Review article

Older people, assistive technologies, and the barriers to adoption: A systematic review

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ABSTRACT

Background: Older people generally prefer to continue living in their own homes rather than move into residential age care institutions. Assistive technologies and sensors in the home environment and/or bodily worn systems that monitor people's movement might contribute to an increased sense of safety and security at home. However, their use can raise ethical anxieties as little is known about how older persons perceive assistive and monitoring technologies.

Objectives: To review the main barriers to the adoption of assistive technologies (ATs) by older adults in order to uncover issues of concern from empirical studies and to arrange these issues from the most critical to the least critical.

Method: A 4-step systematic review was conducted using empirical studies: locating and identifying relevant articles; screening of located articles; examination of full text articles for inclusion/exclusion; and detail examination of the 44 articles included.

Results: Privacy is a top critical concern to older adults, registering a 34% of the total articles examined. Two other equally potent barriers to the adoption of ATs were trust and functionality/added value representing 27 and 25 per cent each respectively of the total studies examined. Also of serious concerns are cost of ATs and ease of use and suitability for daily use (23%) each respectively, perception of "no need" (20%), stigma (18%), and fear of dependence and lack of training (16%) each respectively. These underlying factors are generation/cohort effects and physical decline relating to aging, and negative attitudes toward technologies such as the so-called "gerontechnologies" specifically targeting older adults. However, more and more older adults adopt different kinds of ATs in order to fit in with the society.

Conclusions: The identified underlying factors are generation/cohort effects and physical decline relating to aging, and negative attitudes toward technologies. The negative attitudes that are most frequently associated with technologies such as the so-called "gerontechnologies" specifically targeting older adults contain stigmatizing symbolism that might prevent them from adopting them.

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1. Introduction

The increased in life expectancy has led to new models of positive aging where older adults are being empowered to lead fulfilling lives and adapt to degenerative changes to maintain functionality, autonomy and quality of life [1]. Older adults are as diverse as the younger population and more diverse in their range of abilities [2], which only decline with each passing day. Age tends to be associated with reduced health and physical capacity, as well as diminished openness to new experiences [3]. This may be due to a tacit feeling by older people that they have been outpaced by a fast moving technology their abilities cannot match with. This goes

without saying that elderly people approach the Internet and health information technology differently than younger people, but have growing rates of adoption [4]. Older adults are often faced with functional problems that tend to compound with age [3,5] leaving them with limited active life choices. Forty per cent of those aged 65 years and older are limited in physical activity [6]. A limitation of physical activity may lead to other opportunistic dysfunctional life style. Around two in five seniors indicate that they have a "physical or health condition that makes reading difficult or challenging" or a "disability, handicap, or chronic disease that prevents them from fully participating in many common daily activities" [7]. The participation of physical activities could contribute to a healthy social life style. Most studies have targeted eight older adults' problems: (1) dependent living, (2) fall risk, (3) chronic disease, (4) dementia, (5) social isolation, (6) depression, (7) poor wellbeing, and (8) poor medication management [8]. Findings from studies that target

common age-related health problems could provide clues for policy makers, carers and ATs vendors when deciding on the suitability of ATs for older adults.

Provision of care and support by families to older people with substantial functional decline is becoming more difficult because of changing household structures [9]. However, enabling older people to remain independent by living in the circumstances they choose over their care pathway is a key principle of a forward looking health and social care policy [10]. The idea of Assistive Technologies (ATs) refers to an innovative concept that integrates technology within residences in order to maintain and even enhance functional health, security, safety and quality of life of their residents. ATs denote a broad range of devices, services, strategies, and practices that are conceived and applied to ameliorate the problems faced by individuals who have disabilities [11]. They include but are not limited to mobility aids, vision and hearing aids, furniture or daily living aids, gadgets or small aids, and adaptation to accommodation [12]. Mobility aids enhance the movement of persons with physical disabilities that affect movement. Examples include wheelchairs, scooters, walkers, canes, crutches, prosthetic devices, and orthotic devices, to enhance their mobility. Devices such as various canes, walkers, manual wheelchairs, and power mobility devices help those who can walk some of the time, and whose main mobility problem is one of endurance rather than balance or coordination [13].

Both vision and hearing loss are common age-related conditions [14]. BTE (or "on-the-ear") aid is the most common hearing device used. Closed captioning also allows people with hearing impairments to enjoy movies and television programs. For the vision aids, there is optical low vision devices on the one hand, which increase the size of the image of the object on the retina. Examples include magnifiers, telescope, and glare control devices. On the other hand is non-optical low vision devices. These devices alter environmental perception through enhancing illumination, contrast and spatial relations. Examples include, but are not limited to, lamps and reading stands, writing guides, check registers and large print items such as books [15]. In the case of daily living, ATs gadgets including but are not limited to automatic windows and curtain controls, automated ovens, floor clearing robots, temperature sensors for automatic climate controls and electronic showers, taps and toilets could be used. Devices may include 'telecare' and 'telehealth' service packages (that is, assistance devices linked to response teams via a person's telephone, such as community alarm services, detectors or monitors of fire, gas or falls) [16]. Telecare and Telehealth services are useful in the management of chronic diseases, which may result in decrease in hospital admission. Whilst ATs have a role in maintaining the independence and quality of life of both people living with disabilities and their careers, their use have both advantages and disadvantages, can pose challenges for all concerned, and raises ethical dilemmas [17].

2. Method

We conducted an extensive search across disciplines (e.g., Medline, Embase, CINAHL, PsycINFO and SCOPUS to cover empirical studies that reported on the barriers to the adoption of Assistive Technologies by older people from 1976 to 2015, and from 2000 to 2015 for Google and Google scholar, bearing in mind that the search was extensive.

2.1. Search strategy

The objective was to look at the issue(s) of concern to older adults in their decision to adopt ATs. Thus only articles that reported on barriers to ATs adoption were considered. This led to 39 papers meeting our inclusion criteria. Step 1: Locating and identifying relevant articles: A combination of MeSH terms included "technology acceptance by older adults"; acceptance of assistive technologies by the elderly"; technology acceptance and the elderly". This search strategy turned up 553 potential articles with 436 being duplicated articles. Diagram 1 has the details (Fig. 1).

2.2. Inclusion and exclusion criteria

In all 114 located empirical studies were subjected to the inclusion and exclusion criteria below.

2.2.1. Inclusion criteria

1) The study was empirical with focus on determining the barriers or motivational factors for the adoption of ATs; 2) Used qualitative, quantitative or both; 3) the article was written/published in English language; 4) individuals in the study were older people; and 5) after meeting the above 4 criteria, at least 2 of the four authors must have selected the article for inclusion.

2.2.2. Exclusion criteria

Because this review study examined empirical findings of barriers to the adoption of A/HMTs by older people, studies with the following characteristics were excluded: 1) health information technology (HIT)-related but not ATs empirical studies; 2) empirical studies that involved individuals/groups other than older people such as children; 3) reviewed papers, and 4) theoretical and conceptual articles, editorials, and letters published in English language were all excluded. We excluded 30 from the 94 after duplicates because they reported generally on the adoption of ICTs by older people. A further 20 full articles were excluded because they fulfilled some or all of the three remaining exclusion criteria above.

3. Results

Also in the list of potential barriers to the adoption of ATs are uncertainty about the appropriate time for ATs intervention, lack of information and support from formal health and social care services about how to access AT, where to source it and when and how it can be used [47,56] respectively. Peek, Luijkx [57] found six major evidences that seem to influence the level of technology use in the context of aging in place: challenges in the domain of independent living; behavioral options; personal thoughts on technology use; influence of the social network; influence of organizations, and the role of the physical environment. Additionally, Wherton, Sugarhood [58] found lack of awareness and information to potential users of ATs together with inability of ATs services aligning closely with the individual's wider social support network. Contrary to the key findings of majority of articles reviewed, senior Danish citizens applying for AT devices think that devices will offer them quality of life, help them realize their personal goals, keep up roles, positive self-image and personal dignity, independence, activities and participation (occupation) self-care, security, and access to their surroundings. Whiles needing the AT devices they also think of cultural stigma of negative symbolic value, and the difficulty of using the devices as a result request standardized devices [51]. Of the 44 empirical studies included in this study, 26 (59%) used qualitative method: 5 of which were based on pilot-testing of various prototype ATs equipment; 5 focus groups. A further 6 were conducted quantitatively and 5 through mixed methods.

4. Discussion

We identified 44 articles that contained one or more factors hindering the wider adoption of ATs by older adults attesting to