

Dolphins, dogs, and robot seals for the treatment of neurological disease

A growing body of evidence suggests that animal-assisted therapies and activities involving all kinds of real and even robotic animals can have beneficial effects in people with neurological disease or mental illness. But what is the quality of that evidence and do these interventions really provide any health benefits? Adrian Burton investigates.

In 2011, 18 elderly people with dementia living in a care home outside Brisbane, QLD, Australia, spent 45 mins, three-times a week for 5 weeks, interacting with a robotic baby harp seal called PARO (compANion RObot). PARO moves his tail and flippers when stroked, responds to the human voice, shows a range of emotions, and complains when ignored. The product of Japanese ingenuity, PARO has advantages over real animals in animal-assisted therapy (AAT): it needs no food, there are no infections to worry about, and although some people's negative experiences might lead them to dislike touching real animals, what harm could a robotic *Pagophilus groenlandicus* ever have done them? More importantly, PARO had a positive effect on these residents' quality-of-life and pleasure scores.

The PARO study is not the first to report that interacting with animals (robotic or otherwise) has beneficial effects on patients. However, this pilot study, led by Wendy Moyle of Griffith University (Nathan, QLD, Australia) and funded by the Dementia Collaborative Research Centre: Carers and Consumers, is different. It has paved the way for a trial far larger than any undertaken to date in this area, one that might provide high-quality evidence regarding the value of such therapies. This evidence is exactly what this field has been missing

"[The new study] will take the form of a cluster, randomised controlled trial in which residential aged care facilities will be randomised to one of three conditions: PARO, plush toy, or usual care", says Moyle. "[We] are

interested in understanding if it is the interactive robotic features of PARO that reduce emotional, behavioural and psychological symptoms of dementia, and we will conduct a cost analysis of PARO and/or plush toy as non-pharmacological methods to reduce agitation and improve mood states in people with dementia."

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The literature now contains many reports suggesting that animal-assisted activities (AAA; in which animals are used to provide motivational experiences that might have a positive health or quality-of-life outcome) and AAT (interactions with animals designed with a definite therapeutic outcome in mind) are beneficial to people with neurological or mental disorders. For example, stroking or caring for dogs is reported to increase positive emotions and reduce anxiety and sadness in people with Alzheimer's disease. Stories abound of how bringing a dog into a dementia care home made residents light up and suddenly become communicative, and many volunteer organisations now provide this kind of pet therapy. The presence of a dog in psychosocial treatment sessions has also been associated with reduced anhedonia in patients with schizophrenia. Other animals appear to have their uses too. Watching fish in aquaria is

reported to increase nutrient intake in people with Alzheimer's disease, and therapeutic horse-riding is said to improve gait and balance in patients with multiple sclerosis. Specialised stables are now providing therapy to people with multiple sclerosis in many countries. Claims exist that riding can also help people with mood disorders, addictive and negative behaviours, and communication difficulties. More exotically, some claim that swimming and interacting with dolphins increases attention span, motivation, motor function, and language skills in severely disabled children, and provides similar benefits for those with autism, epilepsy, Angelman's syndrome, dyslexia, or Tourette's syndrome. Companies offering dolphin-assisted therapy now exist across the globe.

But how good is the science behind these claims? "The work done in this area has generally been of low scientific quality, making it very difficult to reliably interpret many results", explains Lori Marino, a neuroscientist at Emory University (Atlanta, GA, US). "Many reports in the literature are observational or, when prospective, involve very small numbers of patients or lack critical control conditions. As a result, most suffer from problems with construct validity—ie, the inability to identify which components of the study (being in a pool, human interactions, new settings, etc) are causally related to any observed short-term changes."

Anna Chur-Hansen (University of Adelaide, SA, Australia) agrees. "There are all kinds of gaps in the evidence. The research methods on which many absolute claims are made are often so

For the study with PARO see *J Geront Nurs* 2013; **39**: 46–53.

For more information on animal-assisted activities see <http://www.petpartners.org/>

For a review of studies investigating the use of dogs in emotions of people with dementia *Int Psychogeriatr* 2011; **23**: 1–7

For the study on animal-assisted activities and anhedonia in people with schizophrenia see *Psychother Psychosom* 2005; **74**: 31–35

For the study of the effect of aquaria on nutrient intake in people with Alzheimer's disease see *West J Nurs Res* 2002; **24**: 697–712

For the study of therapeutic horse riding in multiple sclerosis see *G Ital Med Lav Ergon* 2011; **33**: 462–67

For more on horse riding in mental health see *Mental Health Learn Disabil Res Pract* 2011; **8**: 51–61

For a review on dolphin-assisted therapy in children see *Autism Res Treat* 2012; **2012**: 839792

For commentary on dolphin-assisted therapy by Marino and colleagues see *Anthrozoös* 1998; **11**: 194–200

For a review on dolphin-assisted therapy see *Anthrozoös* 2007; **20**: 239–249

For an article on dolphin-assisted therapy see *Anthrozoös* 2012; **25** (suppl): S139–51.



PARO the robotic harp seal with Wendy Moyle (left) and inventor Takanori Shibita (right). Courtesy of Wendy Moyle.

weak that they have no validity. There may also be other factors at work than the presence of the animal, but which the animal facilitates. For example, an animal may serve the functions of family member and as a companion, but may also increase socialising and exchange with other humans. Many studies do not consider these third factors."

Dolphin-assisted therapy has come in for some particularly rough criticism. In their insistence upon the need for evidence-based claims, Marino and her co-workers have produced several papers denouncing the assertions made by its proponents. "Most studies are plagued by major threats to construct validity such as placebo effects, novelty effects, demand characteristics, experimenter expectancy effects, [and] informant bias", she says. "If it cannot be determined that the dolphin is an important therapeutic ingredient then there is no basis for most of the claims made by the lucrative industry that has grown up around dolphin-assisted therapy."

But what if there is something of value in AAA and AAT? In a world threatened with a dementia pandemic, we might do well to know for sure.

"High quality evidence for the role of animals in human health is important," says Chur-Hansen. "If we can demonstrate that animals promote health, public health

initiatives could be instigated on a population level." But what type of research is needed to provide that evidence?

"Where the efficacy of therapies must be known, clinical trials might seem the obvious goal, but do they really tell us what we need to know?" asks Trudie Lang, a trials expert at Oxford University, UK. "In a tightly designed trial one could measure the efficacy of an intervention, but the result is really only meaningful for the precise conditions under which the measurements are made. Ideally effectiveness should be measured since this is more meaningful for the general population. But such studies are far less accurate and so do not give robust answers unless the numbers are very large indeed. For example you might want to assess if you can reduce depression via interactions with a dog. An efficacy randomised clinical trial (RCT) would recruit patients that were all the same age, lived in the same type of setting, had the same sort of depression on enrolment, and all would be given, say, a 5 year-old black labrador trained in exactly the same way. This would be a nicely controlled study and the data would be clean. However, it would be difficult to apply any findings to more elderly depressives, or those given a terrier! Setting up a study with more variables would give more meaningful data—ie, it would measure real effectiveness—but would need to be vast and therefore very expensive."

And, unfortunately, money is a problem. Even if such a trial could be set up, funding might be difficult when no pharmaceutical company stands to make a profit. "Nonetheless, if the design were carefully considered then it might be worth applying RCT methodology," says Lang. "It's a good way of attempting to deal with confounding factors and of measuring impact."

However, Chur-Hansen argues that RCTs do not always need to be the answer. "It has been argued that the obsession with RCTs as the

gold standard of evidence is not always justified for some research questions. Human behaviour is not always best studied with an RCT, and in the case of AAT, you cannot have true blinding, nor is it always possible to have true randomisation. It may be that we need to be spending more time designing high quality, rigorous qualitative research as well as other quantitative methods, and synthesising the results of multiple studies in order to establish best evidence-based practice."

One might also ask whether, if the downside of a therapy or activity is small or negligible, we really need high-quality evidence of effectiveness. "One might view this as an issue of risk assessment", says Marino. "Before an intervention is recommended for specific patients, one must always determine the ratio of expected benefits to risks."

Puppy therapy, for example, might be associated with a short-term general effect on patients with some disorders, and its risks would probably be minimal or non-existent. Therefore, demands for high-quality evidence might be relaxed. However, in dolphin-assisted therapy, which can be very expensive, could cause injury, and which requires dolphins be kept captive, better evidence might be demanded.

In addition to PARO's therapeutic benefits, Moyle's coming trial will investigate cost-effectiveness. At US\$5000 each, robot seals are not inexpensive, but caring for people with dementia will need an economic effort from society. Knowing whether we can afford or are willing to pay the price of any quality-of-life years gained or therapeutic benefits provided by AAA or AAT is going to be important. "Albeit weak, the evidence amassed so far suggests that AAA and AAT might help us face this [dementia epidemic] and other neurological challenges", Moyle says. "Surely it's worth trying to find out for real?"

Adrian Burton