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The opportunities and challenges of using mobile health in elderly self-care

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Abstract:

Population aging is a phenomenon expanding around the world and will be increase the incidence of chronic diseases and health costs. This study was conducted according to the preferred reporting items for systematic reviews and meta-analyses (PRISMA). A comprehensive literature search was performed on 4 databases (Web of Science, PubMed, Science Direct, and ProQuest) for English language studies from January 1, 2000, to December 31, 2019. The keywords used to extract relevant contents were "e-health," "Elderly care," "Self-care," "challenge," "Opportunity" etc., The search strategy led to a total of 638 potentially relevant papers, of which 19 papers met the inclusion criteria. The results showed that the challenges of using mobile health in elderly self-care can be divided into technical, human and managerial challenges. The resulting opportunities include reducing health care costs; no need to visit verbal and remote access to elderly information. The use of mobile health in the elderly has advantages and disadvantages. One of the advantages of that is improving physical activity and reducing care costs, but it may break the privacy. The disadvantages of that can be resolved by educating the elder men.

Keywords:

Challenge, elderly, mobile health, opportunity, self-care

Introduction

Population aging is recognized as a worldwide phenomenon, so that from 1950 to 2009, the global population of people over the age of 65 increased from 8% to 11% and is expected to reach 22% by 2050.[1-3] This phenomenon affects developing and developed countries and represents a major global challenge. It has many implications for a wide range of public services such as health, social care, pensions, housing, transportation, and also the economic performance of a country.[4]

Elderly people are susceptible to a variety of chronic diseases (such as cardiovascular disease, diabetes, etc.); so that the prevalence of these diseases is higher in the elderly. Also growing the elderly population is increasing the cost of health care for chronic disease management.[5] According to statistics, in most developed countries the costs of the diagnosis and treatment of patients with chronic diseases in health care system increase significantly each year. Reducing the people's productivity of community[6,7] and Increasing burden and cost of chronic diseases has led to a considerable enhancement in the use of elderly care services.[1]

Recently, the hospital's medical cares and nursing practices has transferred to the patient's home (especially the elderly); known as home healthcare. It is designed to reduce admission costs, transportation costs, and medical errors improve the quality of health care and increment patients' independences at home. By 2020, it is predicted that 70 million elderlies will increasingly need to stay at home rather than nursing home. Modern technology tools in particular

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information and communication technology should be used to reduce health care costs, increase empowerment of people, improve patient surveillance, support home health care and prevent chronic diseases.[6] Today, technology helps 80% of seniors to live independently at home and away from care facilities.[8]

One of the innovations of information technology in healthcare plans is the emergence of mobile health systems due to the advent of mobile communication and advanced network technologies. Mobile health can be a solution to overcoming barriers of health care staff, timely access to patient's health information (especially in emergencies), avoiding frequent tests, and reducing delay and errors in providing appropriate treatment to patient.[6]

Nowadays, owing to importance of chronic diseases self-management, the rising costs of health care, and the growth of internet users to access health-related information; remote health (Tele-Health) applications utilization is recommended.[9] Mobile health applications can help home health care providers in three stages: before, during, and after consultations. Although mobile health applications can effect on home health care, it must be beyond monitoring and managing electronic medical records to provide necessary assistances at home visit time.[10]

While there are potential benefits of mobile health programs, many challenges for developing and implementing these tools are known. In order to make effective use of mobile devices in health systems and especially in elderly health, therefore there is need for extensive research and investigation of various aspects of that. It is clear that identifying opportunities and challenges of mobile health technology plays an important role in caring of elderly, reducing barriers, and enhancing positive points. As a result, it will be help to improve health system status via planning, designing roadmaps, and promoting achievements of mobile health systems.[6] It is clear that there is a need to develop and expand the use of mobile health programs among all people groups, especially the elderly, but the development of these systems can delay the achievement without considering the challenges and obstacles to their development, Therefore this study will be conducted with the aim of examining the challenges and opportunities of using mobile health in the self-care of the elderly in order to provide adequate knowledge of the obstacles, challenges and opportunities for the development of these systems for developers and health care providers.

Materials and Methods

In accordance with the PRISMA statement,[11] a literature search was conducted in Web of Science، PubMed, Science Direct, and ProQuest for English language citations published from January 1, 2000 to December 31, 2019 for studies including challenges and opportunities of mobile health for elderly home care. Three researchers with a health information management (HB, MS, and MSH) developed and carried out a Boolean search strategy using key words related to "challenges and opportunities of mobile health" (e.g., Challenges of Mobile health, OR Challenges of m-Health OR barriers of mobile health OR barriers of m-Health) and (opportunities of Mobile health, OR opportunities of m-Health) and keywords related to elderly homecare (e.g., elderly care OR elderly health).

We used MESH Thesaurus to find standard keywords for a more accurate search. Truncation, wildcard and proximity operators were also used to improve the comprehensiveness of the searches. Three researchers screened the titles and abstracts of all retrieved citations against the inclusion and exclusion criteria. The full text of relevant papers was then examined by the same researchers. A senior researcher resolved eventual disagreements and confirmed the relevance of all included papers. The authors, date of publication, subject fields of target challenges and opportunities of mobile health for elderly home care were extracted from each paper. The extracted challenges and opportunities were then reviewed, compared, and classified by two health information management specialists.

Inclusion criteria

The inclusion criteria were studies in English that provide a challenge and opportunity of mobile health for elderly home care, Published from January 1, 2000 to December 31, 2019.

Exclusion criteria

Exclusion Criteria were studies in a language other than English and studies on challenges and opportunities of mobile health for other peoples except elderlies.

Study selection

After duplicates were removed, the titles and abstracts were screened by one researcher (HB) according to the inclusion/exclusion criteria. The full texts of potentially relevant papers were then assessed by two researchers (HB and MS).

Data extraction and classification

Data elements were extracted from selected articles, included authors, date of publication, challenges and opportunities of mobile health for elderly homecare. The extracted challenges and opportunities of mobile health for elderly homecare were then reviewed by an expert panel including two health information management specialists. The panel compared similar subject fields and challenges and opportunities from different studies.

Results

We retrieved 638 records by searching the previously mentioned databases. After removing duplicates, 540 articles remained. Based on the review of titles and abstracts, 48 were found to have met the initial selection criteria. Finally, 19 studies were included in the review according to the inclusion criteria [Figure 1]. The most studies about 31/5% (6 articles) were published in 2019. Some of the challenges and opportunities posed by the use of various forms of mobile health in elderly self-care had been addressed in a narrative or systematic review study [Table 1].[12-30] Different studies had addressed the challenges and opportunities of different forms of mobile health, such as telemedicine, teleconsultation, smart home, internet-based technologies, service robots using, personal digital assistants, and telehealth at home. Numerous challenges and opportunities related to the use of mobile health care provided to the elderly have been addressed in this study and a comprehensive classification of them was prepared.

Fritz and Dermody represented that mhealth did not use singly and nurses can help monitoring elder people.[12] Costa Stutzel *et al*. proposed improving in software capability in order to better monitoring elder people and accepting new technology by them. It represented that this ability make a positive change of family caregivers.[13] Yang and Lin represented that using technology for health care may encounter data security and privacy risk. However, it improves social motivation in elder people and decreases loneliness in these people.[14] Wildenbos *et al*. addressed barriers such as cognition, physical ability, perception (vision and hearing), and the motivation of the elderly such as the key challenges of using mobile health in self-care. They also listed increasing memory power and increasing self-management as opportunities to use these technologies.[15] Li *et al*. presented that intervention such as using exercise trainer make improving physical activities in elder people.[16] Ko *et al*. represented that accepting mhealth for disease monitoring is a challenge for elder people.[17] Grossman *et al*. represented that mobile apps have the potential to supply assets, just in time data for problem-solving and stretch decrease techniques for caregivers. Numerous apps offer capacities that have been appeared to decrease burden and progress health results in caregivers, but few give emotional supports.[18] Hoque and Sorwar cited lower technological Efficiency, high levels of anxiety, resistance to change, less control in information and communication technologies, and skills of new technologies as new challenges facing to mobile health in providing services to the elderly.[19] Queirós *et al*. In their study identified challenges such as the fear of becoming a personal home to hospital, the lack of reliable criteria and quality, the risks associated with harmful communication or the inaccurate responses in socials media when using of mobile health for the elderly self-care.[20] Siegel and Derner in their study present the challenges including reducing the number of social interactions and face-to-face communication between service providers and the elderly and transforming smart home technologies into intrusive technologies.[21] Kruse *et al*. in their studies cited the technical challenges, medical data ownership, security and confidentiality, ignorance of the services and capabilities of mobile technologies in providing health services and inadequate training to the elderly.[22] Matthew-Maich *et al*. represented that there is constrained expanding utilize of technologies in home health care for more elderlies. A user-centered, collaborative, intrigue approach to improve feasibility, acceptability, and usability of mHealth innovations is imperative.[23] Baig *et al*. discuss the challenges of using cell phones in health care such as feasibility, reliability, stability, security and privacy, accuracy, user-friendly, energy consumption, data transfer, and cost.[24] Gilbert *et al*. considered the underutilization of the smartphones and internet by elderly population, and the inadequacy of older-age health-related applications from the challenges facing the use of mobile health in elderly self-care.[25] Hunting *et al*. in addition to the challenges identified in previous studies provide access the use of technology and structural barriers to patient participation related to geographic and social contexts.[26] Mohammadzadeh and Safdari in their study expressed organizational and technological challenges, user attitudes, technology adoption, privacy maintenance and privacy threats, legal, ethical and administrative barriers, cost, and adequate investment as the most common public challenges of mobile health.[27] Shah *et al*. mentioned educational,

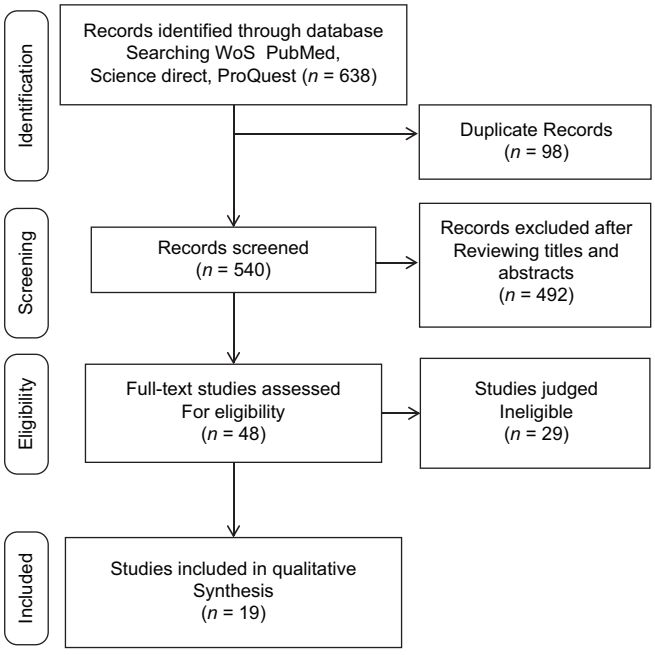

Figure 1: The process of selecting related studies

Table 1: The opportunities and challenges of using mobile health in elderly self-care posed in various studies

Author/year	Scope	Challenges	Opportunity
Fritz and Dermody, 2019	A nurse-driven method for developing artificial intelligence in "smart" homes for aging-in-place	Teaching new technology to nurses	Better monitoring of the elder people
Costa Stutzel *et al*., 2019	Multi-part quality evaluation of a customized mobile application for monitoring elderly patients with functional loss and helping caregivers	Need improving software, user interface, and functionality	A positive chance of family caregivers
Yang and Lin, 2019	The reasons why elderly mobile users adopt ubiquitous mobile social service	Privacy risk, data security risk	Improving social motivation, perceived interactive richness
Widenbos *et al*., 2019	Mobile health for older adult patients: Using an aging barriers framework to classify usability problems	An overview of the barriers to aging of digital computer use (health) and explaining, charting and visualizing these barriers to health usability along with providing a framework	Cognition, motivation, physical ability and perception. people with cognitive and motivational barriers, physical and cognitive barriers, complex medical conditions, such as decreasing diabetes-related eye vision or physical skills
Hodgson *et al*., 2019	A personalized behavioral intervention implementing mHealth technologies for older adults: A pilot feasibility study	Using intervention using exercise trainer	Improving physical activity and sleep in older adults
Ko *et al*., 2019	Evaluating patient attitudes and barriers towards mobile health technology for cardiac monitoring: results from a prospective multi-center study in an elderly population	Patient engagement, accept mhealth for disease monitoring	Improve patient health literacy and facilitate shared decision making
Grossman *et al*., 2018	Mobile applications for the elderly: A qualitative content analysis	The gap between application and empirical findings from the suffering of service recipients The effectiveness of interventions has made many recipients did not get these services as the perfect partner for adult care Recommend applications that are selected solely because of availability The weakness of the ease of use of some applications The security and confidentiality of these programs are also in debate	Increased access to social support Access to relevant information improved coping skills Increased self-esteem – dramatically reduced depression, anxiety and stress Improving the mental-physical and general conditions
Hoque and Sorwar, 2017	A face-to-face structured questionnaire survey method was used to collect data from nearly 300 participants of age 60 years and above from the capital city of Bangladesh	Anxiety, resistance to change, less control over ICT and new skills, new technology, resistance to change their medical habits and decide to continue their previous behaviors	Improving access to health services
Alexandra Queirós *et al*., 2017	A brief review of the current status of mobile health applications for middle age among textsw	Fear of that home transform into hospital Lack of reliable measure and quality Risks related to harmful communication Incorrect answers using social media	Promoting a healthy lifestyle, home safety, reducing loneliness and social isolation, optimizing care and interventions, propagation a healthy lifestyle [physical activity, nutrition, weight management, and health education], recommending regular physical activity, and reducing barriers of nutrition transferring and weight management, health education, improving physical activity, proper nutrition, weight control and health education
Siegel and Dorner, 2017	A structured review study to investigate the impacts of ICT on quality of life and mental health of the elderly men	Decreased social interaction, replacement with personal care and communication	Changing elderly health Increasing people's knowledge of health changing their attitudes, Improving social relationships Monitoring and diagnosing health conditions for physicians who are away from home, improving lifestyle, fitness, managing chronic illness, social robots that act as animals can affect the health of the elderly and demented man, mobile robots can reduce distress levels, increasing positive mood and decreasing loneliness

Contd...

Table 1: Contd...

Author/year	Scope	Challenges	Opportunity
Kruse *et al*., 2017	A narrative review study with the purpose of identifying and analyzing facilitators and barriers to adoption the mobile health for the elderly men	The technical challenges scalability in the link between healthcare providers and end users, integrated agreement among healthcare providers, universal access, management and ownership of medical and health data the cost of technology, Unable to operating on a mobile device, the issue of privacy, security, and privacy and security lack of training in mobile health technology	Understanding independence, pursuing physical activity and adopting a healthier lifestyle, facilitating home care, enhancing medical literacy and adherence to drugs without limitation, enhancing users quality of life and sense of independence, enhancing patient knowledge and ability to self-monitor medical status, building sensory structure for needful people, greater patient engagement, changing behavior through feedback, slowing down dementia progression, stimulating mental activity, increase adherence to medication treatment
Matthew-Maich *et al*., 2016	Design, implementation and evaluation of mobile health technology to manage disease in elderly people	Restrictions on the financial and non-financial resources required to implement mobile health Lack of proper compensation schedule Lack of proper interaction with the system for the user	Preparing organizations for mobile health Adopting a mobile health solution Proper interaction with the user
Mirza Mansoor Baig *et al*., 2015	A critical review of advanced smartphone applications and assessing the challenges and issues in using smart phones in health care	Feasibility, reliability, stability, security and privacy, accuracy, user-friendliness, energy consumption, data transferring and cost	Remote access to patient data and information Reduce medical errors, crash detection and initial evaluation, and save time and money
Barnabas J. Gilbert *et al*., 2015	Assessing the experiences related to the development and applying technology in clinical trials facilitated by Well frame in 2014 and 2015, especially in the field of cardiac rehabilitation and care for patients with chronic psychiatric disorders	Low percentage of old man using mobile smartphones, low percentage of old man using internet and mobile health applications, Limited number of mobile applications for the elderly men	Reporting activities and describes their symptoms regularly. Interviews and analyzing self-efficacy trials, acquisition of knowledge and skills at optimum speed, continuous improvement of treatment using patient feedback, limiting health inequalities, elimination cognitive decline in aging, improving special education performance
Hunting *et al*., 2015	Qualitative study is to examine the multilevel factors and processes that facilitate or hinder the implementation and acceptance of tele homecare in three areas (at five levels: technology, patients, providers, organizations and structures)	Access to technology use, user friendliness, patient restrictions on access to or use of equipment, time constraints, geographic and social location of the elderly	Increasing patient motivation and ability to participate - creating consistent communication between stakeholders
Mohammadzadeh and Safdari, 2014	A review study on patient monitoring in mobile health: opportunities and challenges	Confidentiality and privacy threats, technology adoption, sudden disruption of telecommunications networks, replacement, organizational and technological barriers user attitude, technology adoption, legal, ethical and administrative barriers, cost, some data processing problems, user training to use the system	Reducing health care costs, managing chronic illness, overcoming barriers to health care personnel, timely access to patient-specific health information especially in emergencies and preventing repeated trials, reducing delays and errors in providing appropriate treatment to patients, Improve early prevention, facilitate self-care, improve quality of life, prevent unnecessary readmission, distance counseling and providing complete or partial mobility to patients for routine work
Shah *et al*., 2013	Experiences of patients, their caregivers, healthcare personnel, and staff members with a program that provides telemedicine-enhanced emergency care to older adults	Education and technology challenges, technology reliability, problems such as device failure and software problems, the amount, size and weight of equipment, concerns about using advanced technology by the old man, cognitive impairment in the elderly men	Enhance diagnostic reliability in healthcare providers, Improving reliability and utilization of equipment, Including wireless communications, PCs, and software interfaces

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Table 1: Contd...

Author/year	Scope	Challenges	Opportunity
Ansam Barakat *et al*., 2013	Discuss the competencies required by health care professionals working in home care, with eHealth technologies such as remote telecare and ambient assisted (living AL), mobile health, and fall detection systems	Lack of providers ability and knowledge of health technology Lack of people having both e-health skills and knowledge Lack of standardization Lack of integration in this area. Electronic health technology for home health professionals	Data interpretation Using elderly monitoring can be effective. Problem solving skills used by eHealth in organizations replacing traditional methods. Removing access barriers Reducing costs
Guo *et al*., 2012	A dual-factor model based on the investigation of causing and inhibiting factors in adoption of mobile health services among the elderly men	Fear of the consequences of wrong using of new devices, willingness to continue a normal life routine and unwillingness to change its lifestyle, decreasing of technology acceptance due to the anxiety of using technology	Portability and presence everywhere Emergency usability

ICTs=Information and communications technologies

technical, and cognitive impairments in the elderly as the main challenges of using telemedicine in providing health services to the elderly.[28] Barakat *et al*. presented that progresses in e-Health technology have the potential to bring approximately effectiveness investment funds in terms of delivering care to elderlies and to support self-management by older adults.[29] Guo *et al*. present two important challenges for the use of mobile health for the elderly. First, the elderly is concerned about the consequences of their miss-operation and thus avoid using new devices. Secondly, they like to continue their normal lives and do nothing to change their lifestyle.[30]

After reviewing the various studies discussed in detail in the previous section, the research team summarized the opportunities and challenges posed in these studies. After discussing the classification of these cases in the Experts Team, we finally found the following classification on the challenges and opportunities of using mobile health in elderly self-care [Table 2].

Discussion

In this paper, studies addressing the challenges and opportunities of using mobile health in elderly caregiving were examined. After reviewing these studies, the challenges and opportunities facing the using of mobile health in elderly self-care being placed in three main groups included: managerial, human and technical challenges. Challenges such as security[14,16,22,24,27] and confidentiality,[14,23,25,28] education,[12,16,22,26,28,29] resilience of the elderly,[19-21,23,25,27,30] technical issues[13,15,18,22-24,26,27,29,30] and cost[22-24,27] in using mobile health services for elderly self-care have been repeatedly addressed in various studies. One of the major challenges propounded in the studies is the reluctance of older people to use information technology especially mobile health services.[19-21,23,25,27,30] Matellán-Olivera *et al*. represented that the older users are strongly resistant to change.[31]

It should be considered that in addition to the resistance of the elderly to the use of information technology, in some cases the physical, mental, cognitive and motivational conditions of the elderly prevent the using of these technologies.[19,21,22,27-30] Thorén *et al*. in their study, emphasize older people with moderate to severe hearing problems had less computer and internet use than those without hearing problems.[32]

Osvath *et al*. also emphasizes the negative impact of elderly visual and motor impairment on the using of information and communication technology.[33] Therefore, in addition to resistance and fear of elderly people using mobile health services, their physical and mental health conditions should also be considered as a serious challenge.

Another major challenge in the using of mobile health in the elderly men self-care is the a little using of mobile smartphones and the internet by them. In 2013, only 18% of the population over the age of 65 had a smartphone, compared to 56% of all Americans.[34] Moreover, more than 25% of smartphone users over the age of 65 have never downloaded an app.[35]

However, besides the challenge, it is important to note that apps that are readily available on the App store or Google Play often target the younger population. They do not optimize elderly use and fewer applications in these two stores are found in the field of elderly health and elderly self-care. Their study points out that these technologies can support the empowerment of patients and families by allowing them to be actively involved in their health care. By giving health information to older people, they are gotten the opportunity to make joint decisions and are no longer the sole provider of precise clinical decision making by health professionals.[36]

Another challenge is the ability of health care providers to monitoring and analyzing data. Telehealth[37] can be used in

Table 2: Outline of classification of opportunities and challenges of using mobile health in elderly self-care

Domain	Challenges	Opportunities
Technical	Infrastructure cost	Proper interaction with the user
	Unique characteristics	Remote access to patient information and analysis
	Quality and integrated data	Monitoring the patient's condition and knowing about his or her health
	Safety and security	
Human	User knowledge, provider's workload, user	No need to visit verbal
	Acceptance and readiness, device and gadget use	Help strengthening memory
		Promote a healthy lifestyle
		Reduce loneliness and isolation
		Improve physical activities
		Proper nutrition
		Increasing self-management
Managerial	Budget	Reduce health care costs
	Ethical consideration	Increasing social support for the elderly
	National legal of service providing	disease management

this context, which enables remote monitoring. Telemedicine is a fast and efficient method of monitoring people.[38,39] This monitoring could include day-to-day activities or even sports.[40,41] Familiarizing these technologies is a challenge for health care providers. Teaching these technologies can be costly and difficult to access.[42,43]

Another challenge is the privacy of the elderly men. Patient privacy is one of the key aspects.[44] The result of a research[45] showed that the elderly satisfaction with their privacy in Isfahan hospitals was moderate. Hence, this shows that the elderly emphasize their privacy and are not satisfied with it. While they are constantly under surveillance, they refrain from doing the normal work of daily living. They keep feeling that they are being harassed is why they may refuse to do so. Other key barriers include technology access issues, patient language (if not English or French), telehomecare provider time constraints, gap in patient health care provision, and structural barriers to patient geographic location and participation. Each of them can produce inappropriate results. Technology can be accessed everywhere and everyone can use it is an important that its infrastructure must be provided. Promoting healthy lifestyle, homeland security, reducing loneliness and social isolation or optimizing care and related interventions are the opportunities which were created. Reducing loneliness and social isolation is done by technology user-friendliness and patient-attracted by it. This should be considered by technology designers. In this study, we tried to retrieve the maximum studies related to the subject, but due to current limitations in access to available resources, researchers were forced to investigate a limited number of databases. On the other hand, many recovered resources sporadically presented the challenges and opportunities of using mobile health services, which made it difficult to summarize and classify these factors. In this research, it was tried to present a complete division of these factors based on the frequency of challenges and opportunities in different studies. The creation of three technical, managerial and human groups was done based on the studies and the opinion of the research team. A set of challenges and opportunities was also placed in these three categories based on the opinion of the research team. It is suggested that a comprehensive study on each of these dimensions be done separately and discussed in more detail.

Conclusions

The use of mobile health in the elderly faces many challenges. Considering their age and less inclined to experiment with new items as well as the lack of confidence they may have in using these technology, make refusing to accept the technology. On the other hand, the existence of these systems can help monitor and control their health. In fact, the elderly can use technology to get proper nutrition and control their physical activity. In other words, they get better self-management and the need for other members of their families is reduced. In general, the use of any system has challenge and cannot be overruled because of these challenges. By justifying elder men and educating their children, the challenges can be partially resolved and they are inclined to use this technology.

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Conflicts of interest

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