



Topic Exploration Report

Topic explorations are designed to provide a high-level briefing on new topics submitted for consideration by Health Technology Wales. The main objectives of this report are to:

- Determine the quantity of evidence available for a technology of interest.
- Identify any gaps in the evidence.
- Inform decisions on topics that warrant fuller assessment by Health Technology Wales (HTW).

Topic exploration report number:	TER337
Topic:	Interactive therapeutic devices in advanced dementia care
Summary of findings:	<p>We identified three systematic reviews assessing the role of interactive therapeutic devices to help people with dementia. The majority of included studies were conducted in residential and nursing care facilities outside of the UK, and they used robotic animals or humanoids with varying levels of interactivity. The most common device used in these systematic reviews was the robotic seal, PARO. The topic proposer highlighted HUG as an example of these devices. HUG was not included in studies included in the systematic reviews, but one published study of 20 participants reported on its effectiveness. HUG was also recommended by Care Inspectorate Wales as an option to improve the well-being of people with dementia in care homes. No economic evidence was identified.</p> <p>There is a high level of uncertainty on the effectiveness, and varied findings of interactive therapeutic devices: with some studies suggesting benefit and others suggesting limited effects. This may be due to the differences in the types of interactive therapeutic devices, differences in the comparators used and outcomes measured.</p>

Introduction and aims

People living with advanced dementia can become anxious and agitated. These behaviours can be difficult to respond to and may go unmanaged unless they become severe. Medication can be used to manage anxiety and agitation. However, medication can have negative side effects, including drowsiness that is associated with falls. Interactive therapeutic devices may provide benefit for people living with advanced dementia and be more aligned with person-centred care. The topic proposer highlighted HUG, which has been developed at Cardiff Metropolitan University. HUG is a soft, comforting object, which contains a simulated beating heart and programmable electronics that can play a personalised playlist of favourite songs and sounds. Its weighted arms produce the sensation of a human embrace and the soft form of the body shape is designed to trigger the emotional memories of nursing a small child.

Health Technology Wales researchers searched for evidence on interactive therapeutic devices, including HUG, for use in people with dementia.

Evidence overview

Guidance and health technology assessment

In 2020, Care Inspectorate Wales published a national review of care homes for people living with dementia, based on findings from inspection visits (Care Inspectorate Wales, 2020). They report that care providers highlighted the use of electronic pets, toys, and dolls and suggest that their use can have positive impacts on well-being by improving mood and focus.

Secondary evidence

We identified three systematic reviews assessing the role of interactive therapeutic devices, including robotic animals or humanoids, for the management of dementia symptoms.

A systematic review by Lihui et al (2019) included 11 randomised controlled trials (RCTs). These trials included 1,042 participants, of which, 80% were diagnosed with dementia or cognitive impairment. PARO, a robotic seal, which senses touch, changes position, and mimics baby seal vocalisations and physical movement, was the most commonly used robot. Studies also used a robotic dog (AIBO), two humanoid communication robots (one of which was called NAO) or two health care robots (IrobiQ and Cafero). Seven of the 11 RCTs involved a control group who received usual care or standard treatment without robots or pets, one study used reading activities as a control condition, one study used a similar toy as an active control, and two studies used live dog visits.

Nine of the RCTs in Lihui et al (2019) were included in the meta-analysis; there were no significant differences in treatment using social robots for agitation, neuropsychiatric symptoms, anxiety, depressive symptoms, apathy, cognitive level, or quality of life. Several outcomes were not suitable for inclusion in the meta-analysis and were presented as a narrative review. The authors report that for these outcomes, interacting with social robots improves engagement and communication, as well as reduces loneliness, stress responses, and medication use in older adults with dementia.

Another meta-analysis by Abbott et al (2019) included 10 qualitative studies, two mixed methods studies and seven RCTs, covering more than 800 participants with dementia in residential care. The majority reported on the impact of PARO, two on robotic cats (JustoCat and NeCoRo), one on the robotic dog AIBO, and one on a robotic teddy bear (CuDDler). Interactions with robopets were described as having a positive impact on aspects of well-being including loneliness, depression and quality of life by residents and staff in qualitative findings, although meta-analyses suggest there was no statistically significant difference for these outcomes using data from the

quantitative studies. Meta-analysis did show evidence of a significant reduction in agitation with PARO compared to control (standardised mean difference: -0.32, 95% confidence interval: -0.61 to -0.04, $p = 0.03$).

Riches et al (2021) conducted a systematic review and qualitative synthesis and included 12 studies of 1,126 adults with dementia. PARO, was the most used robot overall, featuring in seven studies. Humanoid robots, including some which could be personalised by programming games and music, and had facial expression recognition features, were used in four studies (NAO, Matilda, Betty, Sophie and Jack), and a robotic cat (NeCoRo) was used in one study. Eight of the 12 studies found positive indicators of engagement. Several studies indicated that engagement with a robot is comparable to engagement with a human, a real animal or a toy. In the studies which used PARO, behavioural, social, verbal, and visual engagement with the robot increased. Pleasure during playing games and music with robots, interaction with robots, and interaction with staff or residents significantly improved in diversion therapy delivered by the two humanoids Sophie and Jack.

Primary evidence

The HUG device was not included in any studies included in systematic reviews above. However, we identified one uncontrolled before-and-after study evaluating the effectiveness of the HUG device published since these reviews (Treadaway, Pool and Johnson. 2020). The study recruited 20 care home residents and 20 hospital patients with dementia: data for care home residents are reported here. Measures of cognitive and functional activity were assessed using a modified version of the Pool Activity Level (PAL) instrument. Scores from PAL allowed staff to assign one of four ability or activity levels to residents at the care home, and also provided an overall score from the total of the values in each of the nine PAL domains.

The evaluation found that six residents improved by one activity level after three months, and a further three residents improved by overall score but did not change level at this time point. At six months, five residents improved by one activity level and one additional resident improved by overall score. Seven residents decreased in score and two did not change over this period. Findings from the adapted Bradford Wellbeing Profile also indicate that wellbeing improved for 87% of residents who had a HUG for six months. The study notes that improvements in residents' posture were observed by care staff when cuddling a HUG, although it is unclear how this was measured within the study. The absence of a control group means it is difficult to assess whether this group would have had less favourable outcomes over this period in the absence of a HUG device.

Areas of uncertainty

Whilst some of the studies included in the systematic reviews were RCTs, they usually consisted of small sample sizes and the authors of the systematic reviews report that they are often of low methodological certainty. There was also variability in comparators and outcomes measures in studies, which may be the reason for mixed findings. A range of devices of varying complexity are included within the studies, and it is unclear whether any of these devices confer particular benefits or whether the findings can be generalisable across devices. Finally, we did not identify any economic evidence and it is unclear whether these devices would be cost-effective approaches.

Literature search results

Health technology assessments and guidance
Care Inspectorate Wales (2020). National review of care homes for people living with dementia: https://careinspectorate.wales/national-review-care-homes-people-living-dementia
Evidence reviews and economic evaluations
Abbott R, Orr N, McGill R, Whear R, Bethel A, Garside R, Stein K, Thompson-Coon J (2019). How do “robotpets” impact the health and well-being of residents in care homes? A systematic review of qualitative and quantitative evidence. <i>International Journal of older people nursing</i> ; 14(3): e12239: https://doi.org/10.1111/ohn.12239
Lihui Pu, MSN, Wendy Moyle, PhD, Cindy Jones, PhD, Michael Todorovic, PhD, The Effectiveness of Social Robots for Older Adults: A Systematic Review and Meta-Analysis of Randomized Controlled Studies, <i>The Gerontologist</i> , Volume 59, Issue 1, February 2019, Pages e37–e51: https://doi.org/10.1093/geront/gny046
Riches S, Azevedo L, Vora A, Kaleva I, Taylor L, Guan P, Jeyarajaguru P, McIntosh H, Petrou C, Pisani S, Hammond N. Therapeutic engagement in robot-assisted psychological interventions: A systematic review. <i>Clin Psychol Psychother</i> . Epub, 2021. https://doi.org/10.1002/cpp.2696
Individual studies
We did not identify any additional relevant evidence
Ongoing research
We did not identify any ongoing relevant research
Provided by topic proposer
Sometimes a hug is all you need,' Treadaway C., Pool, J., and Johnson, A. (2020) <i>Journal of Dementia Care</i> , Nov/Dec 2020 Vol 28:6 pp 32-34

Date of search:	March 2022
Concepts used:	interactive robot, interactive toy, sensory device, therapeutic robot, therapeutic toy, therapeutic doll, interactive doll, sensory doll, HUG, compassionate design, emotional companion, robotic pet, dementia