Robotic Pets: Supplemental Rehabilitation for the Dementia-Suffering Individual

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Abstract

People with dementia (PwD) along with their caregivers currently face challenges in the disease process because there is a major gap in available treatment and therapies, especially those that are non-pharmacological. The literature shows an increased incidence of dementia, and currently, there is no cure. This leaves medication as the treatment of choice. The aim of this project was to investigate whether introducing robotic pets as a supplemental therapy to persons with mild to moderate dementia helps in reducing their level of anxiety and agitation. Based on a review of the literature on the benefits of robotic pet interactions with dementia-suffering individuals, a quality improvement project was conducted in a suburban city in Arizona. Project participants included individuals with dementia and their caregivers. They were asked to interact with the robotic pet in their home for four, one-hour sessions, over a four-week timeframe. Analysis of the findings revealed that individuals with dementia found a sense of joy and peace while interacting with the pets, and they looked forward to the pet visit every week with excitement. These results indicated that introducing robotic pets to dementia-suffering individuals was clinically significant as it relates to their anxiety and agitation levels. Utilizing robotic pets as a supplemental therapy can benefit dementia-suffering individuals and their caregivers. Further evaluation is needed with a larger sample size to better understand the impact of robotic pets on PwD.

Keywords: Therapy, Alzheimer's, standard of care, cognitive impairment, anxiety, agitation

Robotic Pets: Supplemental Rehabilitation for the Dementia-Suffering Individual

One person doesn't get dementia, the entire family does. Finding that one thing that can help to decrease behavioral and psychological symptoms of dementia (BPSD) can make a huge difference in the lives of people with dementia (PwD) and their caregivers. This project will explore dementia, including its national and local significance, and will demonstrate the impact of robotic pets on PwD.

Background and Significance

Worldwide, 50 million people are living with dementia (Alzheimer's Association, 2020). By 2060, the number of people aged 65 and older with dementia is projected to reach 13.8 million, barring the development of medical breakthroughs to prevent, slow, or cure the condition (Rajan et al., 2021). The typical life expectancy after a dementia diagnosis is 4–8 years (Centers for Disease Control, 2020). Researchers expect to spend $2.8 billion on dementia studying everything from blood vessels to hormonal factors to solve the dementia dilemma (Nania, 2020). In 2018, the American Association of Retired Persons (AARP) committed to investing $60 million with Dementia Discovery Fund, a $350 million London-based venture capital group that invests in new therapeutic projects to support the quest for a cure (Nania, 2020). The purpose of the current project is to investigate the emerging evidence that suggests anxiety and agitation levels can be decreased by introducing robotic pets as a supplemental therapy to people with mild to moderate dementia.

Alzheimer's Disease and Related Dementias (ADRD)

Dementia is not a single disease; it is an overall term—like heart disease—that covers a wide range of other dementia conditions, like Alzheimer's disease (Alzheimer's Association, 2020). Recent estimates indicate that Alzheimer's may rank third, behind heart disease and

cancer, as a cause of death for older people (National Institute on Aging, 2019). There is a new case of dementia in the world every 4 seconds, and every 66 seconds, someone in the United States develops Alzheimer's (Alzheimer's Disease International, 2020). One in three seniors in the United States dies from some form of dementia (Alzheimer's Disease International, 2020).

The burden of ADRD in 2014 was 5 million people, which was 1.6% of the U.S. population that year (Centers for Disease Control and Prevention [CDC], 2019). This burden is projected to grow to 13.9 million, nearly 3.3% of the population, by 2060 (CDC, 2019). Thus, the U.S. burden of ADRD will double by 2060, according to a study from the CDC (2019). Although there is currently no cure for ADRD, health-care professionals continue to treat individuals diagnosed with ADRD with the current standard of care, which includes medication that may attempt to decrease the rate at which ADRD progress. Because of the increase in side effects of ADRD medications that contribute to BPSD, researchers have been investigating the use of robotic pet therapy to reduce or prevent BPSD. Recently, many studies have shown added benefits to using robotic pet therapy in the treatment of PwD to decrease agitation and anxiety levels as well as other BPSD.

Dementia

Dementia is a general term for loss of memory, language, problem-solving, and other thinking abilities that if severe enough can interfere with quality of life (QoL) (Alzheimer's Association, 2020). The causes of dementia can vary, depending on the types of brain changes that may be taking place (National Institute on Aging, 2019). Dementia is not a specific disease but an overall term describing a group of symptoms (Alzheimer's Association, 2020). Alzheimer's disease is thought to begin 20 years or more before symptoms arise, and it starts with changes in the brain that are unnoticeable to the person affected. Abnormal brain changes

cause disorders grouped under the general term "dementia," and only after years do individuals experience noticeable symptoms such as memory loss and language problems (Alzheimer's Association, 2020a, 2020b). In the past, the term "Alzheimer's disease" was often used to describe the dementia phase of the disease, but dementia is only one part of the disease (Alzheimer's Association, 2020b). For example, some people have both Alzheimer's disease and vascular dementia (National Institute on Aging, 2019). The continuum starts with preclinical Alzheimer's and ends with severe Alzheimer's dementia, and the duration for each part of the continuum varies (Alzheimer's Association, 2020b).

Nonpharmacological Therapy

Various nonpharmacological interventions for PwD include occupational therapies; cognitive training, stimulation, and rehabilitation; exercise programs such as aerobic exercise and strength training; art therapy; and music therapy. Nonpharmacological therapies are used for PwD to help maintain or improve their cognitive function, QoL, and ability to perform activities of daily living (ADLs). Nonpharmacological treatment in PwD has been shown to be more effective than pharmacological therapy in reducing agitation and anxiety (Watt et al., 2019). The difference between the current standard of care which is pharmacological therapy and nonpharmacological therapy is that it does not interfere with the destruction of the neurons of the brain that causes the symptoms and makes the disease fatal. There is always difficulty in determining the effectiveness of nonpharmacological therapy because of the different types of therapy being tested: including therapeutic aims, stages of dementia, and types of dementia the PwD may have.

Robotic Pets

Dementia is an umbrella term covering diseases that affect one's memory and alter one's ability to perform ADLs. Dementia has been growing fast in the absence of a cure, but major investments are being made in research funding. A tremendous responsibility is placed on scientists and health professionals to look deeper into every aspect of the human brain and make sure that nothing is missed in diagnosing, slowing, and treating the disease. The standard of care has always included medication therapy. Research now shows the benefits of robotic pet therapy in the treatment of PwD. Introducing robotic pets can help reduce anxiety and agitation levels as well as alleviate social isolation and feelings of loneliness, which may contribute to the improvement in cognitive health. Robotic pet therapy can improve the physical and emotional moods of elderly people with and without dementia. Nonpharmacological therapies such as animal interactions, dolls, and robotic pets do not involve medication or drugs. They are used to distract PwD from experiencing BPSD such as anxiety, agitation, wandering, aggression, depression, and/or feelings of loneliness.

Intervention to Decrease Anxiety and Agitation

Although there are currently no FDA-approved pharmacologic treatments that prevent or cure Alzheimer's disease or slow its progression, several groups of researchers have estimated the cost savings of future interventions that either slow the onset of dementia or reduce its symptoms (Alzheimer's Association, 2020b, 2021; Jutkowitz et al., 2017). Researchers estimated that a treatment that slows the rate of functional decline by 10% would reduce average per-person lifetime costs by $4,504 in 2020, and a treatment that reduces the number of behavioral and psychological symptoms by 10% would reduce average per-person lifetime costs by $789 in 2020 (Jutkowitz et al., 2017). A total of 68% of the projected increase in the global prevalence

and burden of dementia by 2050 will take place in low- and middle-income countries (Alzheimer's Association, 2020).

Animal interaction has long been known to benefit people emotionally. Robotic pet therapy serves as a nonmedicinal intervention to enhance the QoL and reduce the negative effects associated with dementia (Sicurella & Fitzsimmons, 2016). Robotic pets enhance effective and social outcomes for PwD (Liang et al., 2017).

Internal Evidence

Located in a large urban area, this city was the first in Arizona to join Dementia Friendly America's initiative to ensure that communities in the United States are equipped to support PwD and their caregivers. That makes this inner suburban community Arizona's first dementia-friendly city. In 2015, at the White House Conference on Aging, this city was designated as one of the six up-and-coming dementia communities and was tasked to help lead the national initiative along with Dementia International. Since then, the city has partnered with a health care organization, devoted to Alzheimer's, to make its community a livable place for PwD by offering training, programs, and resources to employees as well as the community. In the community, about 1,500 people aged over 65 have dementia. Arizona will have the second-highest number of PwD in the nation in the next 10 years, resulting in 3,000 PwD living in the community (U.S. Census, 2020).

This inner suburban city continues to raise awareness, transform the attitudes of people in the community, and move people to action to improve the city's performance measures. As the Dementia Friendly Community Designation their goal is to create an inclusive, informed, safe, and respectful community for PwD. The city's intentions are to raise support to improve the QoL for people touched by the disease, including caregivers and families of PwD; working towards

engaging its diverse population and promoting community life, and encouraging the people who live, work, and play in the city to become dementia friends. Introducing robotic pets to PwD to help decrease anxiety and agitation levels will align with their City Council Priority for Quality of Life and help to increase ratings in the city's engagement and inclusion of PwD, their care partners, and their families (Census.gov, 2020).

As the demographic composition of the United States changes, around 10,000 baby boomers turn 65 each day (U.S. Census Bureau, 2020). Age is the single greatest risk of ADRD (Alzheimer's Association, 2020). The burden surrounding ADRD has doubled as of 2020. In Arizona alone, the number of individuals living with Alzheimer's has increased by 60%. ADRD affects the entire household (about four-to-five people, if not more) (Alzheimer's Association, 2020).

PICOT Question

Millions of older Americans are being diagnosed with ADRD. Although researchers are striving to find a cure for families and PwD, only evidence-based practices (EBPs) to help PwD achieve the best QoL are available. Caring for PwD may be challenging, and the responsibility usually falls on the child, partner, or family member. Increased anxiety and agitation levels are associated with violent/abusive episodes as well as a decline in cognitive ability, which may lead caregivers to place PwD in nursing homes or long-term care facilities.

EBPs suggest that caring for PwD in their own homes and in familiar environments prevents anxiety, and agitation, and slows the decline in cognitive ability. The home is considered the preferred care environment to help PwD live the best QoL attainable. As studies have shown, robotic pets can bridge the gap between PwD and their anxiety and agitation levels. This finding raises the following clinically relevant PICOT question: Does the introduction of

robotic pets as a supplemental rehabilitation therapy help reduce anxiety and agitation levels in mild to moderate dementia-suffering individuals?

Evidence Synthesis

Search Strategies

An extensive search of three databases, CINAHL, PubMed, and PsycINFO was conducted to explore the current data available. These databases based were chosen to help answer the PICOT question comparing robotic pets to the current standard of care and exploring the possibility of reducing anxiety and agitation levels in PwD. These databases were searched using key terms in PICOT question such as “dementia,” “Alzheimer’s,” “standard of care,” “cognitive impairment,” “anxiety,” and “agitation.” “Robotic pet,” “robotic pet therapy,” and “animal therapy” were not included in the key terms because they returned a significantly low number of results. Instead, “nonpharmacological treatment and/or nonpharmacological therapy” and “reducing anxiety and agitation” yielded more results. Filters used in the search included articles written in the English language and publications from 2016–2021 and 2004 were included to review the first study conducted on robotic pets and PwD.

An initial search of CINAHL with the key terms “dementia,” “Alzheimer’s,” “cognitive impairment,” and “robotic pet” produced no results, so the search keys robot*, therap*, Agitat*, and anxiet* along with other Mesh terms was added. These yielded 3,644 results. After adding more filters, the search results ranged from 1–506. An initial search of PubMed using the key terms “dementia,” “agitation,” “anxiety,” and “nonpharmacological therapy” yielded one result. After adding Mesh words, 11,922 results were obtained. After applying filters, the results ranged from 0–1,564. An initial search of PscyhINFO with key terms “dementia,” “Alzheimer’s,”

"cognitive impairment," and "therapy" yielded 11,313 results. After applying filters and adding Mesh terms, results more focused on my PICOT question produced a range from 0–1,190.

A total of 44 studies were deemed relevant because their titles and abstracts were closely related to my PICOT question. A total of 10 studies were chosen for the annotated bibliography and three for the rapid critical appraisal table. These studies consisted of a longitudinal study, a mixed-methods trial, and a randomized control trial. Inclusion criteria included PwD, PwD living at home, health-care professionals encountering or treating PwD, and the geriatric population. The exclusion criteria were PwD that could not participate in care or decision-making and could not consent.

Critical Appraisal and Synthesis

Ten studies were included in this review. Most had a high level of evidence and limited bias. There were three systematic reviews, four randomized control trials, one mixed-methods study, one quantitative longitudinal study, and one qualitative study (Appendix A). All studies included PwD and older adults, and their authors examined the effects of anxiety and agitation/loneliness and robotic pet interaction. Melnyk and Fineout-Overholt's (2019) (Appendix B) rapid critical appraisal process was used to determine the quality and strength of the articles selected for this review. The articles provided limited information on demographics and included participants aged 55 and older. Most studies were conducted internationally, with two studies conducted within the United States and two articles within the SRs originating in the United States. The SRs had a small sample size but rigorous inclusion criteria and measurement tools, which increased their breadth for inclusion in this review. The implementation of interventions involving robotic pets, real pets, and plush pets was done either in a residential home and/or an institution or both.

These interventions included introducing robotic pets to dementia patients, evaluating the effects, and comparing this group to a group that participated in the standard activity of the institution. Sessions were held either individually or as a group, and participants were given the opportunity to spend time with the robotic pets. Heterogeneity was significant in the tools and designs that were used. Although there was variation in the measurement tools, three of the studies (Banks et al., 2008; Birks et al., 2016; Libin & Cohen-Mansfield, 2004) were focused on robotic pets and the effects of anxiety and agitation in elderly and/or elderly dementia patients. The dependent variables in these studies also included loneliness, depression, mood, social interaction, medication, cognitive function, and QoL. Most of the reviewed studies showed significant improvements in BPSD. Significant changes in behavioral symptoms included positive effects on a participant's anxiety and agitation level, feelings of loneliness, feelings of depression, moods, and increased social interaction with staff and residents. Studies showed a positive effect on cognitive function and QoL. More studies need to be conducted to obtain significant data to support the current evidence.

Theoretical Framework

The Theory of Human Caring (Watson, 2006) is applicable for this project because of the notion that health professionals make moral, social, and scientific contributions to humankind and by caring, which influences human development (Appendix C). Nurses are at the center of healing. The constructs of this theory embrace the importance of helping to enhance nursing practice, management, education, and research. Assisting with basic needs with an intentional caring consciousness and administering "human care essentials" will potentiate the alignment of the mind, body, and spirit and introduce wholeness into all aspects of care (Wagner, 2019).

This project focused on two constructs – creating a healing environment and teaching and learning. Creating a healing environment can go both ways. For dementia sufferers, their environment can be crucial to their QoL as the home is the recommended healing ground for dementia. This theory is very relevant to this project because it reflects the fundamental aspects of caring, in a holistic way. Watson formulated her theory based on Florence Nightingale's beliefs which can be described as the soul of nursing. Nurses go out into the environment, see where the pain is, wrap their arms around it, and try to provide comfort. Especially, when there is no certain solution. Providing a tool, in this case, a robotic pet that can help alleviate anxiety and agitation, not having to worry about it causing a reaction with the medication or adding on to the already tedious medication regime reflects caring principles. It's a form of distraction that can decrease these symptoms that may lead to abusive behaviors, if not treated. It instills faith and hope knowing that your loved ones are happy, at least at that moment. PwD will be able to stay in the home environment for longer if the BPSD that is often present due to medication can be suppressed or controlled.

When it comes to teaching and learning, being able to utilize and explore other EBPs to investigate the impact of dementia, and how or what has been done, helped choose the direction for this project. Robotic pets are a readily available tool to help both dementia sufferers and caregivers in improving their QoL as well as their mental health. The aim of the project is to provide a caring environment that can promote healing and growth and encourage a sense of calmness to help decrease anxiety and agitation levels in PwD.

Implementation Framework

Project implementation followed the intervention mapping framework by Bartholomew-Eldredge et al. (2016). This framework was chosen because it encompassed the core constructs

of this project, focusing on knowledge from existing research to guide the implementation of evidence-based intervention in a community setting (Appendix D). The framework further guided this health promotion project within a dementia-populated community and explored different responses to anxiety and agitation in PwD. The intervention mapping framework has six steps. The first step involves the development of comprehension of the purposed issue and formulating objectives to solve the issue. The next step involves using guidance to obtain outcomes and objectives in an analytical manner. The other steps involve designing the project using theories as guides, implementing the project, and evaluating the implementation method to determine if one has achieved one's objectives or outcomes.

A logic model was created to depict the impact of the project (Appendix E). These steps were navigated within the context of the project by first establishing and working with a planning group, completing a needs assessment regarding the Dementia Initiative, and understanding other relevant evidence-based literature. Changes were made to the project design focusing on specific needs, leadership changes, and the evolving pandemic changes. Moving through these steps helped in creating a well-developed answer to the PICOT question. This framework also provided an opportunity for results and data to be reexamined and corrections to be made, while placing them in the right step within the framework. Using this framework has made it possible for this project to achieve the best results from the data obtained during the implementation of this project.

Methods

Recruitment Procedure and Ethical Considerations

Dementia Friendly site volunteers and the co-primary investigator (CO-PI) recruited participants. The CO-PI solely obtained the consent of participants, and volunteers acted as

supplemental resources for the project. The project was introduced to the City's Dementia community via an email that Dementia Friendly regularly sends out to Dementia Memory Café members and family support groups. Informational flyers (Appendix F) were handed out at the in-person Memory Café meetings. This City designated a large community room for recruiting and educating participants for this QI project. This area provided a safe and comfortable environment for project participants to transition from the Memory Café. Project participants were recruited from the attendees.

The recruitment was completed in a two-step process. Volunteers completed the first step using a well-defined script to describe the project to participants (Appendix G). These volunteers completed the Dementia-Friendly Information Session training to become dementia champions to create consistency when dealing with project participants. Objectives of the session included a description of dementia and the types of dementia, key messages about dementia, approaches to communicating with PwD, and the commitment to serve as a "dementia friend" in their community.

Then the CO-PI provided a detailed project presentation to the Memory Café participants, including the site champion, host, staff, volunteers, and community members. Once primary caregivers and PwD displayed interest and willingness to participate in the project, their names, and numbers were recorded. The CO-PI called all interested persons (n = 30) individually to discuss any concerns or answer any questions they had regarding the project. Five PwD and their primary caregivers were chosen for the project. All five individuals that were chosen met the inclusion criteria with a special focus on availability to participate in all aspects of the project.

The consent process took place in the comfort of participants' homes on the first visit to ensure that participants were fully informed about the QI project as well as to give participants

the opportunity to voice their questions and concerns. Handwritten signatures were obtained authorizing consent on a standardized form that outlined the details of the project (Appendix H). Obtaining the consent of participants was the sole responsibility of the CO-PI. This was to ensure that all participants were equally educated on the project.

On the first visit, the CO-PI evaluated the decision-making capacity of the PwD using the University of California, San Diego, Brief Assessment of Capacity to Consent (UBACC) (Appendix I). If a score of 15 or above was obtained on UBACC, the PwD would consent, and the primary caregiver would sign as a witness. If the PwD was cognitively unable to consent or received a score of less than 15, then the primary caregiver, who is the legally authorized agent for the PwD, consented on their behalf. Participants were informed of their rights and assured that they could withdraw from the project at any time without any consequences or explanations. Participants were informed that withdrawing from the project would not affect their relationship with the Dementia Friendly Organization or interfere with the services the organization provided to them. This QI project was approved by the Institutional Review Board of Arizona State University as an Expedited Review.

Participants

Ten participants were included as the convenience sample: five being dementia-suffering individuals and the other five their primary caregivers, who were also their spouses. Inclusion criteria for the QI project included individuals aged 55 and over; diagnosed with mild to moderate dementia, as disclosed by the caregiver; who understood, spoke, and read English; lived with a consenting caregiver/guardian; individual living at home; were available for hourly visits, and was reachable by phone. Exclusion criteria included individuals not diagnosed with dementia; individuals unable to participate in their care; individuals with no primary caregivers

to give consent; individuals not living at home; individuals who could not be available for hourly sessions; and individuals not reachable by phone. No minors, prisoners, and economically or educationally disadvantaged individuals were included in this QI project. However, adults with impaired decision-making capacity were included and provided consent along with their primary caregiver.

PwD are typically diagnosed by an accredited provider as having symptoms affecting memory, thinking, and social abilities that may interfere with their daily life. Participants and/or primary caregivers' recognition of PwD was based on their knowledge of healthcare professionals' diagnosis of dementia. Therefore, no formal written diagnosis or assessment of dementia was required for this project. The absence of primary caregivers to give consent excluded participants from the QI project. Recruited caregivers were the primary caregivers of the PWD with the authority to give consent for participation.

Setting and Procedure

The quality improvement project involved the observation and management of anxiety and agitation levels of mild to moderately diagnosed dementia-suffering individuals while they interacted with a robotic pet in the comfort of their own homes in a large urban community in Arizona. Primary caregivers were given a brief introduction to how the robotic pet works and an instruction manual and care and instruction for robotic pets. Last, the pet was introduced to the PwD. The project was thoroughly reviewed during the first visit, including visit schedule and duration, CO-PI role, types of observations, and measurements (Appendix J).

Robotic Pet Intervention

This QI project focused on the benefits of introducing robotic pets to PwD. These robotic pets have lifelike qualities including sound and movement and the ability to respond to

movement and touch. All participants preferred to interact with the golden retriever dog, instead of the cat. This battery-operated, robotic pet was designed by the manufacturer, Joy for All, to look and feel like a real dog. Its state-of-the-art art technology creates a life-like appearance. It has built-in sensors that allow it to respond to presence and touch, realistically reacting to its environment. Features of the robotic pet include a sensor of the head, cheek, mouth, back, and a light one above the right ear. A microphone is near the upper part of its right front leg and has an on/mute/off switch and a battery door in the tummy area. One can hear a "thump, thump" heart sound, it "WOOFS!" and makes other realistic "pup-like" noises. Petting the pup over the sensor areas will evoke a response and if there is no interaction after a few minutes it will go to sleep. The pup is considered a lap pup and can't walk or run (JoyForAll.com, 2018).

Measures

Brief Assessment of Capacity to Consent (UBACC)

UBACC is a shorter version of the MacArthur-Competence-Assessment-Tool-for-Clinical-Research. It is brief and screens for capacity to consent to research participation among those at risk for decisional capacity (Seaman et al., 2015). UBACC was created as a short and efficient way of conducting screening without extensive training of research staff. It is an alternative rather than a comprehensive assessment for measuring capacity to consent. UBACC contains 10 questions related to reasoning, appreciation, and understanding (see Appendix H for a full set of questions). Individuals are scored from 0 to 2, with 0 indicating little to no understanding of the project and 2 indicating a clear understanding of the project. A score of 15 or higher indicates that an individual can consent to the project. If the individual scores less than 15, the primary caregiver provided consent to participate in the project. The instrument demonstrated acceptable levels of reliability with a Cronbach's alpha of 0.77.

Agitated Behavior Scale (ABS)

The ABS is used to measure the extent and nature of agitation in individuals recovering from a brain injury. This instrument may also be used to measure agitation in nursing home residents with Alzheimer's/progressive dementia (Bogner, 2000). The ABS contains 14 questions related to the anxiety levels of individuals (see Appendix K for a full set of questions). Individuals are scored on the degree to which a behavior is present: 1 = Absent (not present), 2 = Present to a slight degree (does not interfere/disrupt), 3 = Present to a moderate degree (interferes/disrupts but can be redirected), and 4 = Present to an extreme degree (interferes/disrupts and cannot be redirected). A pre-interaction survey was conducted before the session started, and a post-interaction survey was conducted after the session. A score of 21 or less is normal, a score of 22–28 is mild, a score of 29–35 is moderate, and a score of 35 or more is severe. The instrument demonstrated good levels of reliability with a Cronbach's alpha between 0.801 and 0.921.

Rating Anxiety in Dementia (RAID)

The RAID scale is used to evaluate anxiety in PwD. Standardization in administration and scoring makes RAID easy for non-clinicians to use, and it exhibits good reliability and validity in older adults with dementia (Snow et al., 2012). The RAID scale contains 20 questions related to anxiety (see Appendix L for a full set of questions): five questions related to worry, four questions related to apprehension and vigilance, four questions related to motor tension, five questions related to autonomic hypersensitivity, one question related to phobia, and one question related to panic attacks. The RAID scale has the following scoring system: U = unable to evaluate, 0 = absent, 1 = mild or intermittent, 2 = moderate, 3 = severe. A score of 11 or more suggests significant clinical anxiety. Ratings in this project were based on signs and symptoms

occurring pre- and post-interactions with robotic pets. The instrument demonstrated good levels of reliability with a Cronbach's alpha of 0.81.

Caregiver Evaluation of Robotic Pet Interaction Survey

The Caregiver Evaluation of Robotic Pet Interaction Survey was newly created for the purposes of this project. This instrument evaluated caregivers' perceptions and opinions on the benefits of robotic pets, user-friendliness, and the effects the pet has on the anxiety and agitation levels of their loved ones. There are a total of seven questions with a Likert scale from 1 = strongly disagree to 5 = strongly agree and one additional comment box is provided (see Appendix M for a full set of questions).

Results

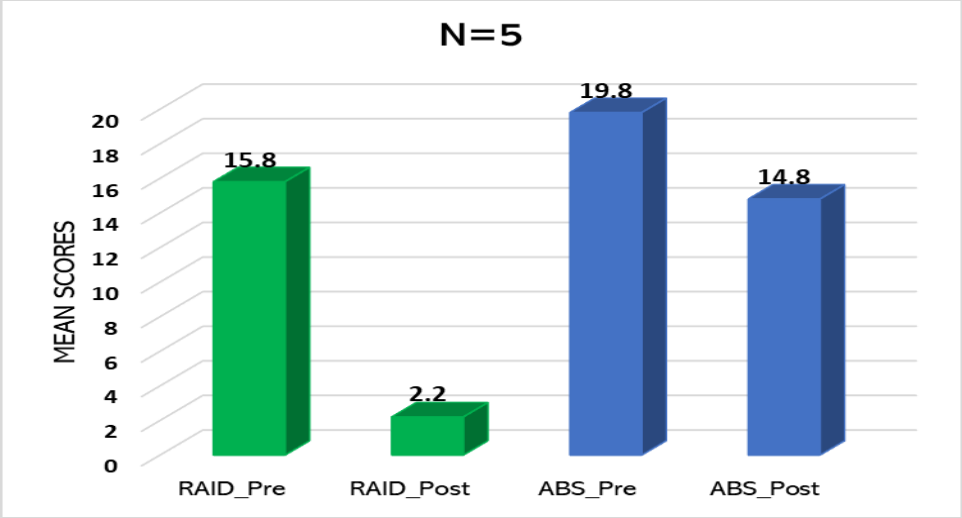
Outcomes

The total number of participants was 10. Of these 10 people, there were 5 male individuals diagnosed with dementia and 5 female individuals who were their primary caregivers as well as their spouses. The age range for participants was 74 to 82 years old and the average age for participants was 77.4 years old. Out of the 5 male participants 2 were diagnosed with mild dementia and the other 3 had moderate dementia. Participants received the Hasbro companion robot of their choice – a golden retriever; none selected a cat as they were all former dog owners. Given the changing needs during the pandemic, personal funds were used to implement this QI project and ensure that strict infection control measures were upheld. All participants were provided with their own robotic pet at a cost of $129.00 per dog. The total budget for this QI project was an estimated $2,309, including personal computers and printers and recruitment materials/stationery (Appendix N).

Caregivers were introduced to the robotic function and given an instruction manual for the care and use of the robotic pet. The robotic pets were not left in the home instead the intervention in this project consisted of one- one hour visit, one day of the week over a period of four weeks. Pre- and post-surveys were completed; before interaction - looking at the individual's anxiety and agitation levels over the week and post looking at anxiety and agitation levels after interaction with the robotic pet. At the end of the 4 weeks in addition to the pre and post survey, caregivers were asked to do a caregiver evaluation of the robotic pet interaction. The level of anxiety and agitation was measured before interaction and after interacting with robotic pets using the RAID and ABS scale. A Shapiro-Wilks test was done initially to test for homogeneity, the results were not significant for RAID based on an alpha value of .05, W=0.89, p=.349 and ABS based on an alpha value of .05, W=0.96, p=.801. The results indicated that the data were normally distributed from the convenience sample.

Figure 1

RAID and ABS Pre and Post Totals

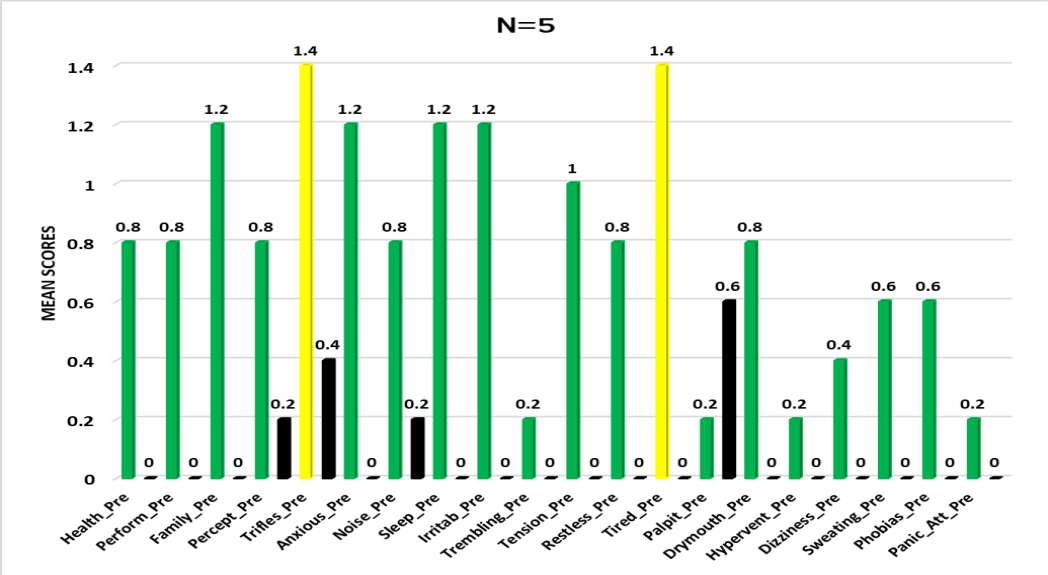


Note: Two-Tailed Paired Samples t-Test, pre and post test means
Statistically significant change in RAID $p < .02$; ABS not statistically significant $p < .06$

As shown in Figure 1, the result of the two-tailed paired sample t-test was significant for RAID based on an alpha value of .05, t(4) = 3.53, p=.024. The result of the two-tailed paired samples t-test was not significant for the ABS based on an alpha value of .05, t(4) = 2.50, p=.067. It was observed that before the interaction with the robotic pets the mean total score for RAID survey was 15.8 (SD = 11.41, range 4 – 32), which indicated that there was significant clinical anxiety present among participants. The mean total score of ABS survey was 19.8 (SD 5.40, range 14 – 26) which falls within the normal range for agitation. At the end of interactions between the PwD and the robotic pet, total mean score for RAID was 0.25 (SD = 0.50, range 0 – 1) and ABS was 14.60 (SD = 1.79, range 14 – 18). Both survey results indicated that they were positive effects of interaction with robotic pets. The RAID Anxiety level mean dropped from 15.8 to 2.2; an 86% decrease. The ABS agitation level, even though it was reported in the normal range, went from 19.8 to 14.8, a 25% decrease.

Figure 2

RAID Symptoms Pre and Post Scores



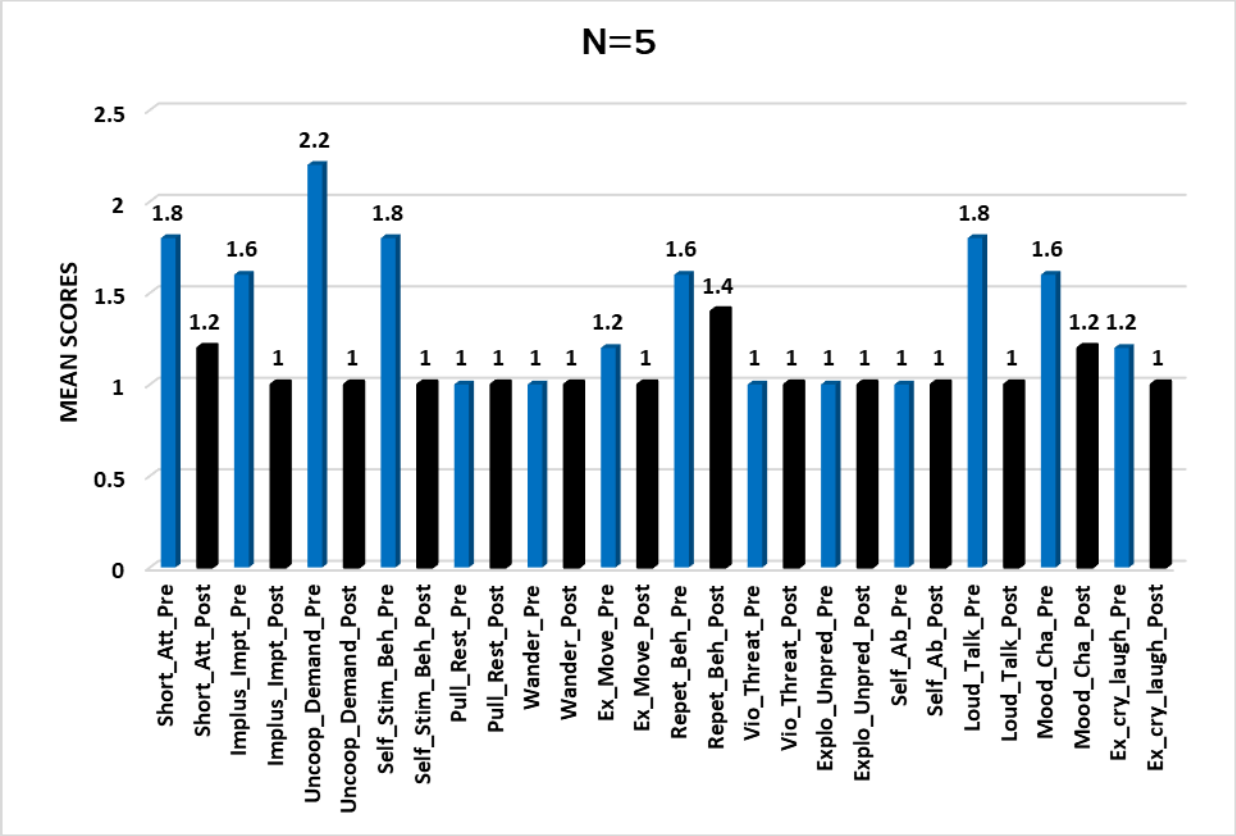
Note: Summary Statistics for pre and post scores of symptoms associated with anxiety. A notable decrease in Trifles and Tiredness pre and post scores was observed.

The results in Figure 2 indicated that Anxiety symptoms were significantly reduced pre vs post RAID survey, including a notable reduction in Trifles pre 1.40 (SD = 1.34, range 0 – 3) to post-survey 0.40 (SD = 0.89, range 0 – 2) and Tiredness pre 1.40 (SD = 0.89, range 0 – 2) to post-survey 0 (SD = 0, range 0 – 0). Trifles are repeatedly calling for attention over trivial matters or attention-seeking behavior. An example from one of the caregivers was, "Whenever he's occupied with the pet, he doesn't shadow me around and I can get stuff done in the kitchen while keeping an eye on him." As for relief from tiredness, PwD was excited once they got the pet and start cuddling, smiling, and talking to the pet. An example from a caregiver was, "He's much more talkative, I think he sits there imagining he has the pet and just keeps talking, I don't understand what he's saying but he's relaxed, smiling, and conversing with himself."

Other caregiver comments included, "He is calmer and more relaxed." "This opportunity has proven to be so beneficial for my husband. He does not fidget with the dog in his hands. He strokes it and smiles." This particular caregiver had a basket filled with small gadgets/devices to otherwise keep her husband's hands busy. "The robotic pet; increased interest in the pet over the phone and calmness and happiness in overall daily interaction with him." When this individual received a call from his friends, he would excitedly tell them about the pet and made plans to take the pet to the community center at the end of the project.

Figure 3

ABS Symptoms Pre and Post Scores



Note: Summary Statistics for pre and post score of symptoms associated with agitation. Uncooperative, demanding, and resisting care were highest and was notably less during observation.

As indicated in Figure 3, even though the agitation level scored within normal per ABS survey, a clinically significant drop in uncooperative, demanding, and resisting care was observed. Before the interaction with the robotic pet, uncooperative, demanding, and resisting care mean scores were 2.20 (SD = 0.84, range 1 – 3), the highest on the ABS scale. After the robotic pet interaction, the average uncooperative, demanding, and resisting care values were 1 (SD = 0, range 1 – 1), a 25% decrease.

While not statistically significant the findings were clinically relevant as noted by an observed reduction in specific behavior after interaction with the robotic pet. The findings suggest that there are benefits in utilizing robotic pets as a supplemental rehabilitative therapy and should be studied further. This gets the site for this project one step closer to achieving its desired performance goal.

Observation of PwD

While observing the PwD interacting with the robotic pets, they were more verbal: “I wish you could live with me,” “You should move in so the pet can stay,” “I don’t want you to go,” “I love you,” and “I miss you.” They became very pleasantly verbal when interacting with the robotic pets. Their mood changed. They smiled, they cuddled, and they rubbed noses with the pets, presenting a very caring and loving demeanor in the presence of or while interacting with the robotic pets. As the process went on, the benefit of interactions between moderately diagnosed vs mildly diagnosed participants became obvious because these were the people who created a real bond with their pets.

In the mildly diagnosed individuals, it was great to watch how they related to the pets and the way they perceived themselves or their roles in interacting with the pets. The mildly diagnosed PwD were very verbal in giving their opinion on who they thought would benefit from having the pets. They also gave their suggestions on robots and how robots have evolved over the years. The mildly diagnosed PwDs enjoyed interacting with the pets because this built their curiosity about why and how the pets looked like real puppies and behaved like real puppies. As they explored the robotic pets and listened to and felt the pets’ heartbeats, they expressed fascination and amazement. They were in tune with the interactions and curious about what was

under the fur and where the batteries were located. This is important because mildly diagnosed PwDs tend to forget they asked a question and keep asking it.

In mildly diagnosed individuals, one of the major influencing factors of their behavior or moods is their tendency to mimic the behaviors of their caregivers. If the caregiver becomes frustrated and agitated, the PwD perceives that as being their fault, causing their mood to change or making them want to leave. During a home visit, when interacting with the caregiver to complete survey questions, she became frustrated because she did not or could not understand the questions. The PwD then stated he was going to go to his room so that he would not be in the way. In another interaction, the caregiver was loud and aggressive, causing the PwD to respond poorly and try to exit the room.

The clinical significance associated with the interaction of PwD and robotic pets is evident as the changes in their behaviors and moods could be visually observed. All individuals, whether mild or moderately diagnosed with dementia, had a more pleasant attitude and were smiling more when the pet was in their presence. The caregiver watched the PwD from a distance while sitting on the opposite side of the living room, cleaning up the kitchen, and starting dinner. They were always excited/happy when anticipating the pets' presence/visit. Caregivers' unanimously scored all evaluation questions as a "5", which signaled their strong agreement that the robotic pet was a helpful, supplemental rehabilitative tool for their loved ones.

Discussion

Summary, Conclusions, Recommendations

Although the results did not produce statistical significance, it is worth mentioning that the interaction between these robotic pets and PwD was visually pleasing and comforting to both the PwD and caregivers. It produced a sense of responsibility and companionship for the PwD.

Robotic pet therapy served as a nonmedicinal intervention to enhance PwD's QoL and reduce the negative effects associated with dementia (Sicurella & Fitzsimmons, 2016). Robotic pets enhance effective and social outcomes for PwD (Liang et al., 2017). Although the standard of care has always included medication therapy, this projects suggests the benefits of robotic pet therapy in the treatment of PwD. Introducing robotic pets to individuals diagnosed with mild to moderate dementia can help decrease anxiety and agitation levels, which may contribute to an improvement in cognitive health.

Maintaining the cognitive health of PwD over a longer period is a part of the Healthy People 2020 objective (OA-5): reduce the proportion of older adults who have moderate to severe functional limitations, and (OA-6): increase the proportion of older adults with a reduced physical or cognitive function who engage in moderate or vigorous leisure-time physical activities (Healthy People 2020, 2019). Hudson et al. (2020) showed that there is an increased benefit in using robotic pets to relieve anxiety, agitation, and loneliness in older adults, especially in care centers. Moyle et al. (2015) stated that the use of companion robots and investigations of the benefits of social robots compared to and in association with human interaction were beneficial. Robotic pets enhance the effectiveness of social outcomes for PwD (Liang et al., 2017).

According to the reviewed studies, robotic pets had beneficial effects on the emotional and social functioning of PwD. Robotic pets played an important role in decreasing anxiety and agitation levels, decreasing the need for mood-adjusting medications, alleviating the burden of caregiver burnout, and enhancing autonomy while encouraging the social interaction of PwD. Evidence shows that robotic pets can help in improving moods and fostering communication among elderly persons with mild to moderate dementia. It also has positive effects on managing

BPSD. Robotic pet interaction has positive effects on agitation, anxiety, loneliness, medication consumption, and QoL for older adults.

Strengths and Limitation

The strengths and facilitators of this project included the opportunity that was given to work with a city that was a part of a National Initiative for Dementia. It was an honor lead this quality improvement project with the community. The city was very supportive throughout the entire project and community members showed significant interest in the project as 30 participants responded to the initial rollout.

Due to the impact of COVID-19, there were many challenges and limitations during this QI project. Cost was incurred by CO-PI due to risk of infection, having to purchase additional robotic pets since they had to be limited to one per household; Smaller sample size and representation of PwD due to heightened precautions/transmission and fear of contact with people outside the household; Inability to carry out the project in a memory care setting and the small sample size, which limited the generalizability of the findings. One of the major challenges that set this project back was the change in the site, sample size, and population. The project went from being conducted in 10 memory care home with 10 patients each to five individuals and their caregivers in their homes.

While there were many changes throughout the project related to the COVID-19 pandemic and concerns about the spread of COVID-19 by handling the pets, leader turn-over at the Dementia Friendly project site was also significant. During this time, new leadership was being onboarded, and a great deal of repetitive work needed to be done such as getting new

stakeholders up to date on the project. Grants and supplies that were to be used for this project changed with the new management. Using the robotic pets that were already acquired for the project was not an option because it was seen as a transmission risk. As a result, personal funds were used to purchase everything needed for the project.

Sustainability, Implication and Future Recommendation

This project revealed that robotic pets can be effectively used as supplemental therapy for PwD. Based on the findings and conclusions, the following recommendations are suggested. Because robotic pets have been shown to decrease anxiety and agitation, providers should incorporate or introduce the pets as a supplemental therapy for dementia-suffering individuals. These pets will act as a tool to foster a sense of responsibility in providing care and be a sensible distractor for symptoms associated with dementia.

Ownership of a robotic pet should be encouraged by providers and embraced by caregivers to provide a sense of peace and calmness for PwD and to create an opportunity for caregivers to take a break or downtime from the constant shadowing/mood changes associated with the progression of dementia. The use of robotic pets should be encouraged as therapy for both elderly and dementia-suffering individuals in nursing homes/long-term care facilities. Robotic pets should be investigated further within the context of PwD, using a larger sample size to provide significant data to help strengthen the effectiveness and benefits of robotic pet interactions. Studies suggest that robotic pets are beneficial when used as a supplemental therapy and they are a readily available and affordable option for improving QoL and fostering effective experience for PwD. Recommendations for further study would include other individuals that may also experience other BPSD. For example, the elderly population who experience loneliness may be a good candidate for this robotic pet as a companion, along with individuals

who suffer mental illness and have multiple BPSD. The opportunities for robotic therapy as an effective therapy shows great promise across many diverse popluations.

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APPENDIX A: Evaluation Tables

Citation	Theoretical/ Conceptual Framework	Design/Method/ Purpose	Sample/ Setting	Variables	Measurement/ Instrumentation	Data Analysis	Results/ Findings	Level of Evidence; Application to Practice/ Generalization
(Chen et al., 2018). Social robots for depression in older adults: A systematic review **Country:** Australia, Denmark, New Zealand, Norway, United States **Funding:** None **Bias:** Publication bias. Implicit bias regarding interviews	**Inferred:** Cognitive and behavioral theoretical framework	**Design:** SR of SRs and Mas Raw data for analysis Blinding of treatment allocation Using intention to treat **Purpose:** To review evidence from existing SRs and Mas of the effects of social robot interventions for dep. in OA	**N** = 7 **N1** = 6 RCT **N2** = 1 comparison study **DS**: CINAHL = 21, MEDLINE = 38, PsychInfo = 41, PubMed = 38, Web of Science = 316, Scopus = 22, Cochrane = 43, EMBASE = 75, ProQuest = 51 LTC facilities: 6 studies Home: 1 study **Inclusion criteria:** SR & Mas; included statement of review; adult ≥ 55; Studies w/ young onset dementia; social robot intervention; outcomes measures	**IV1:** Robot **DV1:** Dep **DV2:** OA	Screening, data extraction, form, discussion, Endnote software, reviews	JBI-MA StARI PRISMA	**IV1**: Moderate-quality evidence. Mixed results. 6/7 studies found significant improvement in dep. Active participation and group delivery associated with better results	**LOE:** I **Strengths:** Comprehensive search and selection strategy used in selecting relevant articles. Thorough observation of interaction w/robot improves health outcomes by reducing depressive symptoms. Inclusion of solely SRs increases breadth of evidence examined **Weaknesses:** No MA d/t diversity of intervention and low sample size **Conclusions:** Overall evidence suggesting that social robot interventions have the potential to reduce depressive symptoms. Evidence was not strong

Key: ABMI—Agitated Behaviors Mapping Instrument; **ABS**—Agitated Behavior Scale; **AIBO**—robotic dog; **AIBOG**—robotic dog group; **ANCOVA**—analysis of covariance; **ANOVA**—analysis of variance; **b/w**—between; **CG**—control group; **CI**—confidence interval; **CMA**—Cohen-Mansfield Agitation Inventory; **CMAI**—Cohen–Mansfield Agitation Inventory instrument; **CSDD**—Cornel Scale for Depression in Dementia; **CSS**—cross-sectional study; **d/o**—diagnosis of; **Dep.**—depression; **DG**—dog group; **DM**—Delphi methodology; **d/t**—due to; **DQ**—descriptive qualitative; **DS**—databases searched; **DSM-IV**—Diagnostic and Statistical Manual of Mental Disorder; **DSS**—Delphi survey scale; **DV**—dependent variable; **dz**—disease; **EG**—experimental group; **FSS**—Face Scale Score; **GDS**—Global Deterioration Scale; **h/o**—history of; **hr**—hour; **ICC**—intraclass correlation coefficient; **IG**—intervention group; **ITT**—intention to treat; **IV**—independent variable; **JBI-MAStARI**—Joanna Briggs Institute Meta-Analysis of Statistics Assessment and Review Instrument; **LAPS**—Lexington Attachment to Pet Scale; **LMBS**—Lawton's Modified Behavior Stream—**LOE**—level of evidence; **LS**—longitudinal study; **LTCF**—long-term care facility; **MA**—meta-analyses; **MANOVA**—multivariate analysis of variance; **MD**—mean difference; **min**—minutes; **MLAPS**—Modified Lexington Attachment to Pet Scale; **MMSE**—Mini-Mental State Exam; **mn**—months; **N**—number of studies; **n**—number of participants; **NGO**—nongovernmental organization; **NRCT**—nonrandomized control trials; **NRNCT**—nonrandomized noncontrolled trial; **OA**—older adult; **OMI**—outcome measurement; **OT**—observation table; **PI**—Paro intervention; **PO**—potential outcomes; **PRISMA**—Preferred Reporting Items for Systematic Reviews and Meta-Analyses; **pt**—patient; **PwD**—person with dementia; **QD**—qualitative data; **QDC**—qualitative data collection; **QIS**—qualitative interview study; **QoL**—quality of life; **QUALID**—Quality of Life in Late-Stage Dementia scale; **RAID**—Rating Anxiety in Dementia; **RCT**—randomized control trial; **RT**—recreational therapist; **SCS**—single case study; **SD**—standard deviation; **SG**—support groups; **SPS**—stated preference survey; **SR**—systematic review; **UCLA**—University of California Los Angeles; **w/**—with; **w/o**—without; **wk**—weeks; **wkly**—weekly; **y.o.** —years old; **y**—years; **ZBI**—Zarit Burden Inventory; **&**—and; **α**—Cronbach's alpha value; **+**—plus; **≥**—greater than or equal to

Citation	Theoretical/ Conceptual Framework	Design/Method/ Purpose	Sample/ Setting	Variables	Measurement/ Instrumentation	Data Analysis	Results/ Findings	Level of Evidence; Application to Practice/ Generalization
			of dep.; quantitative; includes pre- and posttest; English peer-reviewed journals **Exclusion criteria**: Grey literature; non-English articles **Attrition:** Not discussed					enough to formulate recommendations on clinical effectiveness on dep. in OA. Rigorous and powered studies needed for Mas. **Feasibility**: Recommended for use in practice because of effectiveness of nonpharmacological benefits for Dep. in PwD
Harding et al. (2018). Developing a core outcome set for people living with dementia at home in their neighborhoods and communities: Study protocol for use in the evaluation of nonpharmacological community-based health and social care interventions	**Inferred:** Caregiver dynamics, middle range theory	Four-phase mixed-methods study **Phase 1**: Identification of PO through QDC and LR **Phase 2**: DM **Phase 3**: SR of OMI **Phase 4**: SPS Interviews and **FG**, recruitment, bringing together **QD** and data extracted from **LR**	Random 50% sample; N = 124 Key reviews and qualitative studies; N = 8 Policy documents; N = 38 **DS:** MEDLINE, CINAHL, ALOIS, PROSPERO, and Cochrane	To establish an agreed standardized **COS** for use when evaluating nonpharmacological health and social care interventions for **PwD** Identify and achieve a consensus around which outcomes should be measured from the perspective of key stakeholders	Surveys, audiotaped histograms, workshops, discussions	Logistic analyses, probity regression analyses	Identification of potential outcomes through qualitative data collection and literature review. LR of existing outcomes reported in studies and review. Bringing together the qualitative data and the data extracted from literature.	**LOE**: I **Strength**: Study design and the Delphi method are increasingly being recognized as a robust approach to forming **COSs.** Study focused on **PwD**. **MMS** to achieve best possible results **Weaknesses:** Data from UK only. Sample restricted to North-West England.

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Country: United Kingdom **Funding:** ESRC and NIHR **Bias:** None stated by authors Diversity/sample bias		**Purpose:** To establish an agreed **COS** for use when evaluating nonpharmacological health and social care interventions for **PwD**	**Demographics**: 20–30 PwD and care partners **Setting:** Homes across north-west of England **Inclusion criteria**: d/o dementia, living in home in North-West England, capacity to understand and consent to participate in study **Exclusion Criteria**: Inability to consent, PwD institutionalized, non-English speaking, too unwell to participate **Attrition:** Not discussed	(people living at home with dementia, care partners, health and social care professionals, researchers, and policymakers). Review and recommend how outcomes should be measured			Delphi methodology	Use of online survey tool will limit participation. Study limited to mild to moderate PwD **Feasibility:** Recommended for use in practice owing to effectiveness of nonpharmacological benefits in caring for and treating PwD
(Pu et al., 2018). The effectiveness	**Inferred:**	**Design: MMSR** of **RCT's**	**DS:**2202 **(A)** **N:** 13 **(A)**	IV: Robotic Pet	QUALID CMAI	Interrater reliability	(α- = 0.86)	**LOE**: I

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of social robots for older adults: A systematic review and meta-analysis of randomized controlled studies. **Country:** Denmark Norway New Zealand United States Australia Japan Spain **Funding**: PhD Scholarship from Griffith University & the Chinese Council **Bias**: None reported by author. High in allocation concealment, random sequence and blinding; Selection bias	Health belief model	4 trials**:** 25–45 **min** sessions **12 wks** **FU**- 12–6–5 wks after intervention **Purpose:** Summarize the effectiveness of social robots on outcomes (psychological, physiological, QoL, or medication) of OA from RCT's.	**n:** 11 **(RCT)** **n:** 9 **(MA)** **N=**1042 **DS**: (n=2202) Scopus (n=748) ProQuest (n=84) PubMed (n=724) EBSCO (n=152) PsycINFO (n=41) Science Direct (n=143) Web of Science (n=289) Cochrane (n=21) **Setting**: Hospital **LTC** Facilities Daycare Centers 1 **A** -Home setting **Inclusion criteria:** OA; 55y + RCT's using social robots w/o restriction of type English articles **Exclusion criteria**: Subject were children. Younger adults Reviews	DV1: Effects on PwD DV2: Effects on professional caregiver DV3: Effects on relative **Definition**: Interaction—Impact/Implications of robotic cat Communication—Using robotic cat Usable—Qualities of robotic cat	Introduction and training coding of patterns using qualitative description. Interviews Visual inspection increased. Good internal consistency	High test–retest reliability, internal consistency Cronbach's alpha	Range = 11 to 59 lower QoL. Interrater reliability (0.69), high test–retest reliability (0.86) (α = 0.74 and 0.77) CMAI- 50–83. Baseline (mean = 55.9). 7-wks intervention, (mean = 62.0). Follow-up period (mean = 69.7). Throughout all phases: range = 17–24. Mean values of 19.1 (A—baseline), 19.3 (B—intervention), and 19.0 (A—follow-up). Visual inspection. CMAI: 28–61. Overall CMAI scores low, mean range 34.5–40.7	**Strengths:** Thorough discussion of numerous components in study to improve health outcomes. Inclusion of SRs increases breadth of evidence examined. **Weakness:** Sampling limited to participants at dementia care home. Limited discussion of sample demographics **Conclusions:** Results indicate improvement in QoL. Scores were higher after intervention. Further research with a larger sample size is necessary to determine broader impact **Feasibility/ Applicability to pt. population:** Feasible intervention. Could be applicable but may witness more advancement at time of intervention, so results

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Performance bias Detection bias Attrition bias			Nonrandomized studies Study protocols Case Studies Observational studies Pre/post studies w/o CG Conference abstracts w/o full text **Attrition:** Not discussed				(A—baseline: mean = 34.9) B—intervention: mean = 34.5; follow-up: mean = 40.7). QUALID = 11–22 all phases, mean values of 15.3 (A—baseline), 13.8 (B—intervention), 14.0 (A—follow-up	may not be generalizable. Readers recognize descriptions or interpretations as comparable to their own experiences. Transferred to comparable situations and contexts
(Banks et al., 2008). Animal-Assisted Therapy and Loneliness in Nursing Homes: Use of Robotic versus Living Dogs. **Country**: United States **Funding:** None stated	Inferred to the Social-Emotional Selectivity Theory	Quantitative Study **Design:** RCT (pre- & posttest, 8 - wks follow up test) Wkly 30 mins visits **Lonely elderly LTCF pt**: 3 groups w/ wkly 30-min visit w/ AIBO/dog over 8wks. Reviewed initial pretest & posttest 7wks to compare effects of loneliness.	**N:** 38 **n1**: 13 (initial group w/ dog) **n2**: 12 (initial group w/ AIBO) **n3**: 13 (CG) **Setting**: All in LTCF. In pt's room. **Sample Demographics:** No significant differences between DG, AIBOG, or CG.	**IV:** Lonely elderly LTCF pt. **DV1**: CG **DV2**: DG **DV3**: AIBOG	UCLA loneliness scale Delta Loneliness Score MLAPS & LAPS Newman-Keuls range test Prism 4.0 statistical package Survey/ Questionnaire	ANOVA Student 2 tailed t-test Pearson Correlation Subscale analysis 1 tailed t-test	There were no statistical differences among pretest UCLA loneliness scale for 3 groups. CG, DG, AIBOG; mean loneliness score= 45.9±1.16 (n=38) (F(2,35)=37.3, p<.01) CG; (N=13) AIBO (p<.05, n=12)	**LOE:** II **Strengths:** RCT design, relatively high attrition rate for short duration study (over 8 wks), adequately powered. **Weaknesses:** Initial sampling limited to participants in LTCF. No intervention for those who did not get any visits. Details not provided regarding the health status of pt.'s.

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Bias: None stated by author. Sampling and Informational Bias was noted.		**Purpose:** Compare the ability of a living dog (Dog) and a robotic dog (AIBO) to treat loneliness in elderly patients living in 3 LTCF in St. Louis, MO.	**Exclusion Criteria:** Score <24 on MMSE Allergic to dogs or cats Score < 30 on UCLA Loneliness scale Known h/o Psychiatric dz or Alzheimer's dz. **Inclusion Criteria:** LTCF pt. **Attrition:** Not discussed				DG; ($p<.05$, n=13) m=0.437 i= (-18.9) r= 0.459 n=38 $p<.005$ MLAPS & LAPS Pearson r= 0.9937 r^2=0.9874 slope 1.01; intercept (-3.04) AIBO (47.2±4.03, n=12) DG (55.0±3.73, n=13)	Limited discuss of sample demographics. **Conclusions:** Results demonstrate a significant decrease in the feeling of loneliness after visits compared to those who didn't get visits. Improvement in feelings of loneliness noted when using either dog or AIBO with no significant difference in type of pet use in visit. **Feasibility/ Applicability to pt. population:** A visit session similar to that described in the study could be feasible with caregivers. The applicability is relevantly easy since caregivers provide care and can help in reporting effects of intervention pre-intervention & compared to post intervention.

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(Liang et al., 2017) A Pilot Randomized Trial of a Companion Robot for People with Dementia Living in the Community. **Country**: New Zealand **Funding:** University of Auckland Faculty Research Development Fund to E.B. (Grant 360813) Sasakawa Young Leaders Fellowship Funds. **Bias**: The authors declare no conflict of interest.	Psychodynamic Theory Rogers' phenomenological theory Kelley's Covariation Model Weiner's Three-Dimensional Model	**RCT –** Pilot Block **Purpose –** To investigate the effective, social, behavioral, and psychological effects of the companion robot Paro for people with dementia in both day care center and home setting.	**N** = 74 Excluded N = 44 Not meeting **inclusion criteria**: N = 9 Non-English speaking: N = 2 Moved away: N = 5 No dementia diagnosis: N = 1 Care recipient passed away: N = 1 Declined Participation: N = 35 Time constraints N = 23 Caregiver health concerns N = 2 Care recipient health concern N = 4 **Setting:** 2 Dementia day care centers Residential homes of participants Formal diagnosis of Dementia	**IV** – Companion Robot (Paro) **DV1** – Effects in home setting **DV2** – Effects in day care center **Definition**: Companion robot – an animal with whom one spends a lot of time with Home setting – residential area where action is taken place. Day Care center – Facility where action is taken place Dementia – complex, brain deteriorating disorder that results in significant cognitive and functional decline. ace	**TSM** Responses recorded Physiological – B/P, Salivary Cortisol, hair cortisol **CMAI-SF** **NPI-Q** **ACE**- New Zealand Version **CSDD**	**FET** **MD** **MMA** **ANOVA** **BA** **IStT** **MWUT** **SD**	Paro had beneficial effects on emotional & social functioning in people with dementia. Based on: Effects in day care center n = 13 Observation: Facial expression SD = 17.5% PG 33.8% CG r=0.49 z=-2.22 Social interaction SD = 29.2% PG 25.1% CG r=0.11 z=-0.56 Agitated behavior SD = 11.4% PG 21.6% CG r=0.29 z=-1.14 Effects in home setting n= 14 Cognitive score	**LOE:** II **Strengths**: Examined individual characteristic to determine who benefitted most. Examined range of self report, observational, & physiological variable providing comprehensive assessment. First study providing home context for robot. **Weakness:** Sample size was small. Maintaining participants was difficult. Challenging group to do research many drop out d/o deterioration in health /inability to complete assessment. **Conclusion:** **EG** showed significantly more positive facial expressions, talked more to staff & researchers

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			Attrition: Not discussed				SD = 19.2% PG 20.9% **CG** **CMAI-SF** Score SD = 10.4% PG 7.16% CG NPI-Q Score SD = 6.83% PG 2.43% CG	compared to those in the **CG**. **Feasibility** Recommended for use in practice due to effectiveness of companion robot in decreasing loneliness.
(Libin & Cohen-Mansfield, 2004). Therapeutic robocat for nursing home residents with dementia: Preliminary inquiry. **Country:** United States **Funding:** None Stated **Bias:** Gender homogeneity Small sample size Short term sessions	Inferred Theory of Planned Behavior	**RCT** (pre- & posttest) Comparison Condition Experimental Designs Analysis of Agitation/ Affect/ Age/ Level of cognitive impairment 2-10 min sessions; 1-5min pre & 5min post w/ cat Examine what kind of effects occur when a cognitively impaired person interacts w/ a robotic pet; does a robotic cat trigger more positive experience than a plush toy; and to what degree does a nursing home	**N:** 10; candidates n= 9; consented **n=**6 first session w/ robotic pet **n=**3 first session w/ plush toy **Setting**: Large suburban not-for-profit nursing home. **Sample Demographics:** PwD. Age range 83 – 98y. Mean age of 90y. Female gender. **Inclusion criteria:** d/o Dementia nursing home resident **Exclusion criteria:**	**IV**- Time (baseline vs intervention) **DV1**- Robotic cat **DV2**- Plush toy cat **Time:** 2, 10-min interactive session w/ resident 1 session per day conducted by research assistance **w**/ 1 year+ experience.	**GDS** **ABMI** **LMBS** 3 constructs on 5-point scale Interactive Sessions Protocol Observation	Pearson correlations Paired sample t-test Separate t-test	GDS= 5.4 (range 4-7) r=.76, p<.008 /duration r=.63, p<.018 /attitude r=.67, p<.012 /attention r=.66, p<.014 /intensity ($t_{(8)}$ =2.0, p<0.036 and $t_{(8)}$= 2.4, p<0.046) ($t_{(8)}$= 2.0, p< 0.078)/overall agitation ($t_{(8)}$= 3.6, p<0.007) /pleasure ($t_{(8)}$= 2.7, p<0.028) /interest 22% held robotic cat	**LOE:** II **Strengths:** RCT design, relatively. Relatively low attrition rate. **Weaknesses:** Sample limited to female participants diagnosed w/ dementia at a suburban nursing home. Small sample size. **Conclusions:** Results demonstrate a significantly increase in the among of pleasure residents had from their interest in pets. Agitation behavior also decreased. **Conclusion:**

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		resident w/ dementia & a robotic cat depends on resident's level of cognitive impairment.	Inability to partake in study. **Attrition:** Not discussed				78% held plush cat	Robots provided a response to nursing home residents' need for social contacts. Level of overall agitation decreased significantly when residents were interacting with pet. **Feasibility/ Applicability to pt. population: Introduction of pets** similar to that described in the study could be feasible to PwD. The applicability is Beneficial due to the effects pets have on resident in a short period of time. Also trained staff at nursing home is readily available to carry out intervention
(Yu et al., 2015). Use of a therapeutic, socially assistive pet robot (PARO) in improving mood and stimulating	Standardized framework	**RCT**—single-blind, methodologically rigorous RCT treatment outcomes assessed at baseline (pre- during, and posttreatment). 2 groups,	N=30 n=15 (CG) n=15 (IG) **Demographics**: Community-dwelling older Chinese	IV1—PARO (TG) IV2—Psychosocial activities (CG) DV1—Mood	**FSS** **OT** **MMSE** **CSDD** **ZBI** Subjective impression, questionnaire,	ANOVA ANCOVA Independent *t* tests Wilcoxon signed ranks test	**FSS** (0.63, SD 0.74) *t* test (alpha=.05 & power=.9) PARO TG 78.6 (range 72–87, SD 5.3)	**LOE**: II **Strengths:** First RCT to use PARO in improving mood and stimulating social interaction and communication.

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social interaction and communication for people with dementia: Study protocol for a randomized controlled trial **Country:** China **Funding:** None Stated **Bias:** Takanori Shibata is the developer of PARO		30-min wkly session; 6-wk period. Examine whether robot-assisted intervention using PARO in older Chinese adults with mild to moderate dementia improves mood and stimulates social interaction and communication compared to psychosocial activities	≥ 60 years. Mild to moderate dementia referrals from community dementia day care centers, geriatric outpatient clinics, nurse-led memory clinics, day hospitals **Setting:** Shatin Hospital, geriatric day hospital in Shatin, new territories, Hong Kong **Inclusion Criteria:** Community-dwelling older Chinese adults aged ≥ 60 years MMSE score b/w 10 and 24 d/o dementia **Exclusion criteria:** Individuals w/ CMAI scoring ≥ 2. Severe medical conditions limiting ability to participate.	DV2—Social Interaction DV3—Communication DV4- Cognitive Function DV5- Depressive Symptoms DV6- Caregiver Burden Pet Robot (PARO) Both treatments consist of six 30-minute weekly sessions, which will be conducted in a geriatric day hospital. Subjects in both groups will be assessed by a trained research assistant at baseline (pre-, during, and posttreatment)	qualitative comments, piloting, video analysis		(Cronbach's alpha = .86), test-retest reliability (alpha = .78), and good inter-rater reliability (ICC = .99), CSDD (Cronbach's alpha = .84), inter-rater reliability (kappa = .43–.89) ZBI- (ICC=.99, split half correlation coefficient=.81)	Videotaped observations of facial expressions and reactions that standard questionnaires or proxy interviews may miss. Modified OT assesses the degree to which PwD will respond w/ the treatment. Advantage in ratings developed in context of social isolation and communication. Inter-rater and intra-rater reliabilities of OT have been developed. Measurement of various variables reflects mood and social behaviors from another perspective **Weaknesses:** Confine study population to mild to moderate dementia. Limiting generalizability of results to a wider population by excluding behavioral and psychological symptoms of dementia.

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			Participating in other studies **Attrition:** 43% (12/30). Causes included death and inability to participate					SFS, CSDD, ZBI, and the subject impression questionnaire are self-reported. Misreporting and nonreporting may occur. **Conclusions:** Strong evidence suggested that PARO improved mood and stimulated social interaction and communication in older PwD, as well as provided an evidence base for the use of such social robots. **Feasibility/ Applicability to pt. population:** The intervention described is feasible at the nursing home. Applicability slightly limited by this study occurring in Hong Kong
(Zhou et. al., 2019) The association between loneliness and cognitive	**Inferred:** Health belief model	Quantitative **LS** **Purpose:** Close the gap in the existing literature by evaluating the	**N** =6 898 65 y/o + Sociodemographic factors:	**IV1**—Men **IV2**—Women **DV1**—Cognitive impairment **DV2**—	Self/proxy report **MMSE** **CES-D** **UCLA** Loneliness Scale	Logistic regression analysis	**OR** = 95% **CI** = 95% Cognitive impairment: 30% Loneliness w/	**LOE**: II **Strengths**: Added from previous studies indicating that loneliness had a

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impairment among older men and women in China: A nationwide longitudinal study **Country:** China **Funding:** US NIA, National Natural Science Foundation of China & Natural Science Foundation of Fujian Province **Bias:** Female prominence noted in oldest group. Most of the women were illiterate		association between loneliness and cognitive impairment among older men and women in China using a nationally representative longitudinal sample.	Age, sex, education level, employment status, BMI **Setting:** 22 provinces in China **Inclusion criteria: OA** 80y+ **Exclusion criteria:** < 65y/o **Attrition:** Not discussed	Feelings of loneliness	3-model analysis, sociodemographic factors, lifestyle factors, health status		OR = 1.30;95%, CI 1.01–1.69 Men: $p < 0.05$, $p < 0.01$, $P < 0.001$ Women: $p < 0.05$, $p < 0.01$, $P < 0.001$ Age w/ OR = 1.85; 95%, CI 0.68–0.98 More education; OR = 0.78; 95%, CI 0.68–0.98 Employed; OR = 3.34; 95%, CI 0.19–0.61	significant impact. Multiple imputations were applied to address missing data **Weakness:** Use of validated scale rather than single question to accurately measure loneliness. 50% of participants lost to follow-up or died **Conclusion**: Impact of loneliness on cognitive impairment was significant among elderly men but not elderly women **Feasibility:** Applicable to PwD population and w/ favorable effects on loneliness. Can be applied in PwD and readily available grants to purchase nonpharmacological therapy for maintaining QoL in PwD

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(Birks et al., 2016). Robotic seals as therapeutic tools in an aged care facility: A qualitative study **Country**: Australia **Funding**: None **Bias**: Author declared none. Implicit bias regarding interviews	Inferred physiological model	Qualitative descriptive, exploratory Daily 1-hr semi-structured interview over 4 mths. Diversional therapy **Purpose:** Aims to contribute to the existing body of knowledge by exploring the experiences of therapists using Paro as a therapeutic tool with a more diverse group of residents in an aged care facility in regional Australia	**N** = 3 RT **n2** = Selected aged care residents **Setting:** Aged care facility in a regional Australian city 127-bed facility operated by an **NGO** 125–130 staff **Inclusion criteria:** Elderly PwD aged care facility resident **Exclusion criteria:** Unable to participate in study **Attrition:** Not discussed	Animal-assisted therapy reduces depressive symptoms and agitation and results in an overall positive experience for residents	Journal/logs (notes), interview, 1:1 observation, group activity, diversional therapy	Inductive thematic analysis	Findings support the use of therapeutic tool revealing improvement in emotional state, reduction of challenging behaviors, and improvement in social interactions of residents A therapeutic tool that's not for everybody Every interaction is powerful Keeping the momentum	**LOE**: I **Strengths**: Strong design, dependable, transferable **Weaknesses**: Small n; limited generalizability; Focus on one facility; uses perspective of RT. Limited information on sample size and demographics. Funding not disclosed **Conclusions:** Evidence suggesting improvement in emotional, behavioral, and social well-being following PI. **Feasibility/ Applicability to pt. population:** Feasible intervention. Could be applicable to PwD. Evidence of improvement and easy-to-use process for both care providers and caregivers.

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APPENDIX B: Synthesis Table

Study										
Author	Banks	Birks	Chen	Gustafsson	Harding	Liaag	Libin	Pu	Yu	Zhou
Year	2008	2016	2018	2015	2018	2017	2004	2018	2015	2019
Design/LOE	RCT/II	QS/VI	SR/I	MMS/III	SR/I	RCT/II	RCT/II	SR/I	RCT/II	QLS/II
Measurement Tools	UCLA-LS D-LS MLAPS and LAPS Newman-Keuls range test	Interviews	GDS QoL-AD CSDD BARS RAID UCLA-LS MMSE	QUALID CMAI	JBI-MAStARI COSMIN COMET Delphi = Surveys, interviews	CSDD CMAI-SF NPI-Q TSM ACE-New Zealand version	ABMI LMBS	MMSE GDS ACE BARS CSDD NPI-Q NPI RAID CMAI-SF	MMSE CSDD ZBI	CLHLS MMSE CES-D
Sample										
# of Studies/ Participants	38	Not stated	7	18	7	30	10	9	30	6898
Age (y/o)	≥ 55	Not stated	≥ 55	≥65	Not stated	≥ 55	83–98	≥ 55	≥ 60	≥ 80
Country	United States	Australia	Australia Denmark New Zealand Norway United States	Sweden	United Kingdom	New Zealand	United States	Denmark Norway New Zealand United States Australia Japan Spain	China	China
Setting										
Residential			✓		✓	✓		✓		✓
Institution	✓	✓	✓	✓		✓	✓	✓	✓	
IV—Intervention										
Robotic Pet	✓	✓	✓	✓	✓	✓	✓	✓	✓	
Real Pet	✓				✓					
Plush Pet					✓		✓			
Standard Activity			✓		✓	✓			✓	✓
No Activity	✓	✓		✓	✓		✓			✓
Group							✓			
Individual	✓	✓		✓		✓		✓	✓	✓

Length Per Session	30 mins	60 mins	Not stated	Unlimited	Not stated	30 mins	2; 5 mins/day	Not stated	30 mins	Not stated
Session Per Week	1	7	Not stated	Unlimited	Not stated	3	1	Not stated	1	Not stated
Length of Intervention	8 weeks	4 months	Not stated	7 weeks	Not stated	12 weeks	1 time	Not stated	6 weeks	Not stated
DV—Outcomes Identified										
Loneliness	✓	✓			✓		✓			✓
Anxiety		✓			✓		✓	✓		
Agitation		✓			✓	✓	✓	✓		
Depression		✓	✓		✓	✓	✓	✓	✓	
Mood		✓	✓		✓	✓	✓		✓	
Social Interaction		✓			✓	✓	✓	✓	✓	
Cognitive Function					✓		✓	✓	✓	✓
QoL				✓	✓			✓		
Medication					✓	✓		✓		

APPENDIX C: Watson's Theory of Human Caring

Figure 1

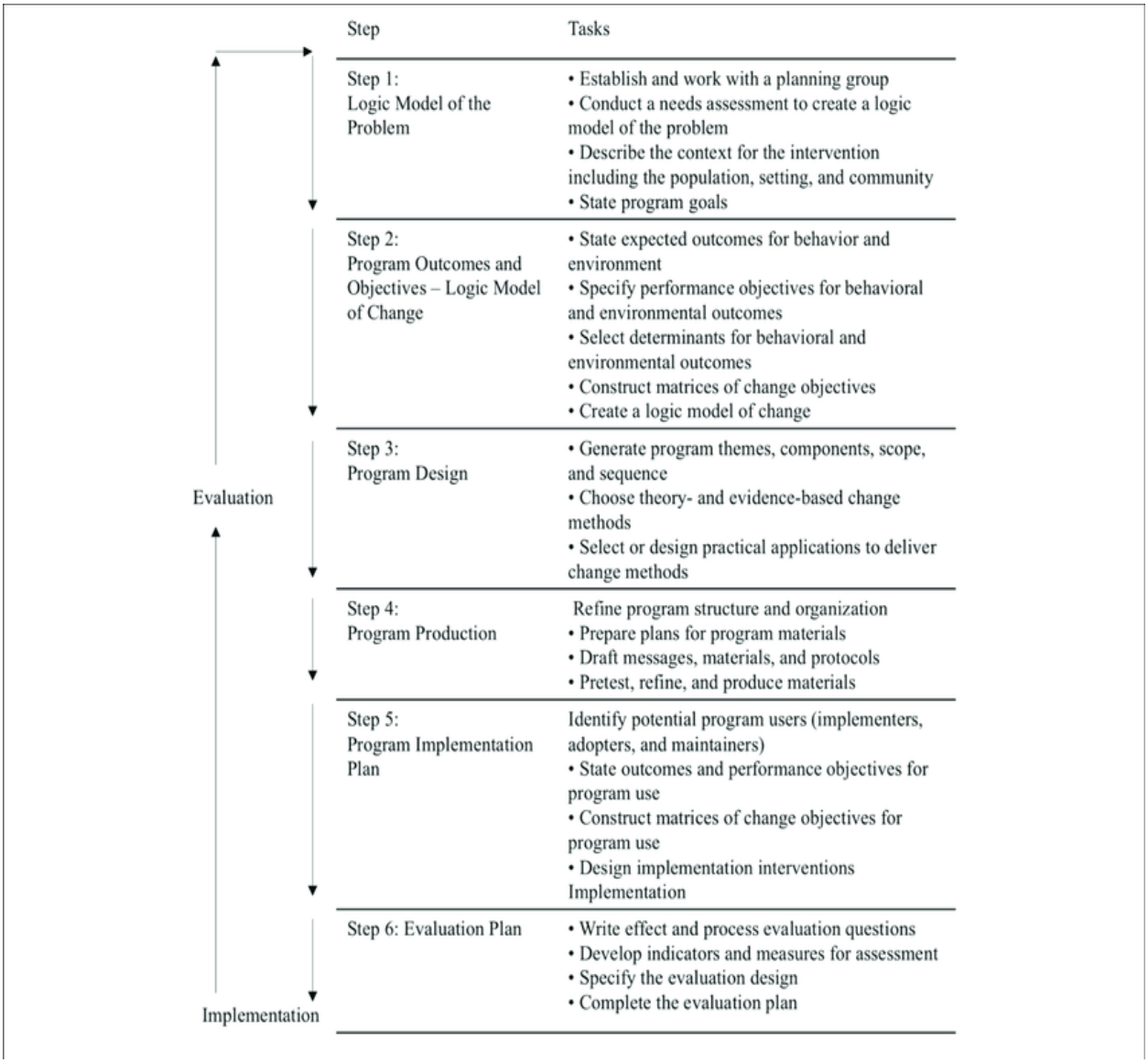
Theory of Human Caring

Parker, 2001)

APPENDIX D: Framework

Figure 2

Innovation Mapping Framework



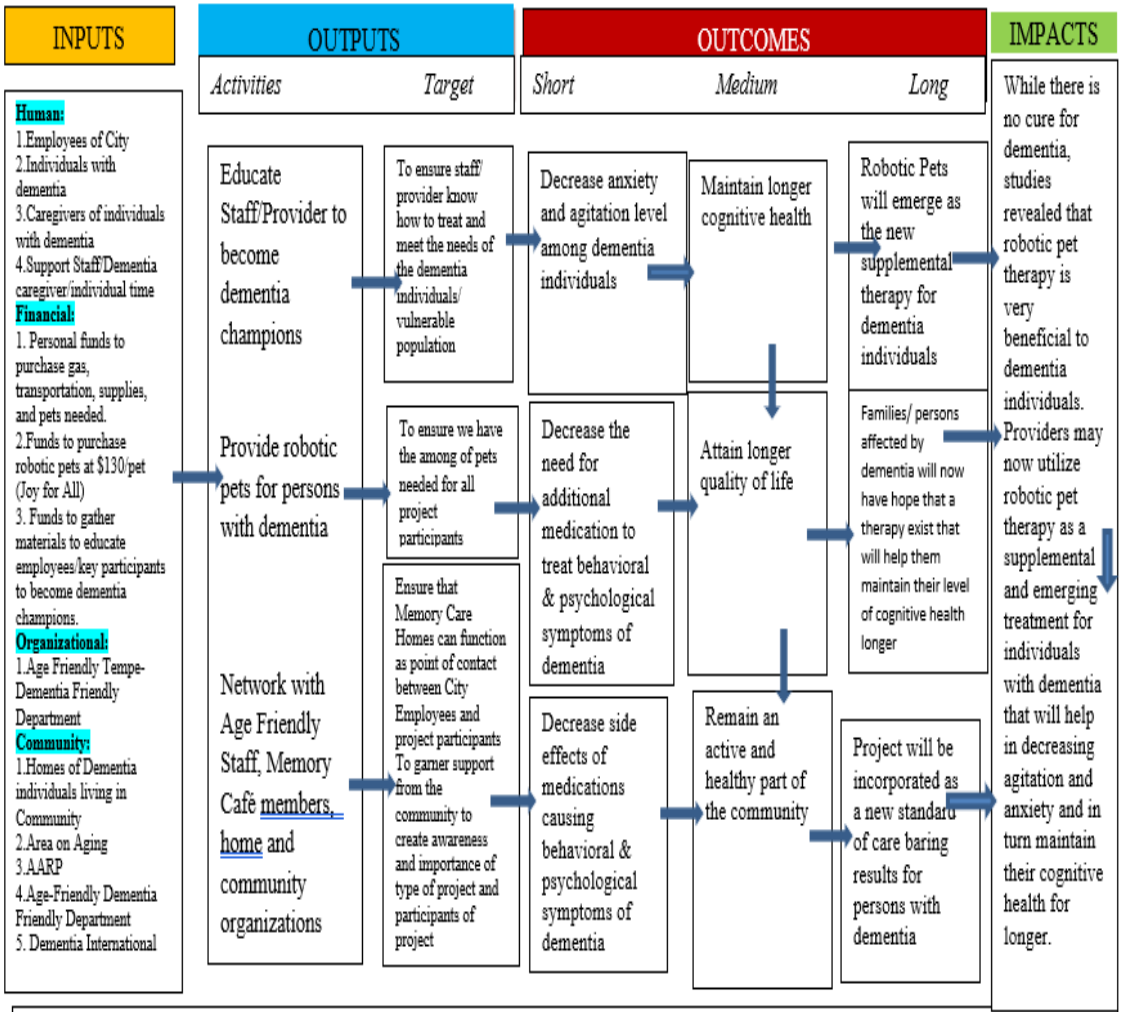
Step	Tasks
Step 1: Logic Model of the Problem	• Establish and work with a planning group • Conduct a needs assessment to create a logic model of the problem • Describe the context for the intervention including the population, setting, and community • State program goals
Step 2: Program Outcomes and Objectives – Logic Model of Change	• State expected outcomes for behavior and environment • Specify performance objectives for behavioral and environmental outcomes • Select determinants for behavioral and environmental outcomes • Construct matrices of change objectives • Create a logic model of change
Step 3: Program Design	• Generate program themes, components, scope, and sequence • Choose theory- and evidence-based change methods • Select or design practical applications to deliver change methods
Step 4: Program Production	Refine program structure and organization • Prepare plans for program materials • Draft messages, materials, and protocols • Pretest, refine, and produce materials
Step 5: Program Implementation Plan	Identify potential program users (implementers, adopters, and maintainers) • State outcomes and performance objectives for program use • Construct matrices of change objectives for program use • Design implementation interventions Implementation
Step 6: Evaluation Plan	• Write effect and process evaluation questions • Develop indicators and measures for assessment • Specify the evaluation design • Complete the evaluation plan

(Bartholomew-Eldredge et al., 2016)

APPENDIX E: Logic Model

A Project introducing robotic pets as a supplemental rehabilitation tool to help decrease agitation and anxiety levels in dementia-suffering individuals

Goals: To help alleviate anxiety and agitation levels which may contribute to cognitive decline, violent behaviors, and caregiver burnout.



Assumptions: Robotic Pet Therapy for dementia-suffering individuals are more accessible and more user friendly. Studies have showed that these robotic pets are very beneficial in helping to maintain the quality of life for dementia-suffering individuals. If introduced to the dementia population it is shown to add value as a supplemental therapy in reducing anxiety and agitation levels as well as other behavioral and psychological symptoms associated with dementia.

APPENDIX F: Project Informational Flyer

Edson College of Nursing and Health Innovation

Arizona State University

5 PARTICIPANTS NEEDED

FOR QUALITY IMPROVEMENT PROJECT INVESTIGATING ROBOTIC PET & DEMENTIA

Investigator from ASU—Edson College of Nursing and Health Innovation are looking for volunteers to participate in a quality improvement project that will help to determine if introducing robotic pets to persons with dementia will decrease their agitation and anxiety levels.

Participation in this project involves being available for approximately 90 minutes, every Monday, over a 4 weeks period. Meeting will be held in the comfort of your home.

Who do we need?

- 5 Participants who are 55 years or older
- Diagnosed with mild to moderate Dementia
- Must understand, speak and read English
- Must have a consenting caregiver/guardian

There is no financial compensation, but you do get to keep your robotic pet for participating in the project.

CONTACT FOR MORE INFORMATION:

rgillram@asu.edu

APPENDIX G: Recruitment Script

Recruitment Script (in person):

"Hello, my name is _____. I am a volunteer with [redacted]. I received information that you might be interested in taking part in our quality improvement project "Introducing robotic pets to persons with dementia". The purpose of the project will be to determine if introducing robotic pets to persons with dementia will help in decreasing their anxiety and agitation levels. This project will be occurring within the next few weeks. It involves collecting information from you through questionnaires and includes observation of you and your loved one interacting with the robotic pet. You will be paired with your loved one with dementia and will be given the robotic pet to introduce to them. You and your loved one will be observed by our CO-Primary Investigator (CO-PI), Rushana, for a 60-minute period to evaluate interaction with robotic pets and how it affected their anxiety and agitation levels. These sessions will take place over a period of 4 weeks in the comfort of your home. If you decide to take part in this project you have the right to stop at any given time. If your loved ones become uncomfortable or more agitated with the robotic pet it will be removed from their presence immediately. If you would like more information about the project, our CO-PI can meet with you in Library room B to answer any questions or concerns you may have. If interested, you may sign written permission to participate."

APPENDIX H: Consent Form

PARTICIPANT CONSENT FORM

To Participants:

I am a graduate student under the direction of Dr. Jacqueline Medland at the Edson College of Nursing and Health Innovation at Arizona State University. I am inviting you and your family member/care recipient to participate in this quality improvement project. My goal is to determine whether robotic pets affect the anxiety and agitation levels of people with dementia.

The [redacted] volunteers will serve as supplemental resources for this robotic pet project. In your role as primary caregivers, we will pair you with your loved ones during this project. You will help by introducing robotic pets to your loved ones and encouraging their interaction. During the interaction, I will complete a 60-minute observation. Then, I will conduct two pre- and post surveys. The first two surveys will be completed in the first 2–5 minutes of presenting caregivers with the robotic pets. The post surveys will be completed 2–5 minutes after each 60-minute observation. Caregivers will be required to fill out a post study survey after the 4-week sessions. This survey will assess caregiver views on how robotic pets affected their loved ones and should take 2–5 minutes to complete.

The project will take place in the comfort of your homes once per week for 4 weeks with a duration of approximately 90 minutes per session. There is little to no risk to the participants because the interactions will be conducted within their regular routine.

Every effort will be made to ensure privacy and confidentiality throughout the project. All notes collected will be kept on a safe computer and password protected. Hard copies of data received will be kept in a locked filing box. The data may be used in reports, presentations, or publications and reported in aggregate. Individual data will not be disclosed.

You will pay nothing to participate in this study. The same robotic pet will be provided to participants each time to prevent contact/sharing. As a token of appreciation and keeping in mind the current pandemic, participants will be able to keep their robotic pets at the end of the study period. Participation is completely voluntary. Participants can refuse to participate at any time during this project without consequence.

If you have any questions concerning the project, please feel free to contact Rushana Gill-Ramos or Dr. Jacqueline Medland at any time at their phone numbers or email addresses given below. If at any time you have questions about your rights as a subject/participant, or if you feel you are at

risk, contact the Chair of the Human Subjects Institutional Review Board, through the ASU Office of Research Integrity and Assurance, at (480) 965-6788 or research.integrity@asu.edu.

By signing below, you are agreeing to be a participant as well as to extend your right as guardian over your loved one with dementia to participate in the robotic pet project.

Client Name: _____

Signature: _____

Date: _____

Caregiver Name: _____

Signature: _____

Date: _____

Please see attached UCSD Brief Assessment of Capacity to Consent

Thank you for your consideration and participation,

Rushana Gill-Ramos, RN-BSN-MHA
ASU – DNP Innovation Leadership Student
Co-Primary Investigator
602-315-0645
rgillram@asu.edu

Dr. Jacqueline Medland
Faculty Mentor
ASU-Edson College of Nursing and Health Innovation
Primary Investigator
jmedland@asu.edu

NOTE: A COPY OF THE SIGNED AND DATED CONSENT FORM WILL BE KEPT BY THE CO- INVESTIGATOR AND PROVIDED TO THE PARTICIPANT AND CAREGIVER.

APPENDIX I: University of California, San Diego, Brief Assessment of Capacity to Consent (UBACC)

PATIENT ID NUMBER:										
COLLECTION DATE:			/			/	2	0		

UCSD Brief Assessment of Capacity to Consent (UBACC)
Adapted for Use with the Robotic Pets and Dementia Project

Instructions: After reviewing study details and the informed consent document, explain that you are going to ask a few brief questions about the study. Participants should be allowed to refer to the Informed Consent Form when answering these questions, but should be encouraged to respond in their own words. If a participant has trouble understanding one of the questions on the UBACC, rephrase the question. Rate the participant's responses on a scale of 0 – 2, with "0" being the lowest (little to no understanding of this aspect of the study) and "2" being the highest (clear understanding of this aspect of the study). A score of 15 or higher is needed for inclusion in the study. If a patient scores lower than 15, the primary caregiver will consent and review the study details on behalf of their loved ones.
Note: This form is not data entered. The final total score will be attached to consent form for inclusion of entry into study.

	Score
1. What is the purpose of the study that was just described to you? Response: (2 = To determine if robotic pet interaction can help to decrease anxiety and agitation level of persons with dementia)	0 1 2
2. What makes you want to consider participating in this study? Response: (2 = Find an activity that works for me, help others)	0 1 2
3. Do you believe this is primarily a study or primarily a treatment? Response: (2 = a study)	0 1 2
4. Do you have to be in this study if you do not want to participate? Response: (2 = No)	0 1 2
5. If you withdraw from this study, will you still be able to receive regular treatment? Response: (2 = Yes)	0 1 2

PATIENT ID NUMBER | | | | | | | | | COLLECTION DATE | | | / | | / | 2 | 0 | | |
M M D D Y Y Y Y

	Score
6. If you participate in this study, what are some of the things you will be asked to do? Response: (2 = At least 2 study procedures for example: interact with robotic pet, answer questions, being observed)	0 1 2
7. Please describe some of the risks or discomforts that people may experience if they participate in this study. Response: (2 = At least 2 of the following: the interaction will make me uncomfortable, I will be uncomfortable interacting with study participant, I could be uncomfortable interacting with robotic pet)	0 1 2
8. Please describe some of the possible benefits of this study. Response: (2 = Might learn more about my health, might benefit from interacting with robotic pet, society might learn more about behavioral and psychological symptoms associated with dementia)	0 1 2
9. Is it certain that this study will benefit you? Response: (2 = No)	0 1 2
10. Who will pay for medical care if you are injured as a direct result of participating in this study? Response: (2 = These costs would be billed to me or my insurance company)	0 1 2

Total Score: ..... _____

I have examined _____ on _____ for the purpose of determining whether he or she is capable of understanding the purpose, nature, risks, benefits, and alternatives (including non-participation) of the study, making a decision about participation, and understanding that the decision about participation in the study will involve no penalty or loss of benefits to which the patient is otherwise entitled, for the quality improvement project, "Introducing Robotic Pets to Persons with Dementia". On the basis of the examination I conclude that:

_____ A. This patient has this capacity at this time.

_____ B. There is a question about this patient's capacity at this time.

_____ C. This patient clearly lacks this capacity.

Printed Name_____

Signature_____ Date_____

(CO- Primary Investigator)

APPENDIX J: Project Outline

Introducing Robotic Pets to Persons with Dementia Study

Four-Weeks Outlined

The CO-PI will educate the PWD's and primary caregivers about the project

1. Each group will be assigned 4 home visits over the course of 4 weeks
2. Home visits will be approximately 90-minute in duration; to accommodate interaction with the robotic pet (~60 minutes), the pre- and post-interaction questionnaires (~5 minutes per questionnaire), and a review of the care guide (~5 minutes).
3. The CO-PI will review the instruction/care guide for robotic pets with caregiver
4. PWD will be paired with their primary caregiver in the comfort of their home and caregiver will introduce the robotic pet
5. Rating of Anxiety in Dementia scale and ABS will be completed by the CO-PI before caregivers introduce the robotic pet to the PWD
6. Ongoing observation of the robotic pet interaction with PWD will be done by CO-PI
7. RAID scale and Agitated Behavior Scale will be completed by CO-PI immediately following the interaction with robotic pet and PWD
8. Caregiver will complete the Caregiver Evaluation Survey at the end of the 4 weeks project period
9. Caregivers will be able to review the assessment tools used and answers included to ensure accuracy

APPENDIX K: Agitated Behavior Scale (ABS)

Alberta Health Services

Affix individual ID within this box

Agitated Behaviour Mapping Tool

Instructions: Complete the Agitated Behavior Scale (ABS) pre and post robotic pet interaction for each 1-hour session

Complete each of the following items. Do not leave blanks. Score each item using the following:
1 = Absent (behaviour not present)
2 = Present to a Slight Degree (behaviour does not interfere/ disrupt)
3 = Present to a Moderate Degree (behaviour interferes/disrupts but can be redirected)
4 = Present to an Extreme Degree (behaviour interferes/disrupts and cannot be redirected)

☐ **Pre-Interaction (Before 1-Hour Session)**
☐ **Post-Interaction (After 1-Hour Session)**

Date *(yyyy-Mon-dd)* _____

	Time *(hh:mm)*								Highest Score
Short attention span, easy distractibility, inability to concentrate.									
Impulsive, impatient, low tolerance for pain or frustration.									
Uncooperative, resistant to care, demanding.									
Rocking, rubbing, moaning or other self-stimulating behavior.									
Pulling at tubes, restraints, etc.									
Wandering from treatment areas.									
Restlessness, pacing, excessive movement.									
Repetitive behaviors, motor and/or verbal.									
Violent and/or threatening violence toward people or property.									
Explosive and/or unpredictable behavior.									
Self-abusiveness, physical and/or verbal.									
Rapid, loud or excessive talking.									
Sudden changes of mood.									
Easily initiated or excessive crying and/or laughter.									
Total Score for Shift									

21 or less NORMAL	22 to 28 MILD	29 to 35 MODERATE	35 or more SEVERE

19626(2014-07)

APPENDIX L: Rating in Anxiety Scale (RAID)

Rating Anxiety in Dementia – RAID

Individual ID#: _____ **Date:** _____

Scoring system:

U. unable to evaluate. 0. absent. 1. mild or intermittent. 2. moderate. 3. severe

Rating should be based on symptoms and signs occurring pre and post interaction to the robotic pet. No score should be given if symptoms result from physical disability or illness. Total score is the sum of items 1 to 18. A score of 11 or more suggests significant clinical anxiety.

			Score
Worry	1.	Worry about physical health.	
	2.	Worry about cognitive performance (failing memory, getting lost when goes out, not able to follow conversation).	
	3.	Worry over finances, family problems, physical health of relatives.	
	4.	Worry associated with false belief and/or perception.	
	5.	Worry over trifles (repeatedly calling for attention over trivial matters).	
Apprehension and vigilance	6.	Frightened and anxious (keyed up and on the edge).	
	7.	Sensitivity to noise (exaggerated startle response).	
	8.	Sleep disturbance (trouble falling or staying asleep).	
	9.	Irritability (more easily annoyed than usual, short tempered and angry outbursts).	
Motor tension	10.	Trembling.	
	11.	Motor tension (complain of headache, other body aches and pains).	
	12.	Restlessness (fidgeting, cannot sit still, pacing, wringing hands, picking clothes).	
	13.	Fatigability, tiredness.	
Autonomic hypersensitivity	14.	Palpitations (complains of heart racing or thumping).	
	15.	Dry mouth (not due to medication), sinking feeling in the stomach.	
	16.	Hyperventilating, shortness of breath (even when not exerting).	
	17.	Dizziness or light-headedness (complains as if going to faint).	
	18.	Sweating, flushes, or chills, tingling or numbness of fingers and toes.	
Phobias (fears which are excessive, that do not make sense and tend to avoid–like afraid of crowds, going out alone, being in a small room, or being frightened by some kind of animals, heights, etc.).			
Panic attacks (feelings of anxiety or dread that are so strong that think they are going to die or have a heart attack and they simply have to do something to stop them, like immediately leaving the place, phoning relatives, etc.).			

Reference: K. K. Shankar , M. Walker , D. Frost & M. W. Orrell (1999) The development of a valid and reliable scale for rating anxiety in dementia (RAID), Aging & Mental Health, 3:1, 39-49. Reproduced with permission from M. W. Orrell.

APPENDIX M: Caregiver Evaluation of Robotic Pet Interaction

CAREGIVER EVALUATION OF ROBOTIC PET INTERACTION

Individual ID#: _____ **Date:** _____

Please circle the appropriate response

1. The robotic pet was easy to use.

Strongly Disagree 1 2 3 4 Strongly Agree 5

2. My loved one appeared less agitated because of the interaction with the robotic pet.

Strongly Disagree 1 2 3 4 Strongly Agree 5

3. My loved one appeared less anxious because of the interaction with the robotic pet.

Strongly Disagree 1 2 3 4 Strongly Agree 5

4. My loved one looked forward to coming to interact with the robotic pet.

Strongly Disagree 1 2 3 4 Strongly Agree 5

5. Features of the robotic pet are appealing.

Strongly Disagree 1 2 3 4 Strongly Agree 5

6. Having a robotic pet would help with the anxiety/agitation level of my loved one.

Strongly Disagree 1 2 3 4 Strongly Agree 5

7. Having a robotic pet will benefit my loved one.

Strongly Disagree 1 2 3 4 Strongly Agree 5

8. Additional Comments:

APPENDIX N: DNP Project Budget

Phase	Activities	Cost	Subtotal	Total
Preparation	Design and print educational materials for staff and potential audiences	$400	**$400**	
	Provide video of use and function of robotic pets (provided by manufacturer Joy for All)	$0	**$0**	
	Design, develop, and print evaluation tools (surveys), ability to consent forms, and contracts for participants of project. Purchase ink and paper	$240	**$240**	
	Send out letters reaching out to memory care homes for participation in project (includes multiple attempts to reach memory care homes and resending and follow-up of letters)	$120	**$120**	
	Travel expenses (gas/food) to help network with the city/memory care homes to ensure everyone is on board with project	$680	**$680**	
Delivery	Provide robotic pets to five individuals from the memory care community 10@ $130 (paid for by CO-PI related to the pandemic and fear of transmission of COVID-19)	$650	**$650**	
Evaluation	Reach out to memory care staff/family members and PwD for postsurvey (gas/food/phone calls/time)	$120	**$120**	
	Review and analyze results (30days@$99/day)	$99	**$99**	**$2,309**