

Companion Animals and Human Health: The Human-Animal Interaction

Laurie Dohmen, VMD, MS

Author Contact:

Purple Moon Herbs and Studies
drlaurie@purplemoonherbstudies.com
www.purplemoonherbstudies.com

Abbreviations

AAA	Animal-assisted activities
AAI	Animal-assisted interventions
AAT	Animal-assisted therapy
HAI	Human-animal interaction
PTSD	Post-traumatic stress disorder
QOL	Quality of life
SARS-CoV-2	Severe acute respiratory syndrome coronavirus 2

Abstract

Animals and humans have interacted throughout time. Animals impact both health and wellness every day in almost every human’s life by providing companionship, recreation, and activity. In this article, the origins of the human-animal interaction (HAI), specifically as it pertains to the pet-human bond, will be explored. The mechanisms of action of the HAI for health are elucidated. Research into the benefits, including physical, mental, and social health, is discussed. Health benefits have been shown for children, the elderly, and those with mental disorders and physical disabilities. Animal-assisted activities (AAA), animal-assisted therapy (AAT), and animal-assisted interventions (AAI) are discussed.

Introduction

Animals and humans have interacted throughout time. Our relationship with them has evolved as we have evolved. We have always eaten animals and utilized their bodies. We have domesticated them to aid us in our daily lives; we have furthered that relationship by having animals become our companions and family members, and we have expanded the tasks animals perform for us. They impact our health and wellness every day, whether we realize it or not. Animals influence our basic health by providing food and covering (clothes and shelter) as well as protecting our food sources (working dogs). They provide transportation of people and supplies, which allows access to basic needs such as water and also facilitates social interactions

with people, which aid our wellness. Carrier pigeons and other animals have been used for communication, even during war times. Service animals assist people with physical and mental disorders, such as blindness, epilepsy, and post-traumatic stress disorder (PTSD). Search and rescue dogs are lifesavers in disasters. Pets aid us by providing companionship, recreation, and activity (such as dog walking or horseback riding). All in all, animals contribute to our health and wellness in almost every facet of our lives. This review focuses primarily on the human-animal interaction (HAI), the bond between humans and their pets, and the myriad of ways in which domesticated animals support humans through their interactions.

Since the beginning of humanity, people have used animals for food, their bones for tools, and their hides for clothes and shelter (1). The first proof of wolves/dogs becoming domesticated is in a 12,000-year-old Paleolithic tomb in northern Israel that contained a human holding a puppy (1, 2). Cats became associated with humans around the time that humans started becoming more settled, 6,000 to 8,000 years ago (1, 2). In 2015, a cat was found deliberately buried with a human in an archeological excavation from the 6th to 7th century in Turkey (3). Both the way the cat was buried and the condition of the remains indicate that she was a beloved pet of the deceased human. In the beginning of domestication, dogs, cats, horses, and ruminants (such as sheep, goats, and

cattle) were used for practical purposes: dogs for herding and protecting the ruminants and fields, cats for hunting mice and other rodents, horses for their ability to carry or pull heavy loads, and ruminants for food (1). Cats, however, were special in that they were revered in ancient Egypt and lived with the pharaohs.

The term *pet* first came into use around the year 1000 (4). It became popular for aristocracy to keep pets. This was true primarily for China with dogs and Egypt with cats, although Greek and Roman rulers also had pets (1). This trend spread into Europe, with women getting lap dogs and men acquiring dogs and falcons to assist with hunting (1). Pet ownership gradually spread to the lower socioeconomic classes. In fact, pet ownership is still regarded as an economic indicator and is considered a luxury in many cultures (5). However, companion animals have been recognized as therapeutic since the 19th century (6). As such, pet ownership has been predominantly a Caucasian and Western phenomenon, as well as primarily in stable couples with children (7). Other cultures have stray domesticated animals coexisting, but few animals live as true “pets.” As globalization occurs, true pet ownership is expanding. In both the United States and Australia, more than 60% of households have some species of pet. In the United States, dogs are the most popular pet, followed by cats and then fish (7). More homes in the United States have pets than children (8). India had a 58% increase in pet ownership between 2007 and 2012 (7). In the United States, the Latino community is increasing its pet ownership, with the same health benefits that are seen in Western Caucasian communities in the United States, England, and Australia (9). In the United States, society recognizes the benefits of HAI, as evidenced by the fact that many presidents have owned companion animals (6).

Animals are also used to improve the health of humans. Three linked concepts are animal-assisted activities (AAA), animal-assisted therapy (AAT), and animal-assisted interventions (AAI). AAA is a broad term used to describe any deliberate activity that involves companion animals and people in the context of wellness, health improvement, motivation, and/or recreation (6, 9). AAT is the use of trained companion animals not owned by the individuals in treatment as a therapeutic tool with a specific goal that benefits the patient (6, 9). AAI is specific to people with impairments or challenges and also is the use of companion animals to improve the quality of life (QOL) and health of these people. These animals may be owned by the person in need or by the person providing treatment (6). AAI incorporates facets of AAT, AAA, and animal-assisted education (9).

HAI Mechanisms of Health Promotion

There are a plethora of proposed mechanisms through which HAI improves health. The Biophilia hypothesis was coined by Edward Wilson in 1984. He defined it as “the urge to affiliate with other forms of life” or humans’ “innate tendency to focus on life and lifelike processes” (10). It presumes that humans subconsciously seek affiliations with other forms of life, and because humans evolved in nature, they are predisposed to respond positively to nature (including animals) (11, 12). Attachment theory states that many humans form bonds with their companion animals that are as strong as interpersonal bonds between humans. Non-human animal support may be more effective than human because animals are unconditional and nonjudgmental and provide physical contact (11). According to distraction theory, animals attract human attention and, as a result, provide a distraction to divert attention from stressors (11). This is one of the many ways in which pets can be beneficial during the current severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) pandemic. Social contact theory claims that pets increase social interaction with other humans, which provides a sense of wellbeing (13). Social support theory states that close relationships provide emotional support, which reduces the perception of stress, provides confidence to cope with stressors, protects against anxiety-related illnesses, and enhances recovery from life-threatening diseases.

There is a preponderance of research validating the fact that social support has a significant effect on wellness, and lack of social support is as serious a health risk as cigarette smoking, obesity, and other life-limiting diseases (13, 14). There are 2 models involved in the social support theory. The Buffering Model proposes that social support buffers the adverse effects of stress, so support is only relevant during periods of stress (14, 15). The Main Effect Model maintains that social support is independent of stress and contributes to consistent well-being (14).

Physiologic mechanisms demonstrating how the HAI promotes human health have been described. HAI has been proven repeatedly to lower blood pressure, heart rate, cortisol, epinephrine, and norepinephrine (2, 16, 17). In households with dogs, the cortisol awakening response dropped from 58% to 10% in children with autism (14). Animals attenuate the human physiological stress response via attenuation of the hypothalamic-pituitary-adrenal (HPA) axis (16). HAI causes the release of oxytocin, which in turn has anti-stress and anxiolytic effects, stimulates social interaction, counteracts aggression,

improves learning, increases interpersonal bonding, is anti-inflammatory, and enhances digestion. The more bonded the human is with the animal, the more oxytocin is released (14, 16-19). Gaze and touch are the mechanisms causing the release of oxytocin in both humans and their pets (20).

The Biopsychosocial Model is an interdisciplinary model of health care that links biology, psychology, and socioenvironmental factors. It purports that health is a continuum of interacting social, biological, and psychological influences, and changes or fluctuations in 1 factor affect all 3 (6, 11). This theory incorporates most of the previously proposed theories.

Humans do not necessarily quantify pet ownership and HAI in terms of their health, but instead acknowledge the role their pets have in their lives and the improved QOL that accompanies HAI. This QOL improvement includes companionship, emotional support, and physical health (11, 13, 21). Studies in both Australia and Germany have shown that the healthiest people in these countries were individuals who had continuously owned pets (14). A 2021 study by Janssens et al. found unequivocal evidence that HAI alleviates negativity, increases positivity, and allows maintenance of positive feelings (12).

HAI Individual Effects

The HAI affects humans on physical, emotional, psychological, and social levels. There are a myriad of personal benefits of pet ownership: reduced risk of allergies, asthma, and eczema; lowered blood pressure; reduced risk of heart disease; enhancement of immune factors; decreased pain; lowered premature mortality; improved fitness and increased exercise; decreased minor health issues; increased physical contact and human interaction; fewer doctor visits and less medication; reduced cortisol levels throughout the day; prevention of illness and improved recovery; improved sleep and mood; increased emotional support during mental illness; greater sense of calm for Alzheimer's patients; support through stressful life events; love, security, comfort, and companionship; decreased loneliness and isolation; abatement of PTSD symptoms; reduced anxiety, fear, and stress; increased relaxation; decreased autonomic nervous system responses; and improved self-esteem (2, 4, 6, 16, 18, 21-27).

Clearly, the benefits from HAI are extensive and varied. According to Aragunde-Kohl et al., Puerto Ricans who live with pets are 6.5 times more peaceful than non-pet owners, 20 times more likely to feel love, and 38 times more likely to feel joy. Pets have been proven to enhance humans' positive traits and allow humans to unwind and

play (26). Other psychological benefits include feelings of intimacy and constancy, entertainment, nonjudgmental companionship, and lessening of social isolation (6, 23).

Many studies have shown that pet ownership increases longevity in the face of heart disease (6, 28). Friedman (1980) showed that there was a statistical increase in longevity following myocardial infarction or angina pectoris in patients who owned pets and that this was not just due to exercise (ie, dog walking) or companionship (29). Pet ownership is associated with lower lipid levels, cortisol levels, heart rate, blood pressure in general, and blood pressure spikes in response to stressors (4, 16, 17, 28, 30). Even gazing at an aquarium has been linked to lowered blood pressure and relaxation (16, 25). Some studies link oxytocin release to pet ownership, and it is surmised that this could be the link to lowered blood pressure, heart rate, and cortisol levels and improved heart health (16, 17, 20). Allen (2003) studied elevated blood pressure in people with and without pets. Individuals who had pets had 50% less increase in blood pressure levels (17, 31).

In homes and public places, aquariums impart health benefits. Studies show that aquariums reduce blood pressure and heart rate; increase relaxation; reduce stress and anxiety; increase pain tolerance; improve nutrition and body weight in dementia patients (they eat more); and increase companionship and bonding (7, 11, 16). Maranda et al. (2015) found that adolescents with diabetes who were given aquariums and responsibility for fish care had a significant improvement in A1C levels (32). Gee et al. (2019) found that a 5-minute exposure to an aquarium "enhances self-reported relaxation and mood and decreases anxiety" prior to a math task (7).

HAI Family and Community Effects

Studies of European, Australian, and North American populations have also started to look at the social implications of pet ownership in terms of not just individual wellness but also system-wide wellness in families and society. Married couples with children are the largest group of pet owners in society (2). In families, pets help broaden social networks of the family members and add security, cohesion, and adaptability to the family structure. This allows children to test their social and personal boundaries and enhances their learning ability. It also stabilizes the marriages of empty nesters (2, 25). According to Soares (1985), "There are two complementary dimensions of pet ownership which exist for the family itself: (1) that an animal can be the means by which a family can widen its social network, and (2) that an animal can make even a secure family setting

a safer place to test out love and hate, preferences and rivalries, independence and cooperation, and destructive and creative feelings” (2).

HAI also has community benefits, including increased human interaction and socialization; enhanced social capital and civic engagement; decreased burden on medical systems; decreased financial burden on society (due to reduced use of social services); increased time in nature; and fewer missed work and school days. In addition, HAI leads to socialization with other pet owners, neighbors, and the community, all of which makes it easier for individuals to get to know others in the community (6, 18, 24). Prison inmates have improved social skills after AAT. In prisons, AAT is used to enhance life skills, coping mechanisms, and emotional and social needs of the prisoners (33).

Social capital was defined by Putnam (2001) as “connections among individuals, social networks and the norms of reciprocity and trustworthiness that arise from them” and is considered to be what holds societies together (21, 34). Pet owners have significantly more social capital than non-pet owners. People who walk dogs have increased social interactions with their neighbors and in public spaces (even with non-pet owners), and they naturally survey the neighborhood as they walk, which increases their sense of security and safety. Pet owners have increased oxytocin levels, which enhances the feeling of trust (20). Pets also break down social inhibitions, allowing discourse between strangers. Pet owners are statistically more civically engaged in their communities (18, 24). All of this leads to current discussions of social capital as a benefit and aid for community cohesiveness and violent crime prevention.

Oscar the cat became famous for predicting death in a nursing home in Providence, Rhode Island (35). He was so accurate that the staff at the nursing home where he lived started calling in family or sitting with the patients he identified until they died. This was reported to have a huge benefit in the wellness of the family as a whole; Oscar gave families and patients time to prepare, which was again reported to improve family unit wellness. Oscar also provided companionship so residents did not die alone: “People take great comfort in this idea, that this animal was there and might be there when their loved ones eventually pass” (35).

HAI: Elderly and Children

Among the elderly, pet ownership has been shown to decrease the number of doctor visits. Elderly pet owners take less pain medication and have less depression (9). Pets help elderly owners handle stressful life events, provide companionship during a time in life when human companions are fewer, and

provide love and security (6). Elderly pet owners have lower blood pressure and serum lipid levels, live independently longer, and get more exercise (2, 4, 6, 36-41). Dog owners also get more exercise and human interaction by walking their dogs (6, 9, 37). Cat ownership has been shown to increase interactions and trust with neighbors as well as lessen social isolation (39). In survey studies of elderly pet owners, these owners believe that their pets are good for their health. Elderly individuals with pets have more physical functioning; more social interactions with other people (including the social aspect of veterinary appointments); better sense of community; less loneliness; fewer bad moods or depressive episodes; and more happiness. Pets provide elderly owners with love, comfort, and security (2, 38, 39, 41, 42). Elders who walk dogs have a 50% decreased risk of stroke, improved cardiorespiratory function, reduced hip fractures, decreased depression, and reduced cognitive impairment. In nursing homes, HAI from visiting animals leads to decreased loneliness and increased spontaneous recollection; residents spontaneously tell visiting animals about their own previous pets and other events (38, 42).

There is a plethora of research on the specific health benefits of HAI for children. According to Soares (1985), there are “three major age-related developmental stages in the way children relate to animals: (1) 6-9 years: major increase in affective relationship to animals; (2) 10-13 years: major expansion in cognitive understanding and knowledge of animals; (3) 13-16 years: dramatic increase in ethical concern and ecological appreciation of animals” (2). Dogs in schools facilitate concentration, attention, motivation, and relaxation. The mere presence of a dog fosters a more relaxed and pleasant atmosphere, which is essential for peak executive functioning (16). Children who live with pets have significantly less absenteeism due to physical illnesses (13). In a study comparing urban and rural children, it was found that whereas rural children who lived with farm animals were more stressed and anxious about math tests, urban children without pets had increased systemic immune activation from the tests. Therefore, although the rural students may have had more transient stress, urban students without pets had more overall systemic effects from the tests (43). In terms of mental health and development of children, 7- and 8-year-olds rank pets higher than humans for comfort and self-esteem and as confidants. Children with dogs in the home have less anxiety and improved emotional development (44). In fact, when toddlers live with dogs, they are 6% more likely to have healthy emotional expression in the preteen and teen years (45). HAI for children also leads to fewer attention deficit disorder (ADD)/attention-deficit/hyperactivity disorder (ADHD) symptoms; reduced aggression when the animal is present; less shyness and separation anxiety (from parents);

increased strength of ego; and more playful moods, energy, and focus (2, 16, 43-45). Children who are the primary caregivers of the pet(s) develop innate nurturing skills (regardless of gender), feelings of mastery, and self-efficacy (8). In a recent study, Endo et al. showed that children with pet dogs at age 10 had increased wellness at age 12, with increased physical activity, decreased obesity, increased responsibility, increased social bonding, and decreased anxiety (19).

HAI for People With Mental Disorders

In addition to its use with prisoners, AAT is used especially for children and adults with mental disorders. AAT is used as a “social lubricant” to build rapport and connection with patients, and it is the fastest and easiest mechanism found so far to establish this relationship (8, 14, 46). Oxytocin release as a response to animals may also be a factor in the effectiveness of AAT (14, 16).

AAT increases social interactions with the animal and with humans in children with autism and adults with schizophrenia (6, 16). Cat owners with psychiatric disturbances had statistically improved psychological health (25). AAT with dogs reduced anxiety and arousal and enhanced attachment in children with mental or developmental disorders. Children with pervasive developmental disorders (PDDs), such as autism, Rett’s childhood disintegrative disorder, and Asperger’s, exhibit symptoms that include lack of social interactions and communication, social withdrawal, lack of social skills, and disengagement from social environments. When AAT with dogs was used in treatment for these children, the patients laughed more and exhibited a happier, more playful mood as well as increased energy. The children’s attention was primarily centered on the dog, and they talked to the dog and were even willing to discuss the dog with the therapist. These children were more agreeable to requests from the therapist (47). AAI with horses improved autistic children’s social behavior and decreased the arousal associated with socializing (6). In addition, both autistic children and children with cerebral palsy benefited from horseback riding, showing improved balance and coordination (6). In patients with serious mental illnesses, pets aided in recovery by providing empathy and therapy, providing connections that led to redeveloped social avenues, serving as family, and supporting patients’ self-efficacy and sense of empowerment (48).

In a comprehensive review of HAI and mental illness, Brooks et al. (2018) found that animals supported emotional work—alleviating worry, providing comfort, and mitigating against feelings of isolation and loneliness (**Table 1**); practical work—physical activity and symptom distraction (**Table 2**); and biographical work—identity, a sense of self-worth, and existential meaning (**Table 3**) (49).

Table 1: Emotional Work, HAI, and Mental Illness (49)

Emotional Work
Patients formed deep connections with their pets, who provided them with consistent comfort and affection that was also always and instantaneously available. Pets were calming and supportive and sensed when they were needed.
Pets were found to be intuitive about when and what was needed, especially in times of crisis and symptomatic episodes.
Pets allayed loneliness through physical contact and by being confidants for patients, which reduced patients’ sense of isolation.
Pets fostered self-acceptance by providing unconditional love and allowing trust in the relationship as well as a lack of complications.
This unconditional love provided by the pets promoted emotional stability by providing a connection, reassurance, and normalcy.

Table 2: Practical Work, HAI, and Mental Illness (49)

Practical Work
Patients with pets were more likely to utilize ambulatory mental health care options.
Pets provided a distraction and/or a disruption during symptomatic episodes or during stressful events.
The routine of caring for pets provided a focus of activity, a challenge, a grounding influence, and humor.
Pets increased mobility and exercise as well as connection to nature, all of which aid mental health.
Pets increased socialization and a sense of community. Patients gained confidence to try new social situations, were more comfortable around other people, were more open to social interactions, and were more willing to have difficult conversations with family and friends.

Table 3: Biographical Work, HAI, and Mental Illness (49)

Biographical Work
Patients who had pets felt better about themselves as people.
Pets gave meaning to patients’ lives, giving them a reason to live and hope for the future.
Patients believed that their pets directly contributed to a constant sense of identity.

The Americans With Disabilities Act (ADA) defines service animals as “dogs that are individually trained to do work or perform tasks for people with disabilities ... Service animals are working animals, not pets. The work or task a dog has been trained to provide must be directly related to the person’s disability” (50). The ADA also has a provision regarding the use of miniature horses as service animals (50). Service animals also include search and rescue and cadaver dogs. After the Twin Towers fell on September 11, 2001, dogs worked tirelessly alongside humans looking for people or bodies. They were honored with the human first responders at the 10th anniversary of the catastrophe. Service dog owners report that in addition to the specific job the service animal fulfills, the HAI improves the owner’s QOL by providing companionship, emotional support, and social support (51). Service dogs are now working in courtrooms and children’s advocacy centers in the United States, Canada, Australia, Chile, and the European Union to support victims (8).

HAI is a burgeoning treatment for PTSD. Veterans with PTSD are reporting that pet ownership is a wonderful adjunct treatment, reducing loneliness, isolation, depression, and worry. Veterans with pets experience less irritability and increased calmness. PTSD service dogs are trained to mitigate symptoms by interrupting flashbacks, providing physical contact during episodes of anxiety, and waking veterans from nightmares (52). After the tsunami in Japan in 2011, many survivors suffered from PTSD. In a study conducted in 2015, pet owners had significantly less PTSD than non-pet owners. Pet owners had fewer visits to doctors and took less cardiac and insomnia medications and also had better social support and psychological well-being (53).

HAI and the SARS-CoV-2 Pandemic

The current global SARS-CoV-2 pandemic is another example of the benefits of HAI, and many studies have already been published. Most of the studies are self-reporting questionnaires of pet owners. In Spain, one study explored the effects of the lockdown on the HAI. Results showed an increased emotional bond between pet and owner and increased interaction and support; in fact, 53% of dog owners reported their QOL was the same as or better than prior to the pandemic and lockdown (54). During times of social isolation from other humans, the Biophilia hypothesis becomes increasingly relevant, and animals can provide humans with comfort, companionship, and even self-worth (55). A United Kingdom study confirmed that the species of animal did not affect the mental health results (15). In times like this, pets can be both life-enhancing and life-saving. Pets can provide both social support and physical contact, decreasing the risk of future PTSD and feelings of isolation and loneliness.

The physical exercise involved in caring for pets (especially walking dogs) is also a benefit (12, 15, 56, 57). In addition, pets provide a sense of normalcy and consistency in the face of global fear and uncertainty; caring for a pet provides routine (12). Many pet owners reported that they are spending more time with their pets, talk to their pets more, have increased physical contact with their pets, and are sleeping with their pets more than they were prior to the pandemic (56). Physical contact with pets was reported to increase feelings of wellbeing, comfort, relaxation, calming, and familiarity. Reciprocity was reported to be an important factor in the physical contact, as it is important to pet owners that their pets both request to be petted and enjoy being petted (55). One study focused on elderly pet owners during the social isolation and found that they reported benefits of pet ownership, including pets being “excellent company”; spending quality time with their pets; being distracted by their pets; and the animals providing them with life purpose, love, support, routine, exercise, and stress relief. This group of elderly pet owners also reported some concerns associated with pet ownership during the pandemic, including access to veterinary care and pet supplies, concern over who would care for their pets if they became ill, and financial concerns of caring for their pets. Overall, elderly pet owners found that their pets provided more pros than cons, especially in terms of companionship, support, resiliency, and loneliness abatement (58, 59).

Conclusion

From the origins of our relationship with animals as a source of food and other supplies, to today when animals are our companions both in our families and in our work, animals have always and will always play a profound role in human health and wellness. Our society as a whole benefits from animals; financially, pet owners use fewer medical resources; environmentally, pet owners demand parks and open spaces; in society, animals provide many services to us as individuals (guide dogs, etc.) and in groups (search and rescue dogs); emotionally, pets make us healthier and happier and elicit increased socialization; and physically, pets are linked to oxytocin release and lower physical stress responses and increased heart health. The current pandemic is once again proving the benefits of the HAI. Humans would have evolved as a completely different species without our symbiotic relationships with animals.

References

1. All things dog: the evolution of pet ownership. Pedigree website. <https://www.pedigree.com/dog-care/dog-facts/the-evolution-of-pet-ownership>. Accessed January 30, 2013.
2. Soares CJ. The companion animal in the context of the family system. *Marriage Fam Rev*. 1985;8(3-4):49-62. doi:10.1300/J002v08n03_05

3. Onar V, Koroğlu G, Armutak A, Öncü OE, Siddiq AB, Chrósczc A. A cat skeleton from the Balatlar Church excavation, Sinop, Turkey. *Animals (Basel)*. 2021;11(2):288. doi:10.3390/ani11020288
4. Tunajek S. Pets can be the best medicine. *AANA NewsBulletin*. 2009;26-27. [https://www.aana.com/docs/default-source/wellness-aana.com-web-documents-\(all\)/pets-can-be-the-best-medicine.pdf?sfvrsn=39274bb1_4](https://www.aana.com/docs/default-source/wellness-aana.com-web-documents-(all)/pets-can-be-the-best-medicine.pdf?sfvrsn=39274bb1_4)
5. Bradley T, King R. The geography of dog ownership. *The Atlantic*. <https://www.theatlantic.com/business/archive/2012/11/the-dog-economy-is-global-but-what-is-the-worlds-true-canine-capital/265155/>. Published November 14, 2012. Accessed January 30, 2013.
6. Friedman E, Krause-Parello CA. Companion animals and human health: benefits, challenges, and the road ahead for human-animal interaction. *Rev Sci Tech*. 2018;37(1):71-82. doi:10.20506/rst.37.1.2741
7. Gee NR, Reed T, Whiting A, Friedmann E, Snellgrove D, Sloman KA. Observing live fish improves perceptions of mood, relaxation, and anxiety, but does not consistently alter heart rate or heart rate variability. *Int J Environ Res Public Health*. 2019;16(17):3113. doi:10.3390/ijerph16173113
8. Arkow P. Human-animal relationships and social work: opportunities beyond the veterinary environment. *Child Adolesc Social Work J*. 2020;37:573-588. doi:10.1007/s10560-020-00697-x
9. Borgi M, Collacchi B, Giuliani A, Cirulli F. Dog visiting programs for managing depressive symptoms in older adults: a meta-analysis. *Gerontologist*. 2020;60(1):e66-e75. doi:10.1093/geront/gny149
10. Wilson EO. *Biophilia*. Harvard University Press; 1984.
11. Clements H, Valentin S, Jenkins N, et al. The effects of interacting with fish in aquariums on human health and well-being: a systematic review. *PLoS One*. 2019;14(7):e0220524. doi:10.1371/journal.pone.0220524
12. Nieforth LO, O'Haire ME. The role of pets in managing uncertainty from COVID-19. *Psychol Trauma*. 2020;12(S1):S245-S246. doi:10.1037/tra0000678
13. McNicholas J, Gilbey A, Rennie A, Ahmedzai S, Dono JA, Ormerod E. Pet ownership and human health: a brief review of evidence and issues. *BMJ*. 2005;331(7527):1252-1254. doi:10.1136/bmj.331.7527.1252
14. Janssens M, Janssens E, Eshuis J, et al. Companion animals as buffer against the impact of stress on affect: an experience sampling study. *Animals (Basel)*. 2021;11(8):2171. doi:10.3390/ani11082171
15. Ratschen E, Shoesmith E, Shahab L, et al. Human-animal relationships and interactions during the Covid-19 lockdown phase in the UK: investigating links with mental health and loneliness. *PLoS One*. 2020;15(9):e0239397. doi:10.1371/journal.pone.0239397
16. Beetz A, Uvnäs-Moberg K, Julius H, Kotrschal K. Psycho-social and psychophysiological effects of human-animal interactions: the possible role of oxytocin. *Front Psychol*. 2012;3:234. doi:10.3389/fpsyg.2012.00234
17. Allen K. Are pets a healthy pleasure? The influence of pets on blood pressure. *Curr Dir Psychol Sci*. 2003;12(6):236-239. doi:10.1046/j.0963-7214.2003.01269.x
18. Wood L, Martin K, Christian H, et al. Social capital and pet ownership: a tale of four cities. *SSM Popul Health*. 2017;3(3):442-447. doi:10.1016/j.ssmph.2017.05.002
19. Endo K, Yamasaki S, Ando S, et al. Dog and cat ownership predicts adolescents' mental well-being: a population-based longitudinal study. *Int J Environ Res Public Health*. 2020;17(3):884. doi:10.3390/ijerph17030884
20. Nagasawa M, Mitsui S, En S, et al. Social evolution: oxytocin-gaze positive loop and the coevolution of human-dog bonds. *Science*. 2015;348(6232):333-336. doi:10.1126/science.1261022
21. Powell L, Chia D, McGreevy P, et al. Expectations for dog ownership: perceived physical, mental and psychosocial health consequences among prospective adopters. *PLoS One*. 2018;13(7):e0200276. doi:10.1371/journal.pone.0200276
22. Serpell J. Beneficial effects of pet ownership on some aspects of human health and behaviour. *J R Soc Med*. 1991;84(12):717-720.
23. Oz M. Dr. Oz reveals why pets really improve your health. Oprah website. <https://www.oprah.com/spirit/pets-and-health-benefits-why-keeping-a-pet-is-good-for-you>. Published April 2012. Accessed January 30, 2013.
24. Wood L, Giles-Corti B, Bulsara M. The pet connection: pets as a conduit for social capital? *Soc Sci Med*. 2005;61(6):1159-1173. doi:10.1016/j.socscimed.2005.01.017
25. Jennings LB. Potential benefits of pet ownership in health promotion. *J Holist Nurs*. 1997;15(4):358-372. doi:10.1177/089801019701500404
26. Aragunde-Kohl U, Gómez-Galán J, Lázaro-Pérez C, Martínez-López JA. Interaction and emotional connection with pets: a descriptive analysis from Puerto Rico. *Animals (Basel)*. 2020;10(11):2136. doi:10.3390/ani10112136
27. Koivusilta LK, Ojanlatva A. To have or not to have a pet for better health? *PLoS One*. 2006;1(1):e109. doi:10.1371/journal.pone.0000109
28. El-Qushayri AE, Kamel AMA, Faraj HA, et al. Association between pet ownership and cardiovascular risks and mortality: a systematic review and meta-analysis. *J Cardiovasc Med (Hagerstown)*. 2020;21(5):359-367. doi:10.2459/JCM.0000000000000920
29. Friedmann E, Katcher AH, Lynch JJ, Thomas SA. Animal companions and one-year survival of patients after discharge from a coronary care unit. *Public Health Rep*. 1980;95(4):307-312.
30. Parslow RA, Jorm AF. Pet ownership and risk factors for cardiovascular disease: another look. *Med J Aust*. 2003;179(9):466-468. doi:10.5694/j.1326-5377.2003.tb05649.x
31. Xie Z-Y, Zhao D, Chen B-R, et al. Association between pet ownership and coronary artery disease in a Chinese population. *Medicine (Baltimore)*. 2017;96(13):e6466. doi:10.1097/MD.00000000000006466

32. Maranda L, Lau M, Stewart SM, Gupta OT. A novel behavioral intervention in adolescents with type 1 diabetes mellitus improves glycemic control: preliminary results from a pilot randomized control trial. *Diabetes Educ.* 2015;41(2):224-230. doi:10.1177/0145721714567235
33. Nolan A. Benefits of animal assisted therapy in the prison system. Poster presented at: University Presentation Showcase Event, Eastern Kentucky University; 2016; Richmond, Kentucky. <https://encompass.eku.edu/swps/2016/undergraduate/24/>. Encompass website.
34. Putnam RD. *Bowling alone: the collapse and revival of American community*. Simon & Schuster; 2001.
35. Associated Press. Furry angel of death? Meet Oscar the cat. CBS News website. <https://www.cbsnews.com/news/furry-angel-of-death-meet-oscar-the-cat/>. Published February 1, 2010. Accessed February 6, 2013.
36. Johnson RA, Meadows RL. Older Latinos, pets, and health. *West J Nurs Res.* 2002;24(6):609-620. doi:10.1177/019394502320555377
37. Siegel JM. Stressful life events and use of physician services among the elderly: the moderating role of pet ownership. *J Pers Soc Psychol.* 1990;58(6):1081-1086. doi:10.1037/0022-3514.58.6.1081
38. Dall PM, Ellis SLH, Ellis BM, et al. The influence of dog ownership on objective measures of free-living physical activity and sedentary behaviour in community-dwelling older adults: a longitudinal case-controlled study. *BMC Public Health.* 2017;17(1):496-504. doi:10.1186/s12889-017-4422-5
39. Taniguchi Y, Seino S, Nishi M, et al. Physical, social, and psychological characteristics of community-dwelling elderly Japanese dog and cat owners. *PLoS One.* 2018;13(11):e0206399. doi:10.1371/journal.pone.0206399
40. Schwarzmueller-Erber G, Maier M, Kundi M. Pet attachment and wellbeing of older-aged recreational horseback riders. *Int J Environ Res Public Health.* 2020;17(6):1865. doi:10.3390/ijerph17061865
41. Knight S, Edwards V. In the company of wolves: the physical, social and psychological benefits of dog ownership. *J Aging Health.* 2008;20(4):437-455. doi:10.1177/0898264308315875
42. Banks MR, Banks WA. The effects of animal-assisted therapy on loneliness in an elderly population in long-term care facilities. *J Gerontol A Biol Sci Med Sci.* 2002;57(7):M428-M432. doi:10.1093/gerona/57.7.M428
43. Böbel TS, Hackl SB, Langgartner D, et al. Less immune activation following social stress in rural vs. urban participants raised with regular or no animal contact, respectively. *Proc Natl Acad Sci U S A.* 2018;115(20):5259-5264. doi:10.1073/pnas.1719866115
44. Gadomski AM, Scribani MB, Krupa N, Jenkins P, Nagykaldis Z, Olson AL. Pet dogs and children's health: opportunities for chronic disease prevention? *Prev Chronic Dis.* 2015;12(E205):150204. doi:10.5888/pcd12.150204
45. Sato R, Fujiwara T, Kino S, Nawa N, Kawachi I. Pet ownership and children's emotional expression: propensity score-matched analysis of longitudinal data from Japan. *Int J Environ Res Public Health.* 2019;16(5):758. doi:10.3390/ijerph16050758
46. Sikstrom L, Meyer T, Katz E, et al. Increasing participation in research with therapy dogs: a qualitative study at a large urban mental health and addiction hospital. *PLoS One.* 2020;15(8):e0238096. doi:10.1371/journal.pone.0238096
47. Martin F, Farnum J. Animal-assisted therapy for children with pervasive developmental disorders. *West J Nurs Res.* 2002;24(6):657-670. doi:10.1177/019394502320555403
48. Wisdom JP, Saedi GA, Green CA. Another breed of "service" animals: STARS study findings about pet ownership and recovery from serious mental illness. *Am J Orthopsychiatry.* 2009;79(3):430-436. doi:10.1037/a0016812
49. Brooks HL, Rushton K, Lovell K, et al. The power of support from companion animals for people living with mental health problems: a systematic review and narrative synthesis of the evidence. *BMC Psychiatry.* 2018;18(1):31. doi:10.1186/s12888-018-1613-2
50. ADA requirements: service animals. ADA website. https://www.ada.gov/service_animals_2010.htm. Published July 12, 2011. Updated February 24, 2020. Accessed October 11, 2021.
51. Rodriguez KE, Greer J, Yacilla JK, Beck AM, O'Haire ME. The effects of assistance dogs on psychosocial health and wellbeing: a systematic literature review. *PLoS One.* 2020;15(12):e0243302. doi:10.1371/journal.pone.0243302
52. Jensen CL, Rodriguez KE, O'Haire ME. Service dogs for veterans and military members with posttraumatic stress disorder: replication with the PTSD Checklist for DSM-5. *J Trauma Stress.* 2021;34(1):221-228. doi:10.1002/jts.22587
53. Tanaka A, Saeki J, Hayama SI, Kass PH. Effect of pets on human behavior and stress in disaster. *Front Vet Sci.* 2019;6:113. doi:10.3389/fvets.2019.00113
54. Bowen J, García E, Darder P, Argüelles J, Fatjó J. The effects of the Spanish COVID-19 lockdown on people, their pets, and the human-animal bond. *J Vet Behav.* 2020;40:75-91. doi:10.1016/j.jveb.2020.05.013
55. Young JO, Pritchard R, Nottle C, Banwell HA. Pets, touch, and COVID-19: health benefits from non-human touch through times of stress. *JBEP.* 2020;4(S2):25-33.
56. Xin X, Cheng L, Li S, Feng L, Xin Y, Wang S. Improvement to the subjective well-being of pet ownership may have positive psychological influence during COVID-19 epidemic. *Anim Sci J.* 2021;92(1):e13624. doi:10.1111/asj.13624
57. Oliva JL, Johnston KL. Puppy love in the time of Corona: dog ownership protects against loneliness for those living alone during the COVID-19 lockdown. *Int J Soc Psychiatry.* 2021;67(3):232-242. doi:10.1177/0020764020944195
58. Applebaum JW, Ellison C, Struckmeyer L, Zsembik BA, McDonald SE. The impact of pets on everyday life for older adults during the COVID-19 pandemic. *Front Public Health.* 2021;9:652610. doi:10.3389/fpubh.2021.652610
59. Applebaum JW, Adams BL, Eliasson MN, Zsembik BA, McDonald SE. How pets factor into healthcare decisions for COVID-19: a One Health perspective. *One Health.* 2020;11:100176. doi:10.1016/j.onehlt.2020.100176

Copyright © 2022. All rights reserved. No part of this article may be reproduced, distributed, or transmitted in any form or by any means, including photocopying, recording, or other electronic or mechanical methods, without the prior written permission of the AHVMA, except in the case of brief quotations embodied in critical reviews and certain other noncommercial uses permitted by copyright law.