Health Promotion Technology and the Aging Population

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Abstract In an effort to improve the quality of care for any population, technology is integrated into the healthcare system. Different types of technologies can aid in health promotion through prevention, education, and monitoring techniques. Prevention methods are becoming more common with older adults to assist with their activities of daily living as well as to support them in learning and remembering healthy behaviors. The willingness to adopt a new technology is key to successfully modifying behavior and what hinder the outcome are issues of competency as well as access.

The purpose of this book chapter is to use empirical studies to review the types of health technology used with the older population, as well as the overall level of success on their behaviors. Once the research question was defined, an inclusion and exclusion criterion was used to select the peer-reviewed articles. Various studies that fulfilled the predefined criteria were used. Data was extracted from 39 articles for the evaluation of the different health technologies and their uses.

mHealth and phones are the most popular type used for health promotion, as it is present in 36% of the articles evaluated. Other successful and popular types of technology used were websites and modules (26%), as well as monitoring technology (23%). In all of the studies, the elderly population was able to successfully use the technology, indicating that the adoption of new technology is possible at any age. Technology can be used to affect the elderly population to integrate healthier habits into their lives. The variety of accessible technologies allows individuals to use it in conjunction for their desired outcomes.

Keywords Aging population · Mobile health · Assistive technology · Serious games

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1 Introduction

In the USA, with similar projections for Canada, it is estimated that approximately 21% of the population will be 65 years or older by the year 2040 [1]. This growing population will require formal or informal continuing care to combat frailty, chronic conditions, and other outcomes associated with aging [2]. A longitudinal study on elderly people in Manitoba found that those who are institutionalized or cohabiting with individuals, other than their spouse, are less likely to be healthy [3]. The populations that are living independently are able to better manage their own health, yet the dependent populations require additional resources to make healthcare more comprehensive and accessible to them [3]. At the present state, there are inadequate healthcare workers trained to care for the complex care that is required for the older adults [1].

In Canada, there are healthcare policy initiatives that focus on the prevention of chronic disorders and the promotion of healthy aging. These initiatives help with reducing the healthcare costs associated with treatment [4]. The cost of poor health affects both the government and the ill individual. If the elderly population does not have adequate funding, the demand for prescription drugs decreases and as a result the demand for physician visits increases [5]. Financial stability is required during retirement since poor health is more frequent among seniors who lack financial security [6]. The cost of treating health conditions can be a financial burden on the elderly. As such, an emphasis on health promotion is required to aid in the prevention of chronic diseases. Web-based wellness programs may decrease healthcare costs and encourage the use of preventative services [7].

The increased use of health promotion technology on the elderly population is a solution to the growing need for support from this age group. The 10 different types of technologies identified in the literature review are mHealth/phones, website/modules, monitoring technology, health games/computer, internet, text messaging, assistive technology, virtual coaching, exercise simulations, and tablets. The most popular types of technology from the papers included mHealth/phones (14), website/modules (10), and monitoring technology (9).

The types of technologies used vary greatly, as some are not intended solely for health promotion. For example, the use of a Smartphone is incorporated in many of the studies but the cell phone's primary use is not for health promotion. Alternatively, "exergames," exercise-simulation games, are an example of technology that is exclusive to health promotion [8]. Exercise simulations make adults more likely to participate in physical activity [8]. The technology used was selected to accommodate the senior population, therefore, there was no need to personalize any of the technology. Another popular type of universal technology is the use of reminders and messaging to motivate adults to increase physical activity [9]. The messages were successful whether or not they were personalized for the participant's needs [9]. As long as the participant finds the technology or the information it is delivering interesting, the use of universal technology is able to modify their behavior [10].

2 Method

Major databases were searched for peer-reviewed articles from 2007 to 2017. Of the articles found, the 39 that fulfilled the inclusion criteria were evaluated for the types of technology and their success at modifying behavior in seniors. The objective was to find different types of health promotion technology.

2.1 Inclusion and Exclusion Criteria

Key terms were used in the initial search to identify articles surrounding the topics of "health promotion," "technology," and "behaviour." Articles were used if they identified a specific type of health technology as well as if the technology was tailored for the elderly population. In this systematic review, a senior is defined as over the age of 50 years.

3 Results

The systematic review of 39 peer-reviewed articles demonstrated the 10 different types of technology used for health promotion.

3.1 Assistive Technology

Assistive technology in the form of tools, aids the senior by modifying an activity to suit the extent of their mobility or cognitive skills. Devices that record messages, sensors, and tracking devices are all examples of assistive technology used to promote health in individuals with dementia. In men and women with dementia, memory aids are useful at helping them maintain their independence [11]. Automated pill dispensers that beep when it is time to take a pill and recorded messages for appointments are successful examples used to maintain the health of older adults and increase their quality of life [11].

3.2 Exercise Simulations

Exercise simulations encourage movement and muscular stress in a controlled area. These technologies allow for fun workouts in the home independent of a large space or the weather [12]. This technology can promote activity through the interaction

of monitoring technologies, including balance boards and game consoles, and the applications/games. This technology can include the use of virtual reality to immerse the participant in the game. Virtual reality is successful at promoting healthy habits by engaging seniors in an interactive exercise regime. These exercise simulations are not limited to the location of an individual and can provide a safe and entertaining option for physical activity [8] (Fig. 1).

3.3   Health Games/Computer Applications

Health Games/Computer Applications encourage activity through the education or entertainment of an individual. Participants are able to keep track of their level of activity and therefore make conscious decisions to increase it. A recurring barrier to the use of this technology is the attitude of others and the assumption that the seniors do not know how to use the technology [14]. Accepting that the technology is usable to the senior population will increase the frequency of use for this population [14]. These games and applications provide an interactive experience for the user allowing them to learn comfortably at their desired pace [15].

3.4   Internet

Internet access is used as a supporting technology. Access to the Internet provides the seniors with the ability to do their own health research independent of a caregiver. The benefits of Internet access extended to both seniors and their caregivers. Caregivers to seniors with Internet access had improved mental health compared the caregivers to seniors without Internet access [16]. Participants in a study were taught about healthy aging and interventions that would impact their future [17]. This method followed a social-cognitive model and after an online assessment the web-based tool provided information as well as skills and motivation to make lasting changes [17]. It is estimated that more than 50% of the American seniors 65 and older use the Internet or email so [11]. The increasing popularity and accessibility of the Internet present an opportunity to engage the senior population in new health promotion tactics.

3.5   mHealth and Phone Lines

mHealth and phone lines allow seniors to use their cell phone to access different health promotion initiatives, including health reminders. It also includes automated telephone chats to encourage and regulate health behavior. Typically, mHealth is developed for individuals with symptoms of chronic diseases, however, a study in
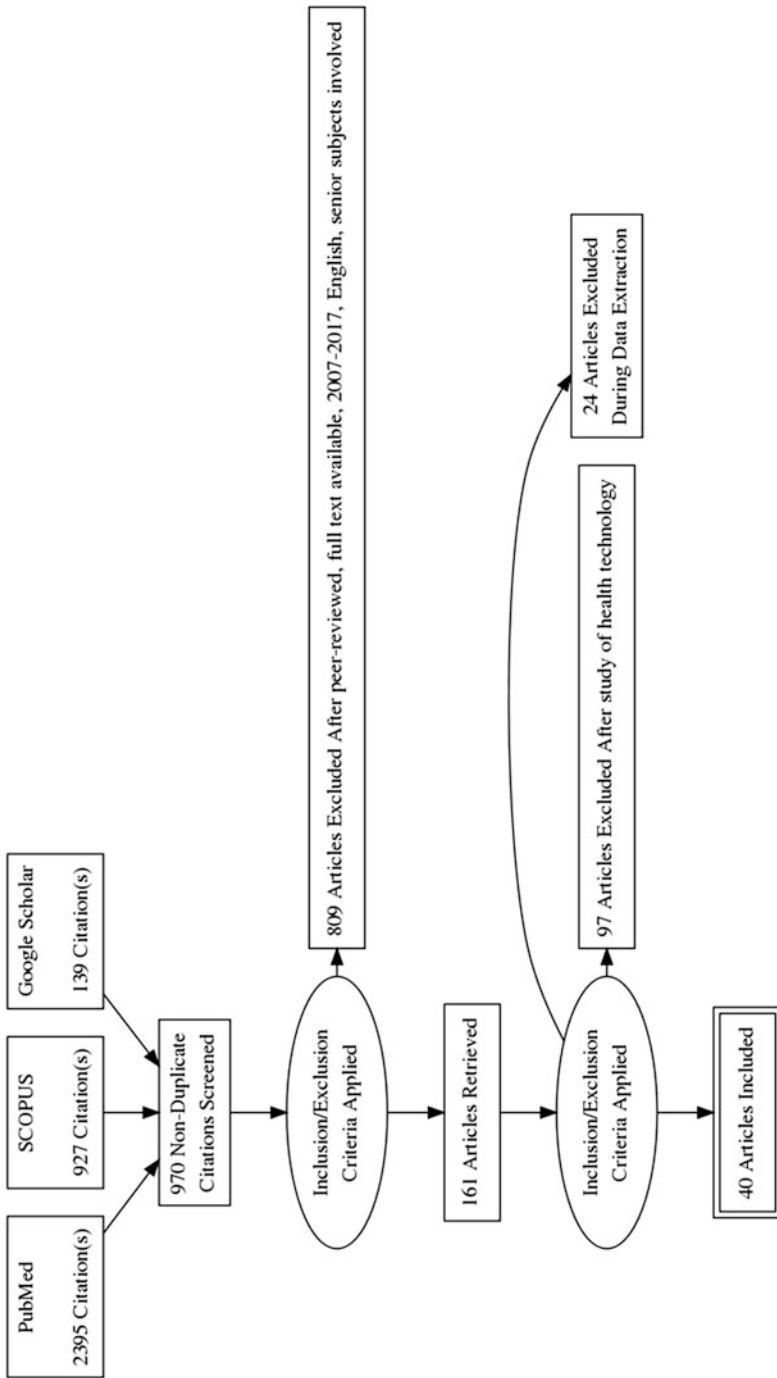
PubMed	SCOPUS	Google Scholar
2395 Citation(s)	927 Citation(s)	139 Citation(s)

970 Non-Duplicate Citations Screened

Inclusion/Exclusion Criteria Applied

809 Articles Excluded After peer-reviewed, full text available, 2007-2017, English, senior subjects involved

161 Articles Retrieved

Inclusion/Exclusion Criteria Applied

97 Articles Excluded After study of health technology

24 Articles Excluded During Data Extraction

40 Articles Included

Fig. 1 PRISMA flow diagram [13]

2014 used the technology in a novel way as a method of reducing risk factors for lifestyle-related chronic conditions [18]. The new method was used, in conjunction with exercise, to prescribe changes to a sedentary lifestyle [18]. A limitation of implementing mHealth was the associated cost by providing the participants with the technology [18]. When this technology is partnered with monitoring technology it increases physical activity [18].

3.6 Monitoring Technology

Monitoring technology includes Smartphone, blood pressure monitors, glucometers, sensors for movement, and pedometers [18]. These technologies will feedback information to an application or individual to help them make informed health-related decisions. The importance of monitoring technology was a significant factor for modifying behaviors in seniors [19]. This was highlighted when trying to change the behavior of seniors aged 65–95 years with the use of cholesterol tests [19]. Qualitative data demonstrated that the role of a health condition motivates older adults to improve their diet and exercise patterns. Monitoring technology can illustrate the degree of severity of their condition as well as reveal the results their lifestyle changes have made to their condition [19]. Both gradual and abrupt changes can be tracked using monitoring technology. The most common form of monitoring technology was the pedometer. It was used to track everyday physical activity and promote an increase in walking.

3.7 Tablets

Tablets facilitate teaching by providing access to modules and internet-based applications. Additionally, this form of technology provides a platform for virtual coaching [20]. Tablets are used as a supplementary tool alongside other types of technology. This electronic device is favored over laptops or desktops due to the convenience of its ease of transport. Tablets assist in teaching the senior population [20]. A barrier to its increased use is the assumption that the senior population cannot incorporate this technology into their lifestyles [15].

3.8 Text Messaging

Text messaging is an effective way to quickly and consistently send fixed reminders to the patients to encourage them to exercise or follow a certain diet. A study in 2016 demonstrated that the effectiveness of this intervention was not based on an interactive component as there was no requirement to reply to daily text messages

[21]. Several unique messages were developed for the intervention that always contained an instruction to exercise and a statement of praise [21]. The frequency in weekly exercise was higher in individuals who received SMS texting than those who did not and the effects of the text messaging lasted 12 weeks after it ceased [21].

3.9   Virtual Coaching

Virtual coaching can be either automated or in person. Having a motivational coach increases participation in physical activity. A study in 2013 used a pedometer to track the physical activity of sedentary older adults who received an Embodied Conversational Agent (ECA) and a control [20]. After participating in the ECA intervention, the participants walked significantly more than the control group [20]. The ECA intervention uses a tablet to simulate a face-to-face conversation with an animated character [20]. The daily session varied each time but always included a greeting, social chat, a check-in, and a tip [20]. The use of a virtual coach provides the same level of success in behavior modification as an in-person coach without requiring the financial investment of training.

3.10   Websites/Modules

Websites/modules have specific learning objectives that are universally presented to the audience. These modules can be used as a means to educate the elderly population on either new technologies or behavior modification [22]. The use of this type of technology is dependent on the use of an electronic device, such as a tablet or computer, and access to the Internet. In seniors aged 65–75 years, the use of modules required self-regulation and without adequate participation, changes in physical activity would be affected [23] (Table 1).

4   Discussion

Health technology has the potential to promote a healthy lifestyle for seniors. These types of technology save on costs as they do not require a trained individual to administer the education. The helpfulness of person-to-person interactions is over-estimated as the impact does not always warrant the investment of training the health professional. For instance, heart failure patients in Finland were assigned more follow-up visits in addition to telephone checkups but there was no significance

Table 1 The frequency of technologies in reviewed articles

Type of technology	Articles	Total
mHealth/phones	[14, 18, 21, 24–34]	14
Website/modules	[20, 22, 23, 25, 27, 33, 35–38]	10
Monitoring technology	[18–20, 23, 26, 39–41]	9
Health games/computer	[14, 15, 31, 42, 43]	5
Internet	[16, 17, 29, 37, 44]	5
Text messaging	[21, 38, 45–47]	5
Assistive technology	[10, 11, 26, 48]	4
Exercise simulation	[8, 12, 40]	3
Virtual coaching	[20, 29, 49]	3
Tablet	[10, 20]	2

Source: Developed for this study

in the improvement of health post-surgery compared to those without additional follow-ups [24]. Automated telephone counseling has the same effect in motivating the elderly population as counseling by trained educators [49]. In a study with 218 adults, automated telephone chats were as effective as the human-delivered interventions [34].

Another benefit to using technology for health behavior modification is that their benefits can be seen when using more than one type at a time. In the majority of studies, multiple technologies are incorporated into a method instead of using a single-type technology. The impact of technology can be enhanced with the use of more than one form per intervention. When a senior use monitoring technology to keep track of their level of physical activity throughout the day, the amount of activity can be increased with targeted text messaging or virtual coaching via the Internet or their phones to encourage them to do more [21].

5   Conclusion

Approximately 47% of seniors in the USA have access to the Internet [50]. A basic set of skills are required to get the full use of technology, including accessing the Internet and the ability to run applications on different software [26]. In order to accommodate the senior population and ensure different types of technology are being used properly for health promotion they need to be modified to the age group.

Further research is required on the success of the long-term effects of newly adopted health technology.

> **Study Highlights**
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> What was already known on the topic:
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> - Health technology can be used for primary prevention of disease by promoting healthy behaviors.
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> What the study added to our knowledge:
>
> - There are 10 effective categories of health technology that can be used in health promotion to modify senior's behaviors.
> - The different categories can be used successfully in combination or as a standalone.

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