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Review

Use of social commitment robots in the care of elderly people with dementia: A literature review

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ABSTRACT

Globally, the population of elderly people is rising with an increasing number of people living with dementias. This trend is coupled with a prevailing need for compassionate caretakers. A key challenge in dementia care is to assist the person to sustain communication and connection to family, caregivers and the environment. The use of social commitment robots in the care of people with dementia has intriguing possibilities to address some of these care needs. This paper discusses the literature on the use of social commitment robots in the care of elderly people with dementia; the contributions to care that social commitment robots potentially can make and the cautions around their use. Future directions for programs of research are identified to further the development of the evidence-based knowledge in this area.

Contents

1. Introduction

Statistics reported by the World Health Organization and Alzheimer's International indicate that by 2050 the number of people with dementia will globally increase by three times affecting 115.4 million people [1,2]. In Canada, dementia is the leading cause of disability of Canadians over the age of 65 with significant economic costs expected to rise to $153 billion dollars by 2038 [2]. Similar issues exist in other countries such as Japan and the United States, where the increasing aging demographic and declining traditional caregiver demographic have driven the search for innovative dementia care strategies [1–5].

The anticipated prevalence and the economic impact of dementia care is significant, nevertheless, few countries have a national agenda for its treatment or management [1–5]. There is a pressing need for innovative research that will enhance quality care for people with dementia, decrease caregiver burden and reduce care costs [2]. Research in the area of social robots is in the initial stages of determining if the use of social robotics can assist the elderly living

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with dementia to improve affect and decrease agitation as well as provide companionship and enrich social interaction and quality of life [3]. The objectives of this paper are: to review the literature on social commitment robots and determine their efficacy within the elderly population living with dementia; and to determine future directions for this emerging area of research.

2. Dementia

Dementia is a progressive disease that erodes the person's ability to meaningfully communicate and interact, and impairs judgment, memory and affect regulation. Caregivers experience a considerable amount of stress in caring for a loved one with dementia. In addition to physical care, the inability to communicate is stressful not only for the person with the dementia, but also for professional caregivers and family members [1,2]. Family members' communication with the person with dementia may be problematic and cause significant burden and subjective distress impacting on the family members' health. Social interaction and interactive communication are recognized helpful strategies to maintain the abilities of people with dementia and improve their quality of life. Social commitment robots are designed to promote therapeutic interactions through communication and social interaction. The therapeutic use of the robots attempts to reach out to people affected by dementia and may provide an alternative mode of engagement with this population [6,7].

3. Search strategy

For this review, the search focused on the use of social commitment robots for dementia patients in long term care. Literature searches for this review were conducted in March, April and May 2012 using databases: PubMed, CINHAL, Ageline, Embase, Scopus, EI Engineering Village, PsychINFO, Cochrane Library, Web of Science, and Google Scholar. Subject headings, from the databases' thesaurus, and free text words (i.e. words from title, abstract or keywords) were used in the search strategies. Thesaurus terms included: robotics, robots, "artificial intelligence", dementia, "Alzheimer's disease", "long term care", "nursing homes", aged, geriatrics, "residential facilities". Free text words included in the search strategies (* denotes truncation): robot*, "socially interactive robot*", "sociable robot*", "social robot*", "social human-robot", "human interactive robot*", "social commitment robot*", "social assistive robot*", "therapeutic robot*", "mental commitment robot*", "care robot*", robotherapy, "affective robot*", geriatric*, "long term care", nursing home*, residential, institutional*, dementia, alzheimer*, "cognitively impaired", "mental health". No limits were made for date or language and a hand search of reference lists was also conducted. Ninety-nine articles were identified as potentially relevant citations based on the search criteria. These 99 citations were reviewed to determine (1) that the sample was totally or partially comprised people with dementia; (2) that the robot was for therapeutic/social purposes; (3) if a research study and published in a peer reviewed journal, and (4) only English language articles were selected. While a paucity of rigorous scientific studies exists (see Table 1), a considerable volume of Institute of Electronic and Electronics Engineers (IEEE) conference proceedings articles were identified. The journal and proceedings publications from Takanori Shibata and Kazuyosi Wada are notable in number. Dr. Shibata, an engineer, created the well-known tabletop robot, Paro and with Dr. Wada, they have conducted longitudinal studies on this social commitment robot in Japan since 2003. As proceedings publications appear to be influential in the discussion on robot use with the elderly who have dementia, select conference proceedings are included in the literature review (see Table 2). Based on these selection criteria a total of 21; 10 journal articles and 11 proceedings citations are included in this review.

4. Terminology related to robots

Of note, there are a confusing array of terms used to describe robots that may fall under a general category of human interactive robots for psychological enrichment and are then further subclassified as interactive autonomous robots which provide personal interactions, pleasure and relaxation [7]. Other literature identifies the classification of social assistive robots. The social assistive robot bridges the assistive robot functions which provide physical assistance with the social interactive robot functions of providing social and non-physical interaction. In our reading of the literature, a multitude of terms, i.e. social commitment robot, social robot, therapeutic robot, caring robot, mental health robot, entertainment robot, interactive autonomous robot, interactive engaging robot and mental commitment robot appear to refer to similar types of robots [7,11]. In addition, several terms may be used within the same article, terms are not consistently used within the literature and often lack clear operational definitions [6]. As described in the search strategy, the authors began with the term 'social commitment robot' and, expanded the search to include additional terms that appear to be used somewhat interchangeably within the literature.

5. History of robotics

The term 'robot' was first used in 1920 by the Czech playwright, Capek in a play entitled Rossum's Universal Robots. Here robots turned against their human masters, a plot which may partially explain the tension between fascination and distrust of robots. While the Japanese culture has welcomed robots and recognized them as "Iyashi" (healing) [12], North Americans have been slower to accept the concept of social and personal robots [9–12]. North Americans are more accepting of animal assisted therapy than the Japanese, which may partially explain North America's limited use of robots in the care of elderly people with dementia and Japan's robust interest [12]. Industrial robots, which perform assembly line work in various industries such as the automotive industry, have been in existence since 1950. There are a variety of other established areas in which robots are used, such as space, surgery, rescue, military and health care settings [11]. Robots in health care have functioned to provide rehabilitation services and to assist with personal activities of daily living; strategies which are being actively pursued in Japan and Korea to address the needs of their aging populations. The newer use of social and entertainment robots in health care is currently being explored with the majority of these robotics designed to provide companionship, improve mental health and affect and to monitor safety for vulnerable populations [7–11,13]. The interaction of human and robot is of current interest with development in the areas of robotic psychology which examines the compatibility of robots and people in emotional, cognitive and social areas. Interactive engaging robots, 'caring robots' respond to people through touch, voice, and within a social context and provide companionship [13]. There are four types of interactive robots namely: performance robots; tele-operated performance robots; and building, programming and controlling robots of which all three are designed for entertainment and creativity. The fourth type is the interactive autonomous robots, inclusive of the mental commitment robot which is intended to be interactive and improve social interaction and mood. This class of robot is capable of soliciting personal interaction between human and robot, a relatively new area of interest that is being actively examined [8,9,12]. Robot therapy is designed from a framework of human robot interaction with