews will be audio tape recorded, and names or any identifying materials will not be reported.

There are no known or anticipated risks to your participation in this study. The questions in the interview are general in nature (for example, what are things that make it easier to involve older adults/caregivers in care planning?). You may decline answering any questions you feel you do not wish to answer and you can end your participation at any time. Further, you will not be identified by name in any report or publication resulting from this study. If you have any questions about this study, or would like additional information to assist you in reaching a decision about participation, please feel free to contact **Dr. Paul Stolee** at 519-888-4567, Ext. 35879.

This study has been reviewed and received ethics clearance through a University of Waterloo Research.

Thank you for your assistance with this project.

(Caregiver)

Understanding how mHealth tools can support care coordination between older adults and healthcare providers: a scoping study

Good morning/afternoon,

My name is Paige Fernandes, a Master's student working under the supervision of Dr. Paul Stolee in the Geriatric Health Systems research group at the University of Waterloo School of Public Health and Health Systems.

We are looking for participants for a study on developing a mHealth tool to support care coordination between older adults, family caregivers and healthcare providers. Participation in this study is voluntary. If you want to participate you would be asked to take part in a face-to-face focus group with family caregivers. With your consent, interviews will be audio recorded, and names or any identifying materials will not be reported.

There are no known or anticipated risks to your participation in this study. The questions in the interview are general in nature (for example, how is information shared by healthcare providers with you?). You may decline answering any questions you feel you do not wish to answer, and you can end your participation in the study at any time. Further, you will not be identified by name in any report or publication resulting from this study. If you have any questions about this study, or would like additional information to assist you in reaching a decision about participation, please feel free to contact **Dr. Paul Stolee** at 519-888-4567, Ext. 35879.

This study has been reviewed and received ethics clearance through a University of Waterloo Research.

Thank you for your assistance with this project.

Understanding how mHealth tools can support care coordination between older adults and healthcare providers: a scoping study

Introduction Script

Thank you for taking the time to participate in this study. I want to remind you that you may choose not to answer any of the questions and can end your participation at any time during this interview. Your confidentiality will be respected and your name will not be associated with the data. With your permission, we will be audio-recording this session.

In our study, we are looking to find out whether older adults and their family members would benefit from using such an app, and what things older adults and family members may find useful. I am also looking for the perspective of healthcare providers on the development of an app to support patients and their family members.

1. What types of personal health information such as blood pressures, medications, etc. do you find is important for patients to keep track of when they come in for medical appointments?
2. How do you usually share information with your patients and how do your patients keep record of this?
Probe: do they bring a notebook with them and write it down?
3. Do you feel that an app on your smartphone or tablet would be helpful for your patients to keep track of the information that was discussed earlier? Why or why not?
4. What features do you think would make your patients want to use the app? What should it do for them?
Probe: texting capabilities with a doctor, look at your own data, keep track of your own records, conversations, and appointments, reminders, service locator
5. What are some concerns that you think would prevent your patients from using this type of app?
Probe: Older adults feel there is no use for technology? Privacy concerns? Low computer literacy? Not appropriate target population?
6. What would prevent you from using or promoting the use of an app that helps older adult/patients keep track of their health information?
Probe: Having to learn how to use the tool? Feeling that the patient won't understand how to use it?

7. What are some gaps you see were not identified during this interview? Any additional comments or feedback?

At the end of the interview, I will hand the participants the feature preference questionnaire and give them 5-10 minutes to complete. If it is a phone interview I will ask them to complete this online and send back via e-mail.

Understanding how mHealth tools can support care coordination between older adults and healthcare providers: a scoping study

Introduction Script

Introduce self.

Thank you for taking the time to participate in this study. I want to start with a reminder that you may choose not to answer any of the questions and you can end your participation at any time during this interview. Your confidentiality will be respected and your name will not be associated with the data. With your permission, we will be audio-recording this session.

This project is about current processes older adults use to manage their healthcare with the help of their family members and how these processes can be improved or supported. I am specifically interested in how you keep track of information when you see your family doctor or other healthcare provider.

1. What types of personal health information, such as blood pressure, medications, etc. do you find useful to keep track of when going for your medical appointments?
Probe: Medication lists? Appointments?
2. When you are in your medical appointment and your doctor or other healthcare provider shares information with you, what do you usually do with that information?
Probe: do you write it down in a notebook or rely on memory?

An app or application is a software program that you can use on tablets such as an iPad, or on mobile devices, such as a smart phone. Apps can have a variety of purposes and are sometimes used by people to keep track of things they think are important to them. A possible use is for recording and keeping track of health information. In our study, we are looking to find out whether older adults and their family members would benefit from using such an app, and what things older adults and family members may find useful. To begin this part of our conversation, I would like to go around the room and learn a bit about what kind of experiences you've had with mobile devices and apps. Could you each say a few words about that (go around the room so everyone has an opportunity to speak if they wish).

3. Do you feel that an app on your smartphone or tablet would be helpful for keeping track of the information that was discussed earlier? Why or why not?
4. What features would make you want to use the app? What would you want it to do?
Probe: texting capabilities with a doctor, look at your own data, keep track of your own records, conversations, and appointments, reminders, service locator

5. Would you be comfortable in using a tablet to keep track of your health information as part of a research study?
6. What are some concerns that would prevent you from using this type of app?
Probe: Discomfort with using mobile devices? Use of technology? Privacy concerns? Low computer literacy? Not appropriate target population?
7. Do you have any additional comments or feedback? (*index cards or can say in group*)

In getting ready for this meeting, I completed a literature search on existing apps that serve a similar purpose and would like your feedback on the results.

At the end of the interview, I will hand the participants the feature preference questionnaire and give them 5-10 minutes to complete and hand back to me.

(Healthcare Provider)

Understanding how mHealth tools can support care coordination between older adults and healthcare providers: a scoping study

INFORMATION FOR HEALTH CARE PROVIDERS**A. WHAT IS THE PURPOSE OF THIS STUDY?**

As a part of a research study for a master's level thesis, the Geriatric Health Systems (GHS) research group from the University of Waterloo will be co-designing an application for mobile phones and tablets to assist older adults coordinate their care with healthcare providers and caregivers. This group is looking for healthcare providers to share their experiences with current care coordination practices. Additionally, the group will be asking for what types of features you may find helpful to include in the application. The data collected will help the group understand the experiences of patients, caregivers, and health care provider's current experiences with care coordination. The group are also able to identify features that would support this process.

B. WHO CAN PARTICIPATE?

The GHS group are looking for adult patients aged 65 years or older, who are current patients of a primary care practice. To get a full picture of what the patient is going through, the group are also interested speaking to caregivers as well as health care providers with whom patients may have interactions with.

C. WHAT WILL I BE ASKED TO DO?

The GHS group are asking health care providers to participate in one focus group or individual interview to understand current care and referral processes and experiences. The individual interview will take place in-person or on the phone and will be approximately 45 to 60 minutes. Before beginning the interview, you will be asked to confirm that you agree to participate. With your permission, the interviews will be audio-recorded and quotations will be used. Any identifying information will be removed. Participants can skip questions if they are not comfortable at any time during the focus group.

D. WHERE WILL THE STUDY TAKE PLACE AND WHEN?

The study will run for approximately 8 months at various primary care centres. Your participation will only require you to participate in one interview. The interview will take place in a location convenient and comfortable to the participant or on the phone.

E. CAN I CHANGE MY MIND ABOUT PARTICIPATING IN THE STUDY?

You may withdraw from the study at any time. Withdrawal from the study will not affect your position at the health clinic. If you wish to withdraw, you can let the interviewer know any time during the focus group/interview, or you can e-mail Paige at paige.fernandes@uwaterloo.ca.

F. DATA USE

The data collected will help us understand the experiences of patients, caregivers, and healthcare provider's current experiences with care coordination. We are also able to identify features that would support this process.

G. RISKS AND BENEFITS

Confidentiality cannot be guaranteed in a focus group setting. The research team does however ask that all participants be respectful of the information shared by other participants in this study and keep it confidential. Participation in this study does not require you as a participant to answer all questions asked.

You will not receive remuneration for participation in the study.

H. CONFIDENTIALITY AND DATA SECURITY

The information you provide will be identified by number only. Any personal identifiers will be removed from the data, your name will not appear in any report or publication resulting from this study. Any quotations used in reports from your focus group/interview will not be identified with your name or any other personal information.

You have the right to ask the researchers about the data being collected about you for the study and about the purpose of these data. You also have the right to ask the researchers to let you see your personal information and make any necessary corrections to it.

Data collected will be kept securely stored in a locked office for a period of at least 5 years, and then destroyed. The data from the focus group/interview will be stored in a locked file cabinet, in a locked office, at the University of Waterloo for a period of at least 5 years. After at least 5 years, any written notes from the will be shredded and electronic files will be erased after 5 years. Only members of the research team who have signed a confidentiality agreement regarding information collected during the study, will have access to the study data.

I. QUESTIONS

This study has been reviewed and received ethics clearance through a University of Waterloo Research Ethics Committee (ORE# 22515). If you have questions for the Committee contact Chief Ethics Officer, Office of Research Ethics, at 1-519-888-4567 ext. 36005 or ore-ceo@uwaterloo.ca

If at any time you have questions about the proposed research, please contact the Principal Investigator: Paul Stolee, PhD, School of Public Health and Health Systems, University of Waterloo, Waterloo, Ontario, 519-888-4567 ext. 35879, stolee@uwaterloo.ca or **Student Investigator:** Paige Fernandes, MSc. (c), School of Public Health and Health Systems, University of Waterloo, Waterloo, Ontario, paige.fernandes@uwaterloo.ca.

(Older Adult)

Understanding how mHealth tools can support care coordination between older adults and healthcare providers: a scoping study

INFORMATION FOR OLDER ADULTS

A. WHAT IS THE PURPOSE OF THIS STUDY?

As a part of a research study for a master's level thesis, the Geriatric Health Systems (GHS) research group from the University of Waterloo will be co-designing an application for mobile phones and tablets to assist older adults coordinate their care with healthcare providers and caregivers. This group is looking for older adult patients to share their experiences with current care coordination practices. Additionally, the group will be asking for what types of features you would find helpful to include in the application. The data collected will help the group understand the experiences of patients, caregivers, and health care provider's current experiences with care coordination. The group are also able to identify features that would support this process.

B. WHO CAN PARTICIPATE?

We are looking for adult patients aged 65 years or older, who are current patients of a primary care setting. To get a full picture of what the patient is going through, we are also interested in speaking with caregivers and healthcare providers whom patients may interact with.

C. WHAT WILL I BE ASKED TO DO?

We are asking older adults to participate in an in-person focus group to understand their experiences with care coordination and referral processes. The focus group will take approximately 45 to 60 minutes to complete. Before beginning the focus group, you will be asked to confirm that you agree to participate. With your permission, the focus group will be audio-recorded and quotations will be used. Any identifying information will be removed. Participants can skip questions if they are not comfortable at any time during the focus group.

D. WHERE WILL THE STUDY TAKE PLACE AND WHEN?

The study will run for approximately 8 months at various primary care centres. Your participation will only require you to participate in one focus held at a location determined by the researcher. This will be at an accessible and central setting.

E. CAN I CHANGE MY MIND ABOUT PARTICIPATING IN THE STUDY?

You may withdraw from the study at any time. If you choose to withdraw, your care at the clinic will not be affected in any way. The participating organizations will not know what healthcare providers, patients, and caregivers have participated in this study. If you wish to withdraw, you

can let the interviewer know any time during the focus group, or you can e-mail Paige at paige.fernandes@uwaterloo.ca.

F. DATA USE

The data collected will help us understand the experiences of patients, caregivers, and healthcare provider's current experiences with care coordination. We are also able to identify features that would support this process.

G. RISKS AND BENEFITS

Confidentiality cannot be guaranteed in a focus group setting. The research team does however ask that all participants be respectful of the information shared by other participants in this study and keep it confidential. Participation in this study does not require you as a participant to answer all questions asked.

You will not receive remuneration for participation in the study.

H. CONFIDENTIALITY AND DATA SECURITY

Any personal identifiers will be removed from the data, your name will not appear in any report or publication resulting from this study. Any quotations used in reports from your focus group will not be identified with your name or any other personal information.

You have the right to ask the researchers about the data that will be collected about you for the study and about the purpose of these data. You also have the right to ask the researchers to let you see your personal information and make any necessary corrections to it.

Data collected will be kept securely stored in a locked office for a period of at least 5 years, and then confidentially destroyed. The data from the focus group will be stored in a locked file cabinet, in a locked office, at the University of Waterloo for a period of at least 5 years. After at least 5 years, any written notes from the focus group will be shredded and electronic files will be permanently erased after 5 years. Only members of the GHS research team who have signed a confidentiality agreement regarding information collected during the study will have access to the study data.

I. QUESTIONS

This study has been reviewed and received ethics clearance through a University of Waterloo Research Ethics Committee (ORE# 22515). If you have questions for the Committee contact Chief Ethics Officer, Office of Research Ethics, at 1-519-888-4567 ext. 36005 or ore-ceo@uwaterloo.ca

If at any time you have questions about the proposed research, please contact the Principal Investigator: Paul Stolee, PhD, School of Public Health and Health Systems, University of Waterloo, Waterloo, Ontario, 519-888-4567 ext. 35879, stolee@uwaterloo.ca or **Student Investigator:** Paige Fernandes, MSc. (c), School of Public Health and Health Systems, University of Waterloo, Waterloo, Ontario, paige.fernandes@uwaterloo.ca.

(Caregiver)

Understanding how mHealth tools can support care coordination between older adults and healthcare providers: a scoping study

INFORMATION FOR FAMILY/FRIEND CAREGIVERS**A. WHAT IS THE PURPOSE OF THIS STUDY?**

As a part of a research study for a master's level thesis, the Geriatric Health Systems (GHS) research group from the University of Waterloo will be co-designing an application for mobile phones and tablets to assist older adults coordinate their care with healthcare providers and caregivers. This group is looking for caregivers to share their experiences with current care coordination practices. Additionally, the group will be asking for what types of features you would find helpful to include in the application. The data collected will help the group understand the experiences of patients, caregivers, and health care provider's current experiences with care coordination. The group are also able to identify features that would support this process.

B. WHO CAN PARTICIPATE?

The GHS group are looking for adult patients aged 65 years or older, who are current patients of a primary care practice. To get a full picture of what the patient is going through, the group are also interested speaking to *caregivers* as well as healthcare providers with whom patients may have interactions with.

C. WHAT WILL I BE ASKED TO DO?

We are asking caregivers to participate in a focus group to understand their experiences with care coordination and referral processes. The focus group will take approximately 45 to 60 minutes to complete. Before beginning the focus group, you will be asked to confirm that you agree to participate. With your permission, the focus group will be audio-recorded and quotations will be used. Any identifying information will be removed. Participants can skip questions if they are not comfortable at any time during the focus group.

D. WHERE WILL THE STUDY TAKE PLACE AND WHEN?

The study will run for approximately 8 months at various primary care centres. Your participation will only require you to participate in one focus group and/or one workshop held at a location determined by the researcher. This will be at an accessible and central setting to the participants.

E. CAN I CHANGE MY MIND ABOUT PARTICIPATING IN THE STUDY?

You may withdraw from the study at any time. Withdrawal from the study will not affect your position at the health clinic. If you wish to withdraw, you can let the researcher know any time during the focus group, or you can e-mail Paige at paige.fernandes@uwaterloo.ca.

F. DATA USE

The data collected will help us understand the experiences of patients, caregivers, and healthcare provider's current experiences with care coordination. We are also able to identify features that would support this process.

G. RISKS AND BENEFITS

Confidentiality cannot be guaranteed in a focus group setting. The research team does however ask that all participants be respectful of the information shared by other participants in this study and keep it confidential. Participation in this study does not require you as a participant to answer all questions asked.

You will not receive remuneration for participation in the study.

H. CONFIDENTIALITY AND DATA SECURITY

Any personal identifiers will be removed from the data, your name will not appear in any report or publication resulting from this study. Any quotations used in reports from your focus group will not be identified with your name or any other personal information.

You have the right to ask the researchers about the data being collected about you for the study and about the purpose of these data. You also have the right to ask the researchers to let you see your personal information and make any necessary corrections to it.

Data collected will be kept securely stored in a locked office for a period of at least 5 years, and then confidentially destroyed. The data from the focus group will be stored in a locked file cabinet, in a locked office, at the University of Waterloo for a period of at least 5 years. After at least 5 years, any written notes from the focus group will be shredded and electronic files will be permanently erased after 5 years. Only members of the GHS research team who have signed a confidentiality agreement regarding information collected during the study, will have access to the study data.

I. QUESTIONS

This study has been reviewed and received ethics clearance through a University of Waterloo Research Ethics Committee (ORE# 22515). If you have questions for the Committee contact Chief Ethics Officer, Office of Research Ethics, at 1-519-888-4567 ext. 36005 or ore-ceo@uwaterloo.ca

If at any time you have questions about the proposed research, please contact the Principal Investigator: Paul Stolee, PhD, School of Public Health and Health Systems, University of Waterloo, Waterloo, Ontario, 519-888-4567 ext. 35879, stolee@uwaterloo.ca or **Student Investigator:** Paige Fernandes, MSc. (c), School of Public Health and Health Systems, University of Waterloo, Waterloo, Ontario, paige.fernandes@uwaterloo.ca.



Appendix N: Consent Form
(Healthcare Provider)



Understanding how mHealth tools can support care coordination between older adults and healthcare providers: a scoping study

I have read the information letter about the study being conducted. I know that the study is being conducted by Dr. Paul Stolee and Paige Fernandes in the School of Public Health and Health Systems at the University of Waterloo.

I have made a decision to participate in the research study based on the information I have received in the discussion with the researcher(s) from the University of Waterloo. I have had the opportunity to ask questions and receive any additional details I wanted about the study. I also understand that participation is completely voluntary. I may decline answering any of the questions, if I so choose and I am free to withdraw from the study at any time by telling the researchers that I no longer wish to continue.

I was informed that you would like my help to better understand current care coordination practices between older adults, healthcare providers and caregivers to help develop a mHealth tool. I was informed that my participation in this study involves an interview.

I am aware that I have the option of allowing the interview to be audio recorded to ensure an accurate recording of my responses. I am also aware that excerpts from the discussion may be included in the thesis and/or publications to come from this research, with the understanding that the quotations will be anonymous

All information that I provide will be held in confidence and I will not be identified in any reports or publications resulting from this research. I was informed that any quotations taken from my interview(s) will be referenced as anonymous in any publications of this research.

Please note, by signing this consent form you are not waiving your legal rights or releasing the investigator(s) or involved institution(s) from their legal and professional responsibilities.

(Check the box or boxes indicating the parts of the study you agree to participate in)

- I agree to participate in this study
- I agree to participate in an interview
- I give consent for quotations from my interview to be used in reports where they will be referenced as anonymous.
- I agree to be audiotaped during the interview/ focus group

Participant Name: _____ (Please print)

Participant Signature: _____

OR

*Proxy Signature: _____

Witness Name: _____ (Please print)

Witness Signature: _____

Date: _____

The research study has been reviewed by and received ethics clearance through a University of Waterloo Research Ethics Committee (ORE #22515).

(Caregiver)

Understanding how mHealth tools can support care coordination between older adults and healthcare providers: a scoping study

I have read the information letter about the study being conducted. I know that the study is being conducted by Dr. Paul Stolee and Paige Fernandes in the School of Public Health and Health Systems at the University of Waterloo.

I have made a decision to participate in the research study based on the information I have received in the discussion with the researcher(s) from the University of Waterloo. I have had the opportunity to ask questions and receive any additional details I wanted about the study. I also understand that participation is completely voluntary. I may decline answering any of the questions, if I so choose and I am free to withdraw from the study at any time by telling the researchers that I no longer wish to continue.

I was informed that you would like my help to better understand current care coordination practices between older adults, healthcare providers and caregivers to help develop a mHealth tool. I was informed that my participation in this study involves a focus group.

I am aware that I have the option of allowing the interview to be audio recorded to ensure an accurate recording of my responses. I am also aware that excerpts from the discussion may be included in the thesis and/or publications to come from this research, with the understanding that the quotations will be anonymous

All information that I provide will be held in confidence and I will not be identified in any reports or publications resulting from this research. I was informed that any quotations taken from my interview(s) will be referenced as anonymous in any publications of this research.

Please note, by signing this consent form you are not waiving your legal rights or releasing the investigator(s) or involved institution(s) from their legal and professional responsibilities.

(Check the box or boxes indicating the parts of the study you agree to participate in)

- I agree to participate in this study
- I agree to participate in a focus group
- I give consent for quotations from my interview to be used in reports where they will be referenced as anonymous.
- I agree to be audiotaped during the focus group

Participant Name: _____ (Please print)

Participant Signature: _____

OR

*Proxy Signature: _____

Witness Name: _____ (Please print)

Witness Signature: _____

Date: _____

The research study has been reviewed by and received ethics clearance through a University of Waterloo Research Ethics Committee (ORE#22515).

(Older Adult)

Understanding how mHealth tools can support care coordination between older adults and healthcare providers: a scoping study

I have read the information letter about the study being conducted. I know that the study is being conducted by Dr. Paul Stolee and Paige Fernandes in the School of Public Health and Health Systems at the University of Waterloo.

I have made a decision to participate in the research study based on the information I have received in the discussion with the researcher(s) from the University of Waterloo. I have had the opportunity to ask questions and receive any additional details I wanted about the study. I also understand that participation is completely voluntary. I may decline answering any of the questions, if I so choose and I am free to withdraw from the study at any time by telling the researchers that I no longer wish to continue.

I was informed that you would like my help to better understand current care coordination practices between older adults, healthcare providers and caregivers to help develop a mHealth tool. I was informed that my participation in this study involves a focus group and/or workshop.

I am aware that I have the option of allowing the interview to be audio recorded to ensure an accurate recording of my responses. I am also aware that excerpts from the discussion may be included in the thesis and/or publications to come from this research, with the understanding that the quotations will be anonymous

All information that I provide will be held in confidence and I will not be identified in any reports or publications resulting from this research. I was informed that any quotations taken from my interview(s) will be referenced as anonymous in any publications of this research.

Please note, by signing this consent form you are not waiving your legal rights or releasing the investigator(s) or involved institution(s) from their legal and professional responsibilities.

Please check the following boxes for your participation in this study

- I agree to participate in this study
- I agree to participate in a focus group
- I give consent for quotations from my interview to be used in reports where they will be referenced as anonymous.
- I agree to be audiotaped during the interview and focus group

Participant Name: _____ (Please print)

Participant Signature: _____

OR

*Proxy Signature: _____

Witness Name: _____ (Please print)

Witness Signature: _____

Date: _____

The research study has been reviewed by and received ethics clearance through a University of Waterloo Research Ethics Committee (ORE #22515).

Understanding how mHealth tools can support care coordination between older adults and healthcare providers: a scoping study

Dear Participant,

I would like to thank you for your participation in this study. As a reminder, the purpose of this study is to find out the features that should be included in a mHealth tool to support care coordination.

The data collected will help us understand the experiences of patients, caregivers, and health care provider's current experiences with care coordination. We are also able to identify features that would support this process.

Please remember that any data pertaining to you as an individual participant will be kept confidential. Once all the data are collected and analyzed for this project, we plan on sharing this information with the research community through seminars, conferences, presentations, and journal articles. If you are interested in receiving more information regarding the results of this study, or would like a summary of the results, please provide your email address, and when phase one of the study is complete (August, 2018), I will send you the information. In the meantime, if you have any questions about the study, please do not hesitate to contact one of the researchers by email or telephone as noted below.

As with all University of Waterloo projects involving human participants, this project was reviewed by, and received ethics clearance through a University of Waterloo Research Ethics Committee (ORE #22515). If you have questions for the Committee contact the Chief Ethics Officer, Office of Research Ethics, at 1-519-888-4567 ext. 36005 or ore-ceo@uwaterloo.ca

Sincerely,
Paige Fernandes, MSc. (c)
School of Public Health and Health Systems
University of Waterloo
Email: paige.fernandes@uwaterloo.ca
Website: <https://uwaterloo.ca/geriatric-health-systems-research-group/>

Paul Stolee, PhD,
School of Public Health and Health Systems,
University of Waterloo
Phone: 519-888-4567 ext. 35879,
Email: stolee@uwaterloo.ca

Please check all that apply:

- I would like to receive further information about the results of this study
- I would like to receive information about additional research that the group is conducting

Please provide your e-mail Address (Please print clearly):

Understanding how mHealth tools can support care coordination between older adults and healthcare providers: a scoping study

Below is a list of types of information and features that could be included in an “app” on a tablet or smartphone that patients or family members might use to keep track of their health information. On a scale of 1 to 5, 1 being not interested, 5 being very interested please rate each of the following statements.

Feature	Scale				
	Not Interested			Very Interested	
My well-being					
61. I will have the ability to document my medication list and dosage	1	2	3	4	5
62. I will have the ability to track my symptoms	1	2	3	4	5
63. I will be able to create personal health goals	1	2	3	4	5
I will be able to keep track of...					
64. My blood pressure	1	2	3	4	5
65. My heart rate	1	2	3	4	5
66. My immunization records	1	2	3	4	5
67. My illnesses	1	2	3	4	5
68. My exercise	1	2	3	4	5
69. My friends and family involved in my care	1	2	3	4	5
70. My glucose levels	1	2	3	4	5
71. My oxygen levels	1	2	3	4	5
72. My general well-being/feelings	1	2	3	4	5
73. My health insurance information	1	2	3	4	5
Some things I would like to see the app do...					
74. I can view a graph of my recorded symptoms	1	2	3	4	5
75. I will have the ability to view, download and print an electronic file of health information	1	2	3	4	5

76.I will be able to connect other devices to the app through Bluetooth (e.g. blood pressure monitor, scale)	1	2	3	4	5
77.I will be alerted if my data falls out of target range (e.g. if my blood pressure is too high)	1	2	3	4	5
78.I will be have the ability to give access to others (healthcare provider(s) or caregivers)	1	2	3	4	5
Reminders to support my memory					
79. I will receive a pop-up reminder to take my medication(s)	1	2	3	4	5
80. I will receive a pop up reminder to input my health data into the app	1	2	3	4	5
81. I will receive a reminder to pop up when I choose (E.g. Talk to my (doctor, nurse, specialist, etc.) about (blood pressure, blood sugar, etc.)	1	2	3	4	5
82. I will receive e-mail notifications as a reminder (e.g. your cardiologist appointment is today at 12:00pm)	1	2	3	4	5
My Appointments					
83. I will have the ability to reschedule missed appointments	1	2	3	4	5
84. I will have the option to rebook easily	1	2	3	4	5
85. I will have the ability to track who created the appointment	1	2	3	4	5
How do I prepare for the appointment?					
86. Wear certain clothes	1	2	3	4	5
87. Limit eating or drinking	1	2	3	4	5
88. Bring medications	1	2	3	4	5
89. Bring health documentation	1	2	3	4	5
90. Form(s)	1	2	3	4	5
91. Others	1	2	3	4	5
I will be able to request feedback after my appointment has occurred such as...(32-36)					
92. I like this service	1	2	3	4	5
93. This service is helping me	1	2	3	4	5
94. I don't like this service	1	2	3	4	5
95. I don't think this service is helping me	1	2	3	4	5
96. Option to enter in "other" reason	1	2	3	4	5
I will be able to record whether or not I attended the appointment and the reasons such					

as... (37-42)					
97. Bad weather	1	2	3	4	5
98. I didn't have a way to get there	1	2	3	4	5
99. I was not feeling well	1	2	3	4	5
100. I had to take care of someone else	1	2	3	4	5
101. It was closed	1	2	3	4	5
102. Option to enter in "other" reason	1	2	3	4	5
I will be able to input information about the appointment such as...(43-50)					
103. Appointment name (e.g. Cardiologist appointment, Dr. _____)	1	2	3	4	5
104. Appointment type – (e.g. referral, service)	1	2	3	4	5
105. Date and time	1	2	3	4	5
106. Location (e.g. 123 King Street West, Grand River Hospital)	1	2	3	4	5
107. Reason for visit (e.g. I am experiencing a lot of fatigue)	1	2	3	4	5
108. Notes for parking (e.g. Parking available at the back)	1	2	3	4	5
109. Notes for travel time (e.g. It takes 15 minutes to drive there)	1	2	3	4	5
110. Important phone numbers (e.g. Phone number of the cardiologist is 123-456-7890)	1	2	3	4	5
How I will communicate with people involved in my care					
111. I will be able to keep a contact list and information of all those involved in my care team (e.g. Doctor, Nurse, Specialists, etc.)	1	2	3	4	5
112. I will have the option to send health data to my providers before appointments	1	2	3	4	5
113. I will be able to give verbal instructions to the app instead of typing it	1	2	3	4	5
114. Online communication with my providers, caregivers and other patients (e.g. live chat, texting or e-mail)	1	2	3	4	5
Things that will help me use the app					

115. There will be a tutorial within the app to explain to me how to set-up and use it	1	2	3	4	5
116. Having the option of a paper-based or hard copy version rather than online version	1	2	3	4	5
117. I will be able to call a telephone support line if I need help using the app or setting it up	1	2	3	4	5
118. I will be given a user manual with written instructions of how to use the app	1	2	3	4	5
119. I will be given a face-to-face training session on how to use the app	1	2	3	4	5
120. I will have access to an online user manual with instructions on how to use the app	1	2	3	4	5
Additional Features (from participants)					
121.	1	2	3	4	5
122.	1	2	3	4	5
123.	1	2	3	4	5
124.	1	2	3	4	5
125.	1	2	3	4	5

Understanding how mHealth tools can support care coordination between older adults and healthcare providers: a scoping study

<p>Below is a list of types of information and features that could be included in an “app” on a tablet or smartphone that patients or family members might use to keep track of their health information. On a scale of 1 to 5, 1 being not interested, 5 being very interested please rate each of the following statements.</p>					
Feature	Scale				
	Not Interested			Very Interested	
Patient well-being					
1. Patients will have the ability to document their medication list and dosage	1	2	3	4	5
2. Patients will have the ability to track their symptoms	1	2	3	4	5
3. Patients will be able to create personal health goals	1	2	3	4	5
Patients be able to keep track of...					
4. Blood pressure	1	2	3	4	5
5. Heart rate	1	2	3	4	5
6. Immunization records	1	2	3	4	5
7. Illnesses	1	2	3	4	5
8. Exercise	1	2	3	4	5
9. Friends and family involved in their care	1	2	3	4	5
10. Glucose levels	1	2	3	4	5
11. Oxygen levels	1	2	3	4	5
12. General well-being/feelings	1	2	3	4	5
13. Health insurance information	1	2	3	4	5
Some things I would like to see the app do...					
14. Patients can view a graph of their recorded symptoms	1	2	3	4	5

15. Patients will have the ability to view, download and print an electronic file of health information	1	2	3	4	5
16. Patients will be able to connect other devices to the app through Bluetooth (e.g. blood pressure monitor, scale)	1	2	3	4	5
17. Patients will be alerted if their data falls out of target range (e.g., if my blood pressure is too high)	1	2	3	4	5
18. Patients will be have the ability to give access to others (healthcare provider(s) or caregivers)	1	2	3	4	5
Reminders to support their memory					
19. Patients will receive a pop-up reminder to take their medication(s)	1	2	3	4	5
20. Patients will receive a pop up reminder to input their health data into the app	1	2	3	4	5
21. Patients will receive a reminder to pop up when they choose (e.g., Talk to my (doctor, nurse, specialist, etc.) about (blood pressure, blood sugar, etc.)	1	2	3	4	5
22. Patients will receive e-mail notifications as a reminder (e.g. your cardiologist appointment is today at 12:00pm)	1	2	3	4	5
My Appointments					
23. Patients will have the ability to reschedule missed appointments	1	2	3	4	5
24. Patients will have the option to rebook easily	1	2	3	4	5
25. Patients will have the ability to track who created the appointment	1	2	3	4	5
How to prepare for their appointment?					
26. Wear certain clothes	1	2	3	4	5
27. Limit eating or drinking	1	2	3	4	5
28. Bring medications	1	2	3	4	5
29. Bring health documentation	1	2	3	4	5
30. Form(s)	1	2	3	4	5
31. Others	1	2	3	4	5
Patients will be able to request feedback after their appointment has occurred such as...(32-36)					

32. I like this service	1	2	3	4	5
33. This service is helping me	1	2	3	4	5
34. I don't like this service	1	2	3	4	5
35. I don't think this service is helping me	1	2	3	4	5
36. Option to enter in "other" reason	1	2	3	4	5
Patients will be able to record whether or not they attended the appointment and the reasons such as... (37-42)					
37. Bad weather	1	2	3	4	5
38. They didn't have a way to get there	1	2	3	4	5
39. They were not feeling well	1	2	3	4	5
40. They had to take care of someone else	1	2	3	4	5
41. It was closed	1	2	3	4	5
42. Option to enter in "other" reason	1	2	3	4	5
Patients will be able to input information about the appointment such as...(43-50)					
43. Appointment name (e.g. Cardiologist appointment, Dr. _____)	1	2	3	4	5
44. Appointment type – (e.g. referral, service)	1	2	3	4	5
45. Date and time					
46. Location (e.g. 123 King Street West, Grand River Hospital)	1	2	3	4	5
47. Reason for visit (e.g. I am experiencing a lot of fatigue)	1	2	3	4	5
48. Notes for parking (e.g. Parking available at the back)	1	2	3	4	5
49. Notes for travel time (e.g. It takes 15 minutes to drive there)	1	2	3	4	5
50. Important phone numbers (e.g. Phone number of the cardiologist is 123-456-7890)	1	2	3	4	5
How patients will communicate with people involved in their care					
51. Patients will be able to keep a contact list and information of all those involved in their care team (e.g. Doctor, Nurse, Specialists, etc.)	1	2	3	4	5
52. Patients will have the option to send health data to	1	2	3	4	5

their providers before appointments					
53. Patients will be able to give verbal instructions to the app instead of typing it	1	2	3	4	5
54. Online communication with their providers, caregivers and other patients (e.g. live chat, texting or e-mail)	1	2	3	4	5
Things that will help patients use the app					
55. There will be a tutorial within the app to explain to them how to set-up and use it	1	2	3	4	5
56. Having the option of a paper-based or hard copy version rather than online version	1	2	3	4	5
57. Patients will be able to call a telephone support line if they need help using the app or setting it up	1	2	3	4	5
58. Patients will be given a user manual with written instructions of how to use the app	1	2	3	4	5
59. Patients will be given a face-to-face training session on how to use the app	1	2	3	4	5
60. Patients will have access to an online user manual with instructions on how to use the app	1	2	3	4	5
Additional Features (from participants)					
61.	1	2	3	4	5
62.	1	2	3	4	5
63.	1	2	3	4	5
64.	1	2	3	4	5
65.	1	2	3	4	5

Appendix T: Ethics Clearance

Dear Researcher:

The recommended revisions/additional information requested in the ethics review of your application for the study:

Title: Building a mHealth Tool to Support Care Coordination: A Co-design Process with Older Adults, Caregivers and Healthcare Providers ORE #: 22515

Principal/Co-Investigator: Paul Stolee (stolee@uwaterloo.ca)

Principal/Co-Investigator: Jacobi Elliott (jacobi.elliott@uwaterloo.ca) Faculty Supervisor: Paul Stolee (stolee@uwaterloo.ca)

Student Investigator: Paige Fernandes (paige.fernandes@uwaterloo.ca)

have been reviewed and are considered acceptable. A University of Waterloo Research Ethics Committee is pleased to inform you this study has been given ethics clearance.

A signed copy of the notification of ethics clearance will be sent to the Principal Investigator (or Faculty Supervisor in the case of student research). Ethics approval to start this research is effective as of the date of this email. The above named study is to be conducted in accordance with the submitted application (Form 101/101A) and the most recent approved versions of all supporting materials.

University of Waterloo Research Ethics Committees operate in compliance with the institution's guidelines for research with human participants, the Tri-Council Policy Statement for the Ethical Conduct for Research Involving Humans (TCPS, 2nd edition), Internationalization Conference on Harmonization: Good Clinical Practice (ICH-GCP), the Ontario Personal Health Information Protection Act (PHIPA), and the applicable laws and regulations of the province of Ontario. Both Committees are registered with the U.S. Department of Health and Human Services under the Federal Wide Assurance, FWA00021410, and IRB registration number IRB00002419 (Human Research Ethics Committee) and IRB00007409 (Clinical Research Ethics Committee).

Dear Researcher:

A Request for ethics review of a modification or amendment (ORE 104) to your ORE application:

Title: Understanding how mHealth Tools can Support Care Coordination between Older Adults and Healthcare Providers: A Scoping Study

ORE #: 22515

Principal/Co-Investigator: Paul Stolee (stolee@uwaterloo.ca)

Principal/Co-Investigator: Jacobi Elliott (jacobi.elliott@uwaterloo.ca)

Faculty Supervisor: Paul Stolee (stolee@uwaterloo.ca)

Student Investigator: Paige Fernandes (paige.fernandes@uwaterloo.ca)

together with a copy of relevant materials, was received in the Office of Research Ethics on:

February 26th, 2018: 1) Change in project title - Understanding how mHealth Tools can Support Care Coordination between Older Adults and Healthcare Providers: A Scoping Study (Old title - Building a mHealth Tool to Support Care Coordination: A Co-design Process with Older Adults, Caregivers and Healthcare Providers.) 2) Add new questionnaire; rephrase and cut down interview guides. 3) Healthcare providers, individual interviews (n=10-14), plus the focus group data (n= 24-26); Caregivers, 3-4 focus groups (n = 12 - 24); Older adults, 3-4 focus groups (n= 12 - 24); Total = 58 - 98. 4) Recruitment will be from Ontario study sites. Older adults will be recruited from sites in Waterloo Region and Kawartha Lakes Community Care Health & Care Network; Caregivers will be recruited from the Dementia Advisory group and Kawartha Lakes Community Care Health & Care Network; Healthcare providers will also be recruited from Kawartha Lakes, Community Care Health & Care Network. 5) Location of study - Quebec / Laval University. Research colleagues at Laval University will be collecting data with a separate ethics application they will complete.

The proposed modification request has been reviewed and has received full ethics clearance.

Appendix U: Scoping Review Extraction Table (Development and Implementation of mHealth tools)

Author, Year	Ref ID	Barriers to development or Implementation	Facilitators to development or Implementation	Features
SYSTEMATIC DATABASE SEARCH				
Clemmensen et al., 2005	565	<ul style="list-style-type: none"> • Collaboration is difficult between different sectors to implement technologies. • Users have trouble remembering to charge their devices. • Cardiologist must remember to bring the device when on-call. • It is challenging to standardize a procedure for all events and communication. 	<ul style="list-style-type: none"> • Use of this tool has shortened prehospital time for patients admitted. 	<ul style="list-style-type: none"> • ECG transmitted from the paramedics to the cardiologist in the hospital once the patient is in the ambulance.
Nguyen et al., 2013	513	<ul style="list-style-type: none"> • Electronic options were stringent as participants wanted to pick and choose features that they were interested in using and were excluded. from the study if they did not use all. • There is a need for more testing of technology-enabled approaches that cater to patient preferences to facilitate patient engagement. 	<ul style="list-style-type: none"> • Using electronics made it easy for researchers to collect user data. • Patients get training on how to use the device/system. 	<ul style="list-style-type: none"> • Patients can communicate with RN through e-mail. • Patients have access to online discussion board to communicate with other users. • Patients have access to web interactive education modules. • Opportunities for patients to participate in live chats with RN and other participants during education sessions • Patients can set exercise goals and have the ability to record exercise on smartphone or

				<p>website.</p> <ul style="list-style-type: none"> • Symptom graphs can be generated for the patient • Patients can record daily symptoms on website and smartphone. • The RN involved is alerted if the patient's symptoms worsen.
Villani et al., 2014	443	<ul style="list-style-type: none"> • Did not involve the patient's GP, who could enable consistent exchange of clinical information and consulting with a heart failure centre. • Did not consider other variables to monitor that could assist providing effective telecare for a patient. • Did not consider less severe heart failure patients that they could use this technology for a longer term. 	<ul style="list-style-type: none"> • PDA device well accepted by patients and their caregivers. • The system was easy to use and instructions were easy to follow. • The telephone line provided was readily available for the users. • Training available on how to use the device. 	<ul style="list-style-type: none"> • Record of variables (e.g. heart rate, body weight, blood pressure, body weight, ECG) • Pre-set alarm to remind user to input their data • Remote transmission of variables (e.g. Blood pressure and ECG) into device • Questionnaires or visual scales for monthly depression and anxiety tests • Information storage server • Information transfer to cardiologist so that they can modify treatment and contact patient via phone call.

Ho et al., 2016	424	<ul style="list-style-type: none"> • A significant proportion of alerts deemed meaningless as no action was required. • Some may argue that this form of telemonitoring is not practical in the real-world with the large and growing COPD population 	<ul style="list-style-type: none"> • The symptoms chosen to monitor were easily available and associated with COPD. • • Training available on how to use the device. 	<ul style="list-style-type: none"> • Electronic diary via website consisting of 8 questions about disease-related symptoms, vital signs and weight and took 2 minutes to complete • Data were transmitted to nurses and pulmonologists for assessment and they had the option to contact and evaluate the patient and be referred
Nazi et al., 2014	374	<ul style="list-style-type: none"> • Many users indicated that there was too much information in the notes which made it difficult to understand. • Study population may not be representative of target audience which may indicate a need for further outreach, education and portal usability. • Not enough awareness of the portal • US physicians believe that patients should have limited access to their EHR information 	<ul style="list-style-type: none"> • Users wanted access to their information because they wanted to know more about their health, were curious and wanted to be sure that they were understanding what their provider said • Many users said it was easy to find their health record notes, they were easy to read and an accurate representation of their visit • Users had reported viewing their health notes assisted in preparing for in-person visits, deeper understanding about their conditions and recall of care plans, improved medication adherence, and felt more in control of their health. 	<p>Web-based personal health record (PHR) that allows:</p> <ul style="list-style-type: none"> • Veterans to view, print and download a single electronic file that contains their personal health information either self-reported or from the electronic health record (EHR). • Veterans have access to health education resources. • Veterans can refill their prescriptions. • Veteran has the ability to communicate electronically with healthcare team via secure messaging. • Healthcare providers have the option to enter information about patient's care, such as, lab test results and clinical visit notes.

Logan et al., 2017	306	<ul style="list-style-type: none"> • Potential to negatively impact mental health as patients get caught up with monitoring their symptoms (i.e. depression or anxiety). • Noted fatigue effect which is a decrease in the number of recordings over time, despite having reminders. • Physicians may not fully endorse the use of home BP monitoring. 	<ul style="list-style-type: none"> • Training provided on how to use device. 	<ul style="list-style-type: none"> • Smartphone was paired to a BP monitoring device and transmitted to a reporting and alerting system which would send a self-care message to the patient's smartphone after a reading. Patients who fell outside of normal BP range would be prompted to take additional readings to inform advice on the urgency to make a follow-up visit with their physician. • Critical readings were sent to physician's office • The day before the visit, patients were prompted to fax a 1 page summary with a graphic presentation of readings, 30-day average and number of readings in the average
Faria et al., 2014	257	<ul style="list-style-type: none"> • Participants had to carry 3 different devices and ensure that they were switched on or off and charged at different times of the day. • Some participants had low literacy rates which caused some invalid data. • Physicians felt that patients did not understand the mechanism of the system. • It was impossible to ensure 	<ul style="list-style-type: none"> • Many participants reported the system was relatively easy to use. 	<ul style="list-style-type: none"> • Digital oximeter sensor monitored oxygen, heart rate and accelerometer for patient's activity level and sent to an app on a mobile phone via Bluetooth signal and then to a server. Physicians had access to a web browser with the data and were able to input clinical information such as oxygen prescription. • Patients were given

		<p>participants were compliant with their oxygen prescription's hours and flow rate and this may have compromised the results.</p>		<p>individualized instructions based on the data.</p>
<p>Stellefson et al., 2013</p>	<p>180</p>	<ul style="list-style-type: none"> • High cost for development and implementation of this tool. • Only half the studies had a formal process for evaluation to assess fidelity. • Unclear of the best way to define and measure web engagement and participation in the older population. 	<ul style="list-style-type: none"> • Useful interactive features included asynchronous communication tools and personal tracking features. • Approaches that were “self-tailored” for the Web 2.0 approaches may reduce health distress and activity limitation, improve health status and foster patient engagement more than less patient-centered approaches of web 2.0. 	<ul style="list-style-type: none"> • Locate and share patient’s disease management information. • Receive interactive healthcare advice, feedback and social support from healthcare providers and website moderators. • Communication tools: email, discussion boards, progress tracking features (graphic displays, uploaded personal data).

Robben et al., 2012	169	<ul style="list-style-type: none"> • E-learning took too long to develop for implementation so was not used. • Some older adults preferred to have face-to-face contact with their providers. • Professionals have doubts that the older population will benefit from an online tool for their care. • Half of the sample professionals and the older adults had limited use of the tool. • Not all professionals in the work area were familiar with the ZWIP tool • Start-up problems included: application not working correctly, older adult eligibility criteria unclear and financial compensation was given too late. • Implementation team struggled with translation of ZWIP into every day practice, which caused support to be delayed or lacking. • Implementation process was slowed down by trying to get the local professionals and organization to work together 	<ul style="list-style-type: none"> • Coaching services for professionals conducting screening • Financial compensation and incentives given to professionals and organizations • Involvement of older adults and professionals in the development of the tool • Implementation strategies were considered necessary to work with the ZWIP tool. • Helpdesk support was offered and considered necessary. • Coaching was considered not as useful for professionals as the older adults. • ZWIP is flexible as it can be used at the older adult's preferred time. • ZWIP system was considered user-friendly. • The ZWIP provided older adults with control of their own care and they appreciated having their message answered in a timely manner by their GP. • Feedback was given in the 	<ul style="list-style-type: none"> • EHR accessible to the frail older adult, caregiver and health professionals. • ZWIP contains frail older adult's health information, functioning and social situation, contact information about professionals involved in their care, care related goals created by the older adult or for them. • ZWIP includes a secure messaging system for the older adult and the professionals involved in their care. • ZWIP provides educational materials for the older adult and caregiver. • The older adult decides who can access their personal ZWIP. • Older adults have the option of paper based version. • Training on how to use device and a telephone helpdesk for support services.
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		<p>first and conduct population-based screening.</p> <ul style="list-style-type: none"> • Barriers to older adults: considered it useful or quite a fuss and only for professionals, older adults were not always invited to participate by a professional that was motivated or considered not eligible and older adults not having a computer or not being comfortable with a computer and concerned about the security. • Some older adults didn't want to use the implementation strategies or support services as they didn't want to be a burden. • Results may not be generalizable because it was conducted in the Netherlands health system with the older adult having their own GP. 	<p>initial development and improvements were made alongside ZWIP implementation.</p>	
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Stroulia et al.. 2012	110	<ul style="list-style-type: none"> • The tool was not covered by provincial health service policies and prevented the study from using real clients for testing, therefore they had to use a simulation protocol. 	<ul style="list-style-type: none"> • Health care aides (HCAs) were receptive of technologies. • The benefits of the technology were realized from home care teams asd they increase productivity, reduce workload and improve the teams overall efficiency. 	<ul style="list-style-type: none"> • HCA can record care plan activity completion or refusal or prevention • Ability to add text/image or video notes on the record • Notes are shared with the head office and nurse may also comment on them with further notes • Scheduling service to generate weekly schedules for the HCA and updates whenever there is a change • Video conferencing for general communication via text messaging and voice/video calls • Continuing Care Desktop, a secure virtual learning community available to Alberta's continuing care community and guests for easy information access when needed to share with client • Google navigation
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Steele-gray et al., 2016	82	<ul style="list-style-type: none"> • The usability pilot showed that one training session was not sufficient enough so a new training plan was suggested to involve a 30 minute training session at 3, 6 and 9 months either manually or through a video. This method was not tested as yet. 	<ul style="list-style-type: none"> • Early evidence shows that the tool has the ability to support patient self-management, which has been shown to help avoid declines and unnecessary health care use for patients with chronic disease. • Canada Health Infoway's Change Management Framework for to guide implementation of eHealth technologies. • International scalability supported by partnerships developed through the CIHR Planning and Dissemination. • Usability pilot was conducted which informed this study proposal. 	<ul style="list-style-type: none"> • The older adult receives prompts to report on outcomes related to their goals set by them and their provider. • The tool allows for multiple users to login (older adult and caregiver) and the older adult has control over this. • The symptoms and outcomes included in the app were identified as important to older adults through prior research. • The app displays prompts appear to report symptoms and goals. • Patient reported Outcome Measurement Information System (PROMIS) global health scale (GHS), pain interface and health assessment questionnaires (HAQ) were included. • The app included monitoring of: weight, blood pressure, heart rate, blood glucose, mood and emotion, sleep patterns, diet, and physical activity and walking logs.
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Klein et al., 2015	61	<ul style="list-style-type: none"> • Document generated by the tool was lengthy and time-consuming to view by the patient and the provider. • The patients that shared information with Blue Button tool tended to be selective in choosing what they provided to their non-Veteran Association providers. • It is a challenge for patients to know exactly what information is important and relevant to share with their providers. • There are issues with sharing information between systems, such as non-VA and VA systems. • It is unclear how the document will be used in real practice. 	<ul style="list-style-type: none"> • Patients liked the convenience of accessing their health information and that it was one document. • Non-VA Providers indicated that having the participants' health information was useful for them. • The most relevant health information was: current medication list, laboratory test results, wellness reminders, immunizations, and allergies, clinical note from the last visit available. 	<ul style="list-style-type: none"> • The main feature was patient clinical care notes and continuity of care document/ VA Health Summary which can be integrated with E.H.R. • Allowed patients to record personal health information through a medical record (personal health record or PHR). • Patients are able to customize the information they choose to include in their report by date range and data class.
Quinn et al., 2013	54	<ul style="list-style-type: none"> • Network issues included slow internet connections which caused a slow down or failure for image uploads. 	<ul style="list-style-type: none"> • App was user friendly, simple, familiar and straight-forward for the user and required minimal training • The picture quality was sufficient for assessment purposes by the specialist 	<ul style="list-style-type: none"> • ReMIT client app was designed for the iPhone to assess patient ulcer wound information. • Nurse took photo of patient's ulcer in the community and transmitted with information about the current dressings to a computer database with the patient's medical history at the hospital for the vascular

				surgeon or registrar to review
Makai et al., 2014	47	<ul style="list-style-type: none"> • Low computer literacy rates among older adults seems to hinder implementation efforts. • Older adults were not receptive to training programs offered in response to low computer literacy. • Healthcare providers that decline invitations or do not respond to messages from their patients. 	<ul style="list-style-type: none"> • Usage was found to be influenced by context effects such as being involved in a family practice. • Having a family caregiver contributed to increased usage as it helps to overcome the issue of low computer literacy. • Older adults with previous experience with computers or technology. 	<ul style="list-style-type: none"> • Patients and their informal caregivers give permission to their providers to join their network. • The tool contains a messaging platform similar to email which the patients can exchange messages with their providers. The messages are visible to all members of the patient's network, unless they are part of a private network. • The tool stores current medical and social care data, offers the ability to create care-related goals/action plans and can receive tailored health information.
Williams et al., 2014	43	<ul style="list-style-type: none"> • Not all telehealth applications are beneficial to all patients as some require self-monitoring rather than self-management. 	<ul style="list-style-type: none"> • The mHealth tool was said to be easy to use and supportive of patient self management behaviour. 	<ul style="list-style-type: none"> • Included a symptom diary and a remote self-monitoring pulse oximetry and multimedia educational and self-management materials such as videos, text and images.

Tabak et al., 2013	41			<ul style="list-style-type: none"> • There were 2 modules in the application, an activity coach for ambulant activity registration and feedback and the second was a web portal containing a symptom diary for self-treatment of symptoms and an overview of the measured activity levels.
Ammenwerth et al., 2015	38	<ul style="list-style-type: none"> • Participants with low socioeconomic status were not able to access the tool. 	<ul style="list-style-type: none"> • Users with the most success with the tool were relatively young, confident with computers, well-educated, and male. • Providing patients with feedback to support their personal goals/choices. 	Connect with blood pressure meter, a pedometer, glucometer, weighing scale and identification card; the patient can document medication intake and subjective wellbeing, provides automatic feedback report weekly and physicians can access data collected by patient through web interface.
de Jong et al., 2016	37	<ul style="list-style-type: none"> • GPs who already have an effective administration tool/secure emailing system in place. 	More activity occurred when more disciplines were present in a case; regional approach; stepwise implementation based on feedback by users; administrative support; linking colleagues and sharing observations.	Care plan based on patient-centered SFMPC (social, functional, mental, physical, and communication) domain model; automatically organizes care problems into the different domains; tasks can be delegated and feedback received immediately; secure emailing for professionals to communicate.

Makai et al., 2014	19	<ul style="list-style-type: none"> • Only 39% of people over 75 have internet access in the region being studied; not targetting implementation to older populations where the likelihood of adoption is higher (e.g. people with high computer literacy; people who need the technology) • Study used pragmatic trial approach instead of efficacy approach in early evaluations. 	<ul style="list-style-type: none"> • Inclusion of frail elderly and GP in design process. • Developed elements piloted by user panels; implementation for providers: using CME accredited education programs, telephonic help desk and e-coaching, financial compensation to support uptake. • Implementation for elderly patients: hard copy versions provided, coaching made available, involvement of informal caregivers and GPs advocated for use. 	<ul style="list-style-type: none"> • Online health community, facilitates communication between HCP, patients and informal caregivers • Secure messaging system is visible for all users. • Shared E.H.R in which providers can only have access at the invite of the patient.
Mertens et al., 2016	15	Not discussed	<ul style="list-style-type: none"> • Providing short instructional sessions for using devices • Modifications to the iPad to make it more useable (green sticker on iPad home button to help users locate it). • Provided a user manual • The app worked better than paper based intervention for improving adherence. 	<ul style="list-style-type: none"> • Set reminders for taking medications • Record blood pressure • A modified home screen - the Medication Plan app was the only available app on first page, all other standard applications were placed in a folder on the second menu page. • The app was unable to be deleted by mistake by the user. • Use of graphs or diagrams for displaying data.

Park, Cho, Kim, 2016	5	<ul style="list-style-type: none"> • Purchasing difficulties and financial burden for purchasers (esp. those without PHDs to begin with) • Operated only on android phones 	<ul style="list-style-type: none"> • Standardized EMRs in the geographic areas • Users with knowledge/skills to use a smartphone 	<ul style="list-style-type: none"> • Vital sign (blood pressure, body weight, blood glucose, oxygen saturation) measurement and management, collects data from multiple Personal Health Devices • Can share information with EMRs
Robben et al., 2015	1	<ul style="list-style-type: none"> • Older adults found that a telephone call would be easier than this system. • Older adults were concerned about privacy. • Older adults did not feel there was a need for new technology. 	<ul style="list-style-type: none"> • Works well for those with high computer literacy. 	<ul style="list-style-type: none"> • Care4Balance is a computer device that has a touch screen that displays a series of tasks available for the caregivers to complete. Motion sensor data is also inputted to show whether the older adult is at home.
de A Melo et al., 2016	2	<ul style="list-style-type: none"> • Application name has a negative connotation which may prevent older adults from adopting. • Stigma that older adults cannot use technology may prevent adoption. 	<ul style="list-style-type: none"> • The app was easy to use as both experienced and unexperienced groups indicated. • Training workshop was available to teach the older adults how the application works. 	<ul style="list-style-type: none"> • The Eldernote application was designed to help older adults record notes on their smartphones or tablets. • Eldernote included an annotation tool and an audio alarm.
GREY LITERATURE				
Hall, Stellefson & Bernhardt, 2012	3			<ul style="list-style-type: none"> • Sensei Wellness supports personal health surveillance by offering personalized digital support and tracks health activities

<p>Center for Technology and Aging, 2011</p>	<p>4</p>	<ul style="list-style-type: none"> • There are 5% of older adults that are the major cost to the healthcare system, reaching this population may be a challenge. • Many technologies don't have enough clinical evidence to support their adoption. • A barrier to adoption and diffusion of mHealth technologies is payment issues. 	<ul style="list-style-type: none"> • In general, there is an abundance of mHealth technologies being developed for older adults. The benefits are clear from helping older adults self manage their health conditions to provide fall detection. • There is an increase in interest from providers, caregivers and patients to use technologies to track, monitor and communicate older adult health which has already shown health benefits and long term career benefits. 	<ul style="list-style-type: none"> • WellDoc was designed to engage patients in their diabetes management. It includes SMS with a cell phone-based diabetes management software system that interfaces with web-based data analytics and therapy optimization tools. Patient coach includes: care plan support, out-of-bounds alerts, real-time coaching, caregiver alerts and support, texting and medication reminders and metabolic target ranges. Expert system features include: evidence-based guidance integration, event alert tracking, predictive modelling and longitudinal tracking. Decision Support tools include outcomes-based support, clinical analysis and trends, multi-disease platform management, case management integration, patient stratification and prioritization and population management. • Aetna mobile: A mobile service through a web-enabled phone allowing the user to access their PHR, view member card, contact Aetna, find physician information and buy health insurance etc.
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				<ul style="list-style-type: none"> • ClearPractice Nimble: This app is designed for health providers to get EMR access on their iPhone or iPad. The provider can access and review patient charts and information, fill or renew prescriptions, view appointments and send messages. • Cloud PHR Pro: This native iPhone client is from Google Health Record that allows users to access information such as immunizations, medications, conditions, procedures and tests results. • GE Healthcare Centricity: This was designed for providers to access patient information and enter notes on their iPhone and/or iPad • NoMoreClipboard: This mobile app links to Microsoft HealthVault PHR where patients can create a comprehensive health record, including information such as immunizations, physiological data, appointments, medications, illnesses, insurances, insurance information and images and files.
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				<ul style="list-style-type: none">• Practice Fusion EMR: This is a web-based EHR available on the iPhone, iPad and Android platforms. Health providers can use this app to perform tasks such as, charting, scheduling, e-prescribing and access to patient data.
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Wicklund, 2015	5			<ul style="list-style-type: none"> • iBreathe assists in care management for COPD by providing a means to track their daily respiratory health that they are able to access in real time from respiratory therapists who can respond to emergent situations. • COPD Navigator combines evidenced-based care guidelines and patient data supplied by the caregiver and other sources. This includes medication reminders, weather and air quality information and symptom-tracking tools.
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Appendix V – Scoping Review Summary of themes

Theme	Description	Node Examples
Current mHealth challenges		
Negative Feedback of existing tools	Studies have identified these as negative aspects to existing mHealth tools	<ul style="list-style-type: none"> • High development cost
System challenges in creating mHealth tools	Issues within the system that make it difficult to create mHealth tools	<ul style="list-style-type: none"> • Difficult to standardize procedures
Challenges for patients to adopt mHealth technologies	What makes it difficult for users to start using an mHealth tool	<ul style="list-style-type: none"> • User abilities and preferences • Difficult to target desired population
Barriers to providers adopting a mHealth tool	Aspects that prevented the healthcare providers from using the tool	<ul style="list-style-type: none"> • Providers not responsive to tool
Support for tool implementation /use		
Facilitators to adopting tech	Aspects that helped users use technology (in general)	<ul style="list-style-type: none"> • Previous experience or interest in using tech
Positive feedback/outcomes of tools	Studies have identified these as positive aspects of existing mHealth tools	<ul style="list-style-type: none"> • flexible tool for user
Facilitators to mHealth tool development		<ul style="list-style-type: none"> • Older adult involved in development
Supplemental resources to support patient adoption	Supports to help users use mHealth tools that exist outside of the tool	<ul style="list-style-type: none"> • Training to use tool
Positive outcomes of tool use	Positive experiences the end-users outlined in the literature	<ul style="list-style-type: none"> • Improvements in workload, productivity and efficiency
System support for implementation of tool	Types of strategies that will support implementation of tools on the system level	<ul style="list-style-type: none"> • Included an implementation strategy
Features		
Outputs of tool for patient/user	What mHealth tools give patients to better understand their health or facilitate self-management	<ul style="list-style-type: none"> • Medication reminders
Resources within the mHealth tool to support patient's use of the tool and their care	Features within the mHealth tool that support the user's ability to use the tool.	<ul style="list-style-type: none"> • Alarm to remind user to input the data
Tool links to external platforms/devices	Other devices and systems that the mHealth tool can connect to for information transfer	<ul style="list-style-type: none"> • Tool can link to EMR
Variables/health information patient can input in existing mHealth tools	Data the user can record using the mHealth tools	<ul style="list-style-type: none"> • Track medications, blood pressure, oxygen, symptoms, etc.

Supporting patients and their relationships		
Support for care circle	How the mHealth tool supports patients and those in their care circle	<ul style="list-style-type: none"> • Live chats with other users and providers
Facilitating patient-provider relationships	How mHealth tools can support patient-provider relationships	<ul style="list-style-type: none"> • Send data to provider before appointment
Patient autonomy	How patient autonomy can influence using an mHealth tool for self-management	<ul style="list-style-type: none"> • Patient's desire to understand health status

Appendix W – Thematic Analysis process

Step 1: Familiarize yourself with the data

KL Focus Group

- Older adult keeps active and healthy
- Having positive relationship with their provider
- Reliance on the doctor to track health information
- Self-monitors health variable for self and spouse
- Importance of trust
- Negative perception of technology
- Privacy concerns

P1_HCP - 022118

- Older adults have a reluctance to use technology
- App would be most beneficial to next generation or caregivers
- App should facilitate sharing information with multiple providers
- Monitoring health variables constantly can worry patients
- Have to limit the amount of data in the app
- Importance of tracking psychological information in app

P2_CG - 022118

- Importance of supporting caregivers
- Having access to resources through an app would be helpful
- Caregiver role in coordinating care for spouse
- Would have liked a place to store health information of spouse
- Learning about the disease would have been helpful
-

WWDAG_031618

- Personalizing application
- Ability to upload current tracking methods to application to facilitate use
- Importance of a simple layout
- Big icons
- Compatibility with multiple devices
- High contrast for colours

P3_KL_HCP_031918

- Working with the patients capabilities
- Spectrum of older patients that are tech savvy
- Can see the benefit of an app to support current processes
- Education is important for implementation
- Accessibility of tech to older patient
- Confidentiality/privacy issues

P4_NV_HCP_06182018

- Social history is assessed by PCP
- PCP addresses broad issues
- Building relationships between PCP and Older adult with frequent visits
- No standardization with older adult tracking health info
- PCP prefers to come in frequently rather than a long visit for a number of issues
- Importance of a clear idea of what the patient needs
- Goal oriented care
- PCP takes the time to write down health information for the older adult
- PCP trying to make it as easy as possible for the patient
- Older adult doesn't know what to communicate/how to communicate
- Clinic using technology for patients
- Older adults open to technology
- PCP open to tech for self-management
- Track changes in medications
- What is important to the patient isn't always important to the provider
- All providers should give a summary of the appointment to the patient
- Time as a barrier to adopting tech

P5_RIA_HCP_06252018

- Specialist relies on information from other providers
- Specialist just wants patient to know meds
- Specialist gives specific instructions to a patient
- Important for patients to know which info is relevant to track and worry about
- Role of a provider to relay what information they are interested
- Lack of standardization in info transfer
- Issues of cognitive impairment
- Stronger communication between physician and specialist
- Tracking goals as important focus

P6_WL_HCP_06282018

- General checkup versus episodic visit to PC has different priorities
- Social history is assessed
- No standardized way patients ask for information
- Demographic health savvy
- Problems with medications and information communicated with different parties
- Reminders may be important for a patients medicine adherence
- Technology as a barrier in Mennonite population
- Contextualized information to track
- Flexible app is ideal
- Older adults are open to technology
- Integrate an app with EMR

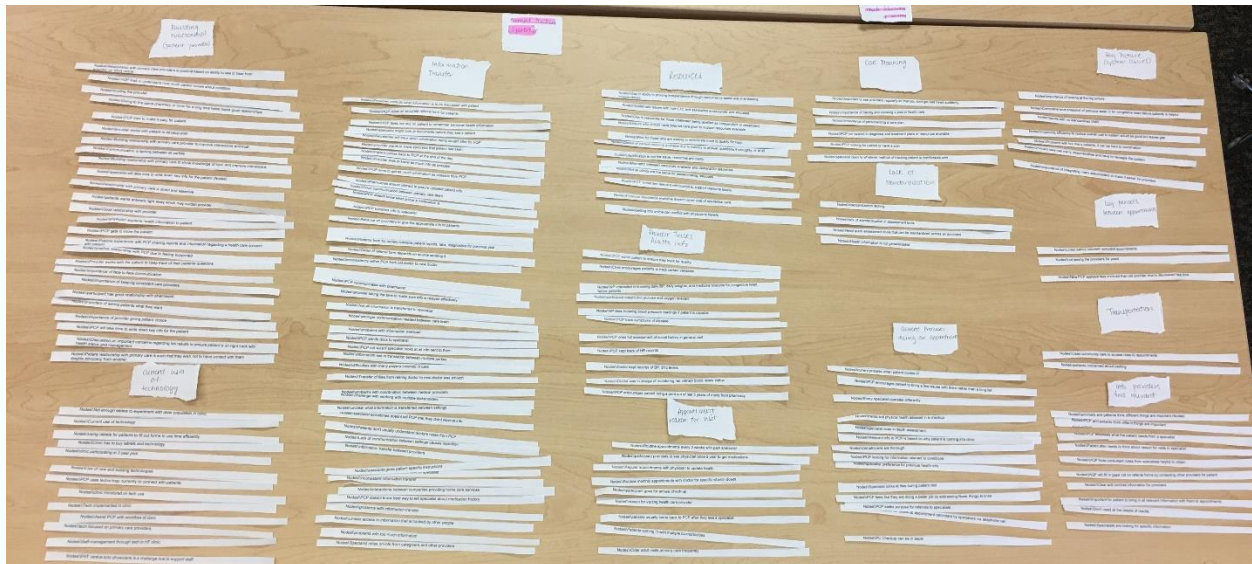
- Privacy concerns with emailing information
- Best practice is home monitoring – app can support this
- Every patient has different needs – important to modify based on this
- Ability to notify user when they tracked or took a medicine

eHealthCE_061318

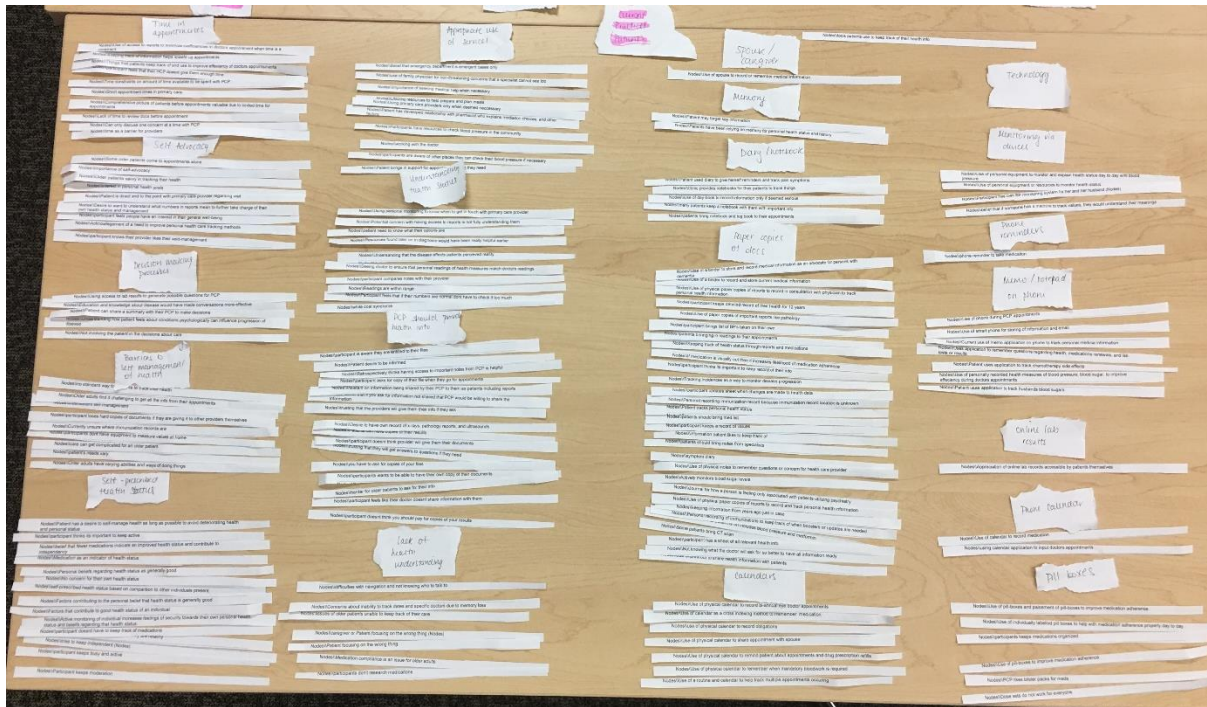
- Technologies supporting physicians
- Importance of pitching the benefits of technology for adoption
- Flexible technologies are important to meet multiple clinic needs
- Time is a barrier to adoption for providers
- Primary care providers have challenge to navigate systems
- Importance of getting to know the target audience of a technology to make benefits clear
- Targeting the right person in an organization to adopt the technology
- Older adults having slower tech adoption compared to younger age groups
- Importance of patient engagement to test out technologies

Step 4: Reviewing themes

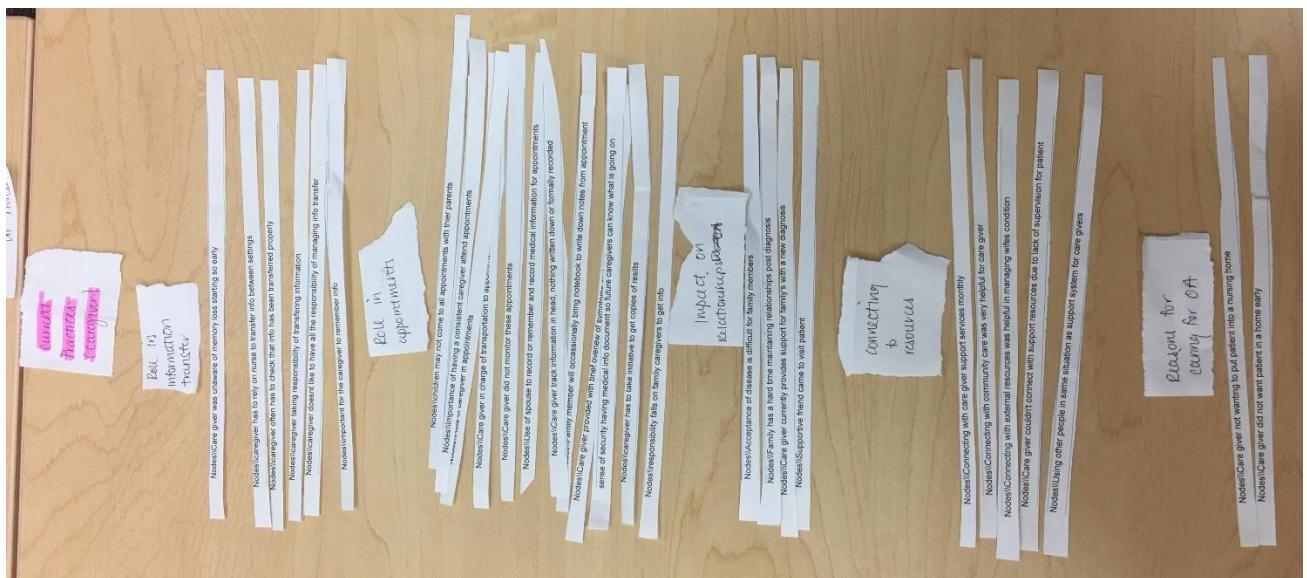
Current practices (system)



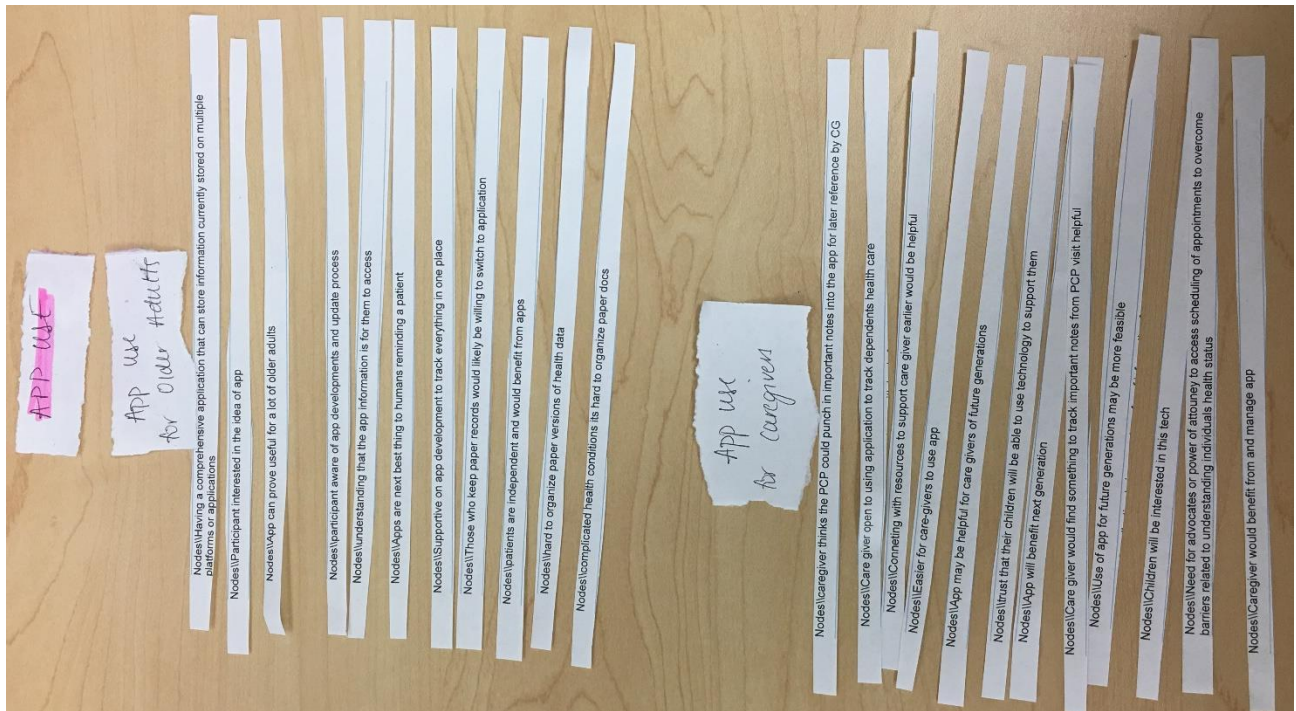
Current practices (patient)



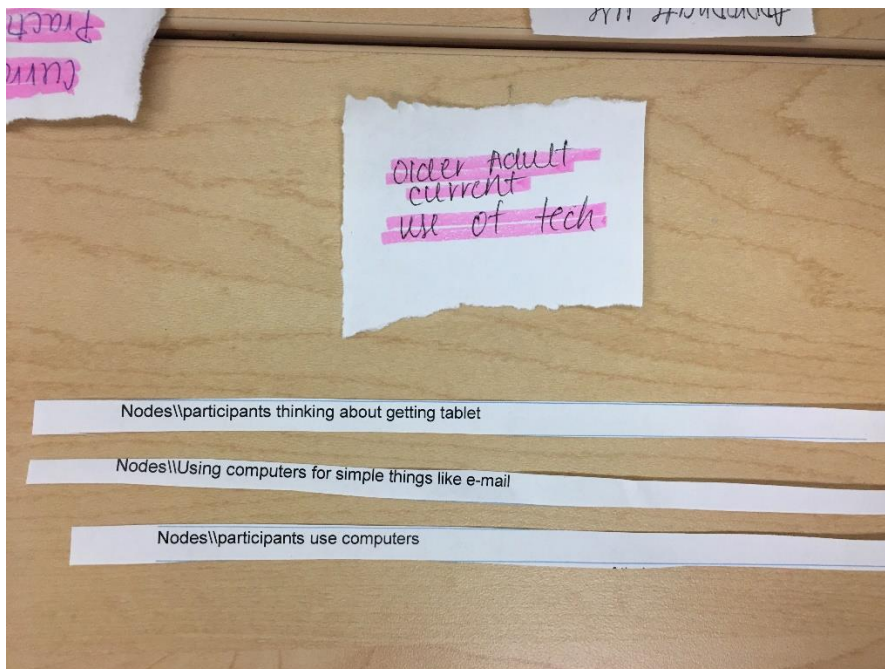
Current practices (Caregivers)



App use



Older adult current use of tech



Perceptions of technology

