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Original Study

The Psychosocial Effects of a Companion Robot: A Randomized Controlled Trial

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A B S T R A C T

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Objectives: To investigate the psychosocial effects of the companion robot, Paro, in a rest home/hospital setting in comparison to a control group.

Design: Randomized controlled trial. Residents were randomized to the robot intervention group or a control group that attended normal activities instead of Paro sessions. Sessions took place twice a week for an hour over 12 weeks. Over the trial period, observations were conducted of residents' social behavior when interacting as a group with the robot. As a comparison, observations were also conducted of all the residents during general activities when the resident dog was or was not present.

Setting: A residential care facility in Auckland, New Zealand.

Participants: Forty residents in hospital and rest home care.

Measurements: Residents completed a baseline measure assessing cognitive status, loneliness, depression, and quality of life. At follow-up, residents completed a questionnaire assessing loneliness, depression, and quality of life. During observations, behavior was noted and collated for instances of talking and stroking the dog/robot.

Results: In comparison with the control group, residents who interacted with the robot had significant decreases in loneliness over the period of the trial. Both the resident dog and the seal robot made an impact on the social environment in comparison to when neither was present. Residents talked to and touched the robot significantly more than the resident dog. A greater number of residents were involved in discussion about the robot in comparison with the resident dog and conversation about the robot occurred more.

Conclusion: Paro is a positive addition to this environment and has benefits for older people in nursing home care. Paro may be able to address some of the unmet needs of older people that a resident animal may not, particularly relating to loneliness.

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The growing aging population is a major concern for the future.¹ An increasing number of older people will require formal long term care as their health deteriorates and they cannot source as much human care and support in the community.^{2,3} For an older person, admission to an elder care facility is rarely easy and is not a highly anticipated milestone in a person's life.⁴ Moving to a nursing home is often precipitated by the loss of a loved one, an inability to look after oneself, declining health, and a lack of control over one's life.⁵ These factors, combined with the institutional environment of elder care facilities, means that older people lose aspects of their lives that constitute high life satisfaction.⁶ Older people in nursing homes often report feelings of helplessness, boredom, and isolation,⁷ increasing

their risk of depression^{8–11} and loneliness,^{12,13} and in general they report a lower quality of life than those residing in the community.¹⁴ Older people may experience problems in nursing homes upon shifting, because residents may find they have fewer of the social connections that previously gave their life meaning. Even when older people have become used to their new living environment, often the feeling of loneliness and isolation does not abate over time as they find it difficult to form new relationships with the people around them.⁸ Research has found that there are negative effects on health for older people after entering formal care. Some early studies have reported that there is a high mortality rate among the aged due to institutionalization,¹⁵ whereas other research has found that moving frail elderly from one setting to another results in mental and physical deterioration.^{16,17}

Many nursing homes now incorporate animal visitations and interactions into care models. Animals help fulfill criteria aimed at promoting better quality of life by increasing social interactions, decreasing loneliness, countering boredom, and helping foster

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a sense of purpose. Furthermore, almost anyone can interact with an animal regardless of physical and cognitive impairment, as any person can communicate nonverbally with an animal by touching and stroking.¹⁸ Over the past few decades, the health benefits of both pet ownership and animal activities in hospitals and elder care settings have been widely reported in the literature.¹⁹ Research has found that interactions with pets or animals have 3 effects: (1) physiological effect (eg, improvement of vital signs), (2) psychological effect (eg, relaxation, reduction of distress, and improvements in mood and depression); and (3) social effect (eg, facilitate communication).^{20–22} Research has found that animals have many positive benefits for people, particularly older people, and in a nursing home setting animals can be a social icebreaker, and can provide companionship, meaning and comfort to a person.^{23,24}

Because animal therapy has been so successful with older people, research has turned to creating companion robots that may offer the same benefits as live animals but require less care and are more hygienic. Animals can cause problems in an elder care setting; they may be a trip hazard, may scratch or bite, may introduce parasites and infectious diseases to the environment, and require extra care considerations on top of daily staff duties.²⁵ A robot animal that does not have to be fed, cleaned, or cared for and that cannot cause harm, may be an adequate substitute for a live animal. Research with companion robots in nursing homes has been conducted predominantly with the companion robot AIBO (a metallic doglike robot) and Paro (a white fluffy seal robot). This work has found that these companion robots can have a physiological effects by reducing stress hormones^{26,27} and can improve brain functioning.²⁸ Research has also found that companion robots have a positive psychological effect and can help forge social relationships.²⁹ For example, in a 5-year longitudinal study³⁰ conducted in an elder care facility in Japan with 14 residents who suffered from mild to moderate dementia, Paro improved mood and depression and decreased stress levels. The nursing staff commented that Paro is a “necessity” for the facility, as Paro made people laugh and more active. In a different study conducted in Japan over 2 months³¹ in a care home with 12 residents, Paro was given a home on a table in a public space for residents to play with for the duration of the day and returned to the office at night. The results showed that Paro encouraged residents to communicate with each other and strengthened their social ties. Overall, the current research suggests that companion robots have positive social, psychological, and physical effects in elder care settings.²⁶ However, much of the research that has been conducted does not have robust study designs, as control or comparison conditions are not used and studies generally take place with small sample sizes and over a short period of time.^{32,33} No previous work has been published that has conducted a randomized controlled trial specifically with Paro in a rest home setting, although some have been conducted with AIBO.³⁴ Most of the research is exploratory, reflecting that this area is relatively new. Additionally, much of the research with Paro has been done in Japan, with less research performed in other cultures. Overall, more research is needed to see if implementation of robotic therapy with Paro has benefits over a long period of time in different settings and with different cultures. The aim of this research was to address some of the shortcomings of the previous research with Paro by using a randomized controlled trial, and in a Western country. This study aimed to explore how the psychosocial effects of Paro could be compared with a control group. This research also evaluated the impact Paro had on the social environment by observing how residents interacted with the robot and with each other when the robot was present in comparison to when the resident dog was present. Although research with the companion robot AIBO has looked at the difference between interactions with a robotic dog and a live dog in children,^{35,36} and one study has looked

at the effect of a live dog or AIBO on loneliness,³⁴ the effects of Paro have not been compared with a live animal.

Methods

Setting

The study was conducted at the Selwyn Heights retirement home, in Hillsborough, Auckland, New Zealand, in the hospital and rest home areas, which provide 24-hour support 7 days a week. In both areas there are a wide range of activities for residents to enjoy, organized by the same activities coordinator. Additionally, the activities coordinator brings her Jack Russell terrier to work each day and the dog is free to visit residents in the hospital and often goes over to the rest home. Ethics approval was obtained from the University of Auckland Human Participants Ethics Committee and written informed consent obtained for all participants. In cases where participants were unable to provide informed consent, enduring power of attorney (EPOA) representatives were contacted asking permission for the resident to participate in the study and written informed consent was obtained.

Participants

Participants were 40 residents (13 men, age range 55–100 years). Twenty residents were randomly assigned to the control group (rest home 11, hospital 9) and 20 were assigned to the Paro group (rest home 7, hospital 13) using a random list generator. Nineteen participants (48%) scored 6 or lower on the Abbreviated Mental Test, which is suggestive of cognitive impairment. There were no significant differences between the intervention and control groups in cognitive impairment.

Procedure

Residents in both groups completed baseline measures assessing loneliness, depression, and quality of life. Loneliness was assessed using the UCLA Loneliness scale (Version 3)³⁷ that has been used in previous research to assess loneliness in older people before and after interacting with AIBO.³⁴ Depression was measured using the Geriatric Depression Scale (GDS).³⁸ This is a short questionnaire composed of 15 yes or no questions pertaining to depressive symptoms experienced over the past week. This questionnaire has been used extensively in older populations and is highly validated.³⁹ Quality of life was measured using the Quality of Life for Alzheimer’s Disease (QoL-AD).⁴⁰ This questionnaire has 13 questions that asked participants to rate various aspects of their lives on 4-point scale. Staff also completed proxy ratings of residents. Again, this measure is highly validated in older populations.⁴¹

Paro sessions were scheduled to take place on 2 weekday afternoons for 12 weeks, which was incorporated into the activities schedule. Residents in the control group went on bus trips around the city during this time or an alternative activity, such as crafts, movies, or bingo, was organized. During sessions with the robot, discussion groups were held and all residents had a chance to interact with the robot. If the resident was unable to attend the session because of ill health, the resident had the opportunity to interact with the robot after the session individually. Observations were conducted over the course of the trial to assess residents’ social behaviors when the robot was present, compared with when the resident dog was present or when neither were present. After the 12-week trial, follow-up measures were administered to participants. Figure 1 summarizes the design of the study and number of participants. Analyses of covariance (ANCOVAs) were performed to compare changes between

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