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Original Study

A Pilot Randomized Trial of a Companion Robot for People With Dementia Living in the Community

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A B S T R A C T

Objectives: To investigate the affective, social, behavioral, and physiological effects of the companion robot Paro for people with dementia in both a day care center and a home setting.
Design: A pilot block randomized controlled trial over 12 weeks. Participants were randomized to the intervention (Paro) or control condition (standard care).
Setting: Two dementia day care centers and participants' homes in Auckland, New Zealand.
Participants: Thirty dyads (consisting of a care recipient with dementia and their caregiver) took part in this study. All care recipients attended dementia day care centers at Selwyn Foundation and had a formal diagnosis of dementia.
Intervention: Thirty-minute unstructured group sessions with Paro at the day care center were run 2 to 3 times a week for 6 weeks. Participants also had Paro at home for 6 weeks.
Measurements: At the day care centers, observations of the care recipients' behavior, affect, and social responses were recorded using a time sampling method. Observations of interactions with Paro for participants in the intervention were also recorded. Blood pressure and salivary cortisol were collected from care recipients before and after sessions at day care. In the home setting, level of cognition, depressive symptoms, neuropsychiatric symptoms, behavioral agitation, and blood pressure were measured at baseline, 6 weeks, and 12 weeks. Hair cortisol measures were collected at baseline and at 6 weeks.
Results: Observations showed that Paro significantly improved facial expressions (affect) and communication with staff (social interaction) at the day care centers. Subanalyses showed that care recipients with less cognitive impairment responded significantly better to Paro. There were no significant differences in care recipient dementia symptoms, nor physiological measures between the intervention and control group.
Conclusion: Paro shows promise in enhancing affective and social outcomes for certain individuals with dementia in a community context. Larger randomized controlled trials in community settings, with longer time frames, are needed to further specify the contexts and characteristics for which Paro is most beneficial.

Dementia is a complex, neurodegenerative disorder that results in significant cognitive and functional decline.[1] It is estimated that 46.8 million people live with dementia worldwide and this number is expected to triple by 2050.[2] The majority of individuals with dementia are cared for in the home.[3,4] Home care is associated with benefits at both the individual and societal level, and is the preferred option for most caregivers and care recipients.[5,6] Keeping individuals with dementia in the home has been associated with better emotional and physical well-being, compared to moving to a nursing home or care facility.[7,8] Moreover, maintaining the care of individuals with

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dementia at home for longer greatly reduces the costs of institutionalization and lessens the burden on the health care system.[5,9]

Dementia is a pervasive illness, with both cognitive and noncognitive symptoms that affect the individual, as well as those close to them. Memory loss and cognitive changes are the defining characteristics of dementia. However, the neurodegenerative nature of dementia affects other areas, resulting in a range of noncognitive symptoms, including changes in behavior, emotion, and social functioning. Many caregivers report the noncognitive symptoms of dementia as the most challenging aspect of dementia care.[1] The most common noncognitive changes observed in individuals with dementia are signs of behavioral agitation, such as fiddling and pacing; affective changes, including depression and anxiety, as well as neuropsychiatric changes, such as delusions.[1] Although the changes in cognition can be hard to ameliorate, the noncognitive symptoms are important and often more modifiable targets. To date, there is no curative treatment available for dementia and existing medication shows modest mitigation of the symptoms, whereas the side effects often do more harm than good.[10] Therefore, psychosocial interventions are increasingly seen as relevant and acceptable options to address the symptoms of dementia. These options need to be suitable in a home setting and viable for family caregivers.

In light of advancements in technology, one relevant psychosocial option is companion robot therapy. Companion robot design stems from the principles of animal-assisted therapy, which has shown physiological and emotional benefits for older individuals in residential care units, as well as reduced agitation in individuals with dementia.[11,12] Companion robots aim to mimic the benefits of caring for a pet, while minimizing the costs and circumventing potential hygiene and safety risks.[13] The most popular companion robot used in older adult therapy is the seal robot Paro (Figure 1). In a randomized controlled trial (RCT), Paro reduced loneliness and served as a salient conversation topic when compared to standard care, for residents at a nursing home.[14] Reductions in agitation and depression were recorded in participants with dementia at a rest home after Paro sessions were run twice a week for 12 weeks in another RCT.[15] A quasi-experimental study showed that Paro not only reduced negative behavior but also promoted relaxation, attention, and sensory stimulation in 91 participants with dementia across multiple rest homes.[16] Furthermore, a cluster RCT showed that participants with severe dementia who interacted with Paro for 12 weeks had lower psychotropic drug use compared with participants who were in the control group.[17] There is also preliminary evidence to suggest that Paro can exert physiological effects. From measurements of hormones (eg, hydroxycorticosteroids, ketosteroid sulfates) in urine, Paro was associated with improved stress levels in mentally healthy participants at a nursing home.[18] After 10 minutes of interaction with Paro, blood pressure appeared lower in rest home residents, indicative of a relaxed and less anxious state.[19]

Fig. 1. Paro.

Most studies to date have explored the effects of Paro in improving mood, but few studies have examined physiological variables and none have systematically examined the effects of Paro in a home setting. Addressing this gap in the literature may have important implications for providing nonpharmacologic therapeutic approaches to support the large proportion of individuals with dementia living in the community. This article describes the findings from a pilot RCT conducted to investigate the psychosocial, behavioral, and physiological effects of Paro for people with dementia in both day care and home environments.

Material and Methods

Research Design

A pilot RCT was conducted with measurements at 3 time points (baseline, postintervention, and follow-up) over the course of 12 weeks. The intervention lasted 6 weeks, and follow-up measures were taken 6 weeks later. Participants (consisting of a dyad of caregiver and care recipient with dementia) were randomly allocated to either the Paro intervention group, or a control group. Cognition, agitation, neuropsychiatric symptoms, and depressive symptoms were the primary outcomes for the care recipients with dementia. Additionally, researchers observed the behavioral, affective, and social responses, as well as measuring physiological indexes (blood pressure, heart rate, salivary, and hair cortisol) of care recipients at 2 dementia day care centers across the 6-week intervention period. The researchers also examined the effects of Paro on caregiver outcomes; the present article focuses on the care recipient outcomes only. Figure 2 provides an overview of the study design and sample size at each stage.

Setting

The study was conducted across 2 Selwyn Foundation dementia day care centers in Auckland, New Zealand. All attendees have a formal diagnosis of dementia, referred by the District Health Board's Needs Assessment and Coordination Services. The day care centers run between 10am-3pm from Monday to Friday. The centers provide meals and run a range of activities, including bingo, quizzes and physical exercises. Participants in the intervention group received Paro at sessions run at the center and at home for 6 weeks. Controls received standard care (see "Control Activities" later). Measurements were also collected in the home setting at baseline, postintervention, and follow-up for participants in both conditions.

Participants

A total of 30 dyads of care recipients with dementia who attended dementia day care (64% female, age range: 67-98 years) and their informal caregivers (96% female, age range: 30-86 years) were recruited. A power analysis showed that 13 patients would be required in each group, based on a power of .80, and the alpha at .05, to detect