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Smart-Home Technologies to Assist Older People to Live Well at Home

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Abstract

Background: With the rapid population ageing that is occurring world-wide, there is increasing interest in "smart home" technologies that can assist older adults to continue living at home with safety and independence. This systematic review and critical evaluation of the world wide literature assesses the effectiveness and feasibility of smart-home technologies for promoting independence, health, well-being and quality of life, in older adults.

Methods: A total of 1877 "smart home" publications were identified by the initial search of peer reviewed journals. Of these, 21 met our inclusion criteria for the review and were subject to data extraction and quality assessment.

Results: Smart-home technologies included different types of active and passive sensors, monitoring devices, robotics and environmental control systems. One study assessed effectiveness of a smart home technology. Sixteen reported on the feasibility of smart-home technology and four were observational studies.

Conclusion: Older adults were reported to readily accept smart-home technologies, especially if they benefited physical activity, independence and function and if privacy concerns were addressed. Given the modest number of objective analyses, there is a need for further scientific analysis of a range of smart home technologies to promote community living.

Keywords: Elderly; Older people; Smart-homes; Smart-technologies; Home

Introduction

We conducted a systematic review and critical evaluation of the effectiveness and feasibility of smart-home technologies to assist older adults to live well, safely and independently at home. Improved health and social care over recent years has increased life expectancy worldwide. As a result nearly 7% of the world's population is now over 65 years of age [1]. The proportion of older people is predicted to rise approximately 20% by 2050 worldwide [1]. The increasing number and proportion of older adults requires a greater focus on policies and resources to meet their needs. Smart home technologies encourage and allow elderly people to live longer in their own homes [2].

Increased longevity is often associated with increased susceptibility to diseases and injury [3]. Chronic diseases such as cancer, diabetes, arthritis, heart disease and chronic obstructive pulmonary disease are common in older adults. Falls and injuries are also more common in elderly people [4]. It has been predicted that by 2035, the proportion of people with dementia will double [5] and by 2050, the number of full-time carriers will have tripled [6]. With the current trends in population demographics, it is becoming increasingly difficult for governments worldwide to fully support the health and social care systems [7]. The use of smart technologies, including smart-homes could arguably relieve the pressure on aged care health and social support services [8].

Smart homes are purpose designed living spaces that provide interactive technologies and unobtrusive support systems to enable people to enjoy a higher level of independence, activity, participation or well-being than otherwise afforded [9,10]. The smart homes movement links together the fields of housing, technology, engineering, sociology, and healthcare in relation to robotics, sensors, tele-health, ergonomics, communications, social care and safety [11,12]. Home based smart technologies can sometimes enable people to live in their own home rather than being hospitalized or institutionalized [10]. Smart-home technologies can also promote independent living and safety. This has the potential to optimize quality of life and reduce the stress on aged-care facilities and other health resources [13].

The challenge with smart-home technologies is to create a home environment that is safe and secure to reduce falls, disability, stress, fear or social isolation [14]. Contemporary smart home technology systems are versatile in function and user friendly. Smart home technologies usually aim to perform functions without disturbing the user and without causing any pain, inconvenience or movement restrictions. Martin and colleagues performed a preliminary analysis of the acceptance of smart-home technologies [15]. The results from this review were limited as no studies met inclusion criteria [15]. Given however, the rapid progression of new smart home technologies, a new systematic review of the literature is required. This paper addresses that need by analysing the range of studies undertaken to assess the impact of these technologies on the quality of life experienced by an ageing population accessing these supports. The broader context incorporates consideration of the social and emotional well-being needs of this population. The current review aimed to answer the following research question: "What is the effectiveness of smart-home technologies for

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