According to the American Veterinary Medical Association (AVMA; see Resources box), American households had 81 million cats, 72 million dogs, 11 million birds, and other animals as pets in 2007.¹ These figures represent an increase of 23 million cats, dogs, and birds from 2001.² The majority of these households included children, and half of the pet owners surveyed considered their pets to be family members.¹ These trends reflect the growing importance of animal companions in the lives of children and adults. This article examines the growing body of research that provides support for the many anecdotally reported health benefits resulting from the human–animal bond.

Theories About Pets’ Roles in Human Lives

Human beings are genetically predisposed to have an affinity with other organisms, according to the biophilia hypothesis of Edward O. Wilson, Ph.D., a professor and curator of entomology at the Museum of Comparative Zoology at Harvard University, in Boston, Massachusetts.³

The key role that pets play in the socioemotional development of children has been attributed to pets serving as “transitional objects” to human relationships, affording opportunities for socialization, emotional support, and security.⁴ Particularly for children with disabilities, who may experience social stigma and isolation, companion animals can serve as catalysts for mainstreamed social interactions. For example, children in wheelchairs received more friendly attention from passersby in school playgrounds and shopping malls when the children were accompanied by service dogs.⁵

Theories proposed about the importance of pets in people’s lives focus on pets as nonjudgmental members of social networks, as child-substitutes, or as “self-objects” that help people define themselves. According to attachment theory, pets—like children—elicit an innate nurturing response. This may account for pet owners who treat their pets like children. Social support theory, which views the human–human bond in terms of an affiliative basis for psychologic and physical health, has been expanded to the human–animal bond. Self-object theory emphasizes the function of the pet in defining one’s identity (e.g., as a nurturing person).⁶ The degree to which a companion animal later influences a person’s sense of well-being depends upon the person’s relationship with pets earlier in life.⁷

Research on humans and dogs indicates that this interspecies affiliative role involves an increase in the neurophysiologic correlates of oxytocin (a hormone involved in affection, maternal behavior, and empathy); beta-endorphin; prolactin; beta-phenylethylamine; and dopamine in both species, with a concomitant decrease in levels of cortisol in humans after positive interactions with animals.⁸

Prevention and Treatment of Cardiovascular Disease

Studies show that pet owners—especially dog owners—exercise more and consequently have lower cardiovascular disease (CVD) risk. In a screening of 5741 participants for risk factors for CVD, blood pressure (BP), plasma cholesterol, and triglyceride values tended to be lower in pet owners than non-pet owners. In groups that were comparable in body–mass index (BMI), socioeconomic status, and self-reported smoking habits, pet owners reported getting significantly more exercise.⁹ Two other recent surveys (one of more than 41,000 Californians, the other of 1803 Australians) likewise showed dog ownership to be associated with higher levels of physical activity.¹⁰,¹¹
A 10-year study of 4435 Americans, ages 30–75, associated pet ownership with a 30% reduction in the risk of dying from heart attacks. Data from the National Health and Nutrition Examination Study, 1976–1980, focused on current and previous cat owners (n = 2435), compared with participants who had never owned a cat (n = 2000). The magnitude, though not the direction, of the effect was unexpected. Lead study author Adnan Querishi, M.D., a professor of neurology, neurosurgery, and radiology at the University of Minnesota in Minneapolis, and executive director of the Minnesota Stroke Initiative,* stated that dogs, though not studied for this effect, would be likely to provide the same benefit.12

Suggested mechanisms of action for this “pet effect” include evoking a conditioned relaxation response and social support as mediators of autonomic responses to stress13 and positive touch.14

A randomized study compared the effects of pet ownership to angiotensin-converting enzyme (ACE) inhibitor therapy on BP in 48 patients with hypertension. While the groups were comparable at baseline, and lisinopril therapy lowered resting BP in both the experimental and control groups, pet ownership in addition to therapy with lisinopril (20 mg/day) resulted in significantly greater reduction in BP in response to task-induced mental stress than lisinopril alone.15

The Cardiac Arrhythmia Suppression Trial found pet ownership to be an independent predictor of 1-year survival of a randomly selected sample of 424 patients after they had myocardial infarction.16 In 76 patients hospitalized with heart failure, three 12-minute sessions of animal-assisted therapy (AAT) improved cardiopulmonary function, neurohormone level, and anxiety level more than a 12-minute visit from a volunteer alone and more than usual care (the control condition).17

In a study of cardiovascular reactivity to a stressful task (mental arithmetic) and a physical stressor (cold) among 240 married couples, participants who had their pets present had significantly lower heart rate and BP levels at resting baseline and faster recovery times from induced stress than subjects who did not have pets present or only had friends or spouses present.18 One study did not find an association between pet ownership and cardiovascular risk factors in adults 50 years and older, after adjustment for age and other confounding variables.19

With respect to high BP as a major cardiovascular risk for stroke, “the role of less dramatic, lifestyle-oriented prevention, including the role of animals, has been underemphasized,” ac-

* This is a collaborative effort between the State of Minnesota and the University’s Medical Center in Fairview.

“Research has shown that interacting with a companion animal can lower blood pressure and heart rate and reduce anxiety.”

and radiology at the University of Minnesota in Minneapolis, and executive director of the Minnesota Stroke Initiative,* stated that dogs, though not studied for this effect, would be likely to provide the same benefit.12

Suggested mechanisms of action for this “pet effect” include evoking a conditioned relaxation response and social support as mediators of autonomic responses to stress13 and positive touch.14

A randomized study compared the effects of pet ownership to angiotensin-converting enzyme (ACE) inhibitor therapy on BP in 48 patients with hypertension. While the groups were comparable at baseline, and lisinopril therapy lowered resting BP in both the experimental and control groups, pet ownership in addition to therapy with lisinopril (20 mg/day) resulted in significantly greater reduction in BP in response to task-induced mental stress than lisinopril alone.15

The Cardiac Arrhythmia Suppression Trial found pet ownership to be an independent predictor of 1-year survival of a randomly selected sample of 424 patients after they had myocardial infarction.16 In 76 patients hospitalized with heart failure, three 12-minute sessions of animal-assisted therapy (AAT) improved cardiopulmonary function, neurohormone level, and anxiety level more than a 12-minute visit from a volunteer alone and more than usual care (the control condition).17

In a study of cardiovascular reactivity to a stressful task (mental arithmetic) and a physical stressor (cold) among 240 married couples, participants who had their pets present had significantly lower heart rate and BP levels at resting baseline and faster recovery times from induced stress than subjects who did not have pets present or only had friends or spouses present.18 One study did not find an association between pet ownership and cardiovascular risk factors in adults 50 years and older, after adjustment for age and other confounding variables.19

With respect to high BP as a major cardiovascular risk for stroke, “the role of less dramatic, lifestyle-oriented prevention, including the role of animals, has been underemphasized,” ac-

cording to David Wiebers, M.D., a professor of neurology at the Mayo Clinic, in Rochester, Minnesota, and a former director of the Mayo Clinic Stroke Center (also in Rochester). Dr. Wiebers stated: “Research has shown that interacting with a companion animal can lower blood pressure and heart rate and reduce anxiety. It can also improve mood.”20 Due to research showing that pets often help patients heal faster and have better overall outcomes, the Mayo Clinic—like many other hospitals and nursing homes—allows pets to visit their ill human companions.21

Treatment of Cancer and Chronic Pain

Edward T. Creagan, M.D., a professor of medical oncology at the Mayo Clinic College of Medicine, considers pets to be so beneficial to patients devastated by the emotional impact of a cancer diagnosis that he “prescribes” pets as part of treatment plans for many of his patients and notes the names of their pets in medical charts. Dr. Creagan said: “I think it creates healing of the soul. Some of the anger and the resentment is channeled in a positive way for caring for the pet.”20

Larry Lachman, Psy.D., a psychologist and animal behavior consultant in Carmel, California, who leads cancer therapy groups and is a cancer survivor himself, suggests that animals can help patients who have cancer and other serious conditions by nonjudgmental listening to what he calls their “illness narratives,” which even family and friends may not always wish to hear.20 An example of animals helping people with life-threatening illness is the finding that pet cats have been shown to be effective additions to the social support systems of men with AIDS.22

Oncologist Ann Berger, M.D., chief of the Pain and Palliative Care Service, National Institutes of Health Clinical Center in Bethesda, Maryland, numbers pet therapy among the complementary and alternative modalities that can reduce chronic pain from cancer and other conditions.20 Based on responses to a patient-symptom questionnaire, she noted that trained dogs in animal-assisted interventions can also improve the quality of life in patients undergoing chemotherapy. According to the survey results, depression was reduced and arterial oxygen saturation increased in a group of respondents who interacted with dogs, compared with the controls.23

Treatment of Pediatric Patients

Service dogs are well-known for serving children who are blind and deaf. Dogs and some other animals are also used in animal-assisted interventions with general or specific physical or mental health goals. Animals in these capacities have been incorporated into health care settings to help children prepare for, or recuperate from, medical procedures or benefit from psychotherapy.

Introducing animals in a children’s hospital was favorably received by 138 patients, their parents, and the medical staff, and the presence of the animals did not result in an increase in the
Treatment of Elderly Patients

AAT has gained popularity as an adjunctive therapy for seniors in nursing homes. Animals provide needed tactile contact and a sense of identity for elderly people who have suffered losses of family, friends, professional affiliations, and functioning. The presence of an animal facilitated social interaction and reduced agitation and aggression in patients with dementia. Watching fish in an aquarium stimulated residents to eat more and gain weight.

In a study of Medicare enrollees (N = 938), those with pets reported having fewer doctor visits over the course of a year than respondents who did not own pets. The researchers postulated that pet owners were buffered from the impact of stressful life events associated with greater use of health services.

In another study, residents (N = 58) in a long-term care facility reduced their as-needed analgesic medication usage and pulse rate and reported improved overall quality of life as the result of contact with a therapy dog.

Biodiagnostics: Early Detection of Medical Conditions

It has been reported that service animals have alerted patients to the onset of a seizure, migraine, or diabetic hypoglycemic episode. Based on a literature search combined with interviews with 29 dog-owning patients with epilepsy and 15 service dog trainers, a group of researchers concluded that some dogs appear to have an innate ability to detect early warning signs of such impending episodes.

The presence of an animal facilitated social interaction and reduced agitation and aggression in patients with dementia. Watching fish in an aquarium stimulated residents to eat more and gain weight.

The presence of a companion animal (a dog) has reduced physiologic arousal and behavioral distress in young children who underwent routine physical examinations and dental procedures, as well as in children who were placed in an experimental verbalization situation.

Pets and the Hygiene Hypothesis

Much research supports the hygiene hypothesis that postulates that early exposure to allergens helps strengthen the developing immune system, so that a child who is exposed to microbes associated with pets and farm animals appears to be at reduced risk for developing asthma and allergies later in life.

**EDITOR’S NOTE:** For a more complete treatment of this topic, see Horowitz S. The hygiene hypothesis: The paradox of immunity. Altern Complement Ther 2005;11:63-68.
Dogs may be able to detect chemical or electrochemical changes that accompany these conditions, such as particular odors in sweat or the spike in electrical discharges that precede an epileptic seizure. It is also possible that such dogs react to subtle behavioral changes in their owners.20

Some evidence supports clinical case reports of dogs, due to their well-known acute sense of smell, being able to detect the chemical changes that accompany cancer. These animals appear to detect the odor of a unique signature of volatile organic compounds (VOCs) exhaled by patients with lung cancer41 or the VOCs produced by tumors.42 Two bodies of evidence support this hypothesis. First, human body odor is determined by major histocompatibility genes; these antigen molecules (human leukocyte antigen, HLA) have detectable isofoms that are present in sweat, blood, and urine. Second, there is a strong association between changes in certain classes of HLA expression and tumors.43 Such detection has been reported for cancers of the lung,43 breast,43 and bladder,44 and for melanomas.45,46 Although a recent study yielded mixed results of dogs’ ability to detect cancer at better than chance odds, the researchers concluded that a more stringent training protocol might produce better outcomes.47

Zoonotic Infections

A negative aspect of companion animals are zoonoses, diseases that are transmissible from lower vertebrates to humans. Consequently, providers of AAT animals, such as the Delta Society (see Resources) adhere to preventative standards for animal–patient contact. According to Elson S. Floyd, Ph.D., president of Washington State University in Richland,‡ about 70% of diseases that affect humans are caused by zoonotic infectious agents shared by animals and humans.48

Because the globalized pet trade has increased the potential for the spread of zoonotic diseases,49 the Centers for Disease Control and Prevention (CDC) has regulations regarding importation of animals capable of causing human disease.50 The modes of interspecies transmission include direct contact (e.g., *Microsporum canis* infection, commonly known as ringworm), scratches (cat scratch disease caused by *Bartonella henselae* bacteria),51 bites (rabies), and inhalation of or contact with animal urine or feces (toxoplasmosis).52

Due to immature immune systems and play habits, infants and children younger than 5 are at increased risk of being exposed to, and affected by, these agents. Persons with suppressed immune systems, pregnant women, and elderly people are also at risk. In recent years, *Escherichia coli* (*E. coli*) infections in children have been linked by the CDC to petting zoos. The CDC has also expressed concern about two diseases that children can be exposed to from pet rodents, including hamsters, mice, and rats: Lymphocytic choriomeningitis, a viral disease that is spread by inhalation of airborne particles of rodent droppings or saliva, and rat-bite fever, a bacterial illness spread by a rodent bite, scratch, or ingestion of food or water contaminated with rodent feces.53 Strains of

---

‡Washington State University’s College of Veterinary Medicine has received funding for a new School for Global Animal Health.
Salmonella have also been associated with pet rodents\textsuperscript{54} and
turtles and other reptiles.\textsuperscript{55}

The New England Journal of Medicine recently featured a
case report about the transmission of a particularly viru-
ient strain of methicillin-resistant Staphylococcus aureus
(MRSA) among a symptomatic woman, her asymptom-
atic family, and their healthy pet cat.\textsuperscript{56} A previous paper
focused on the outbreak of Malassezia pachydermatitis, a yeast
infection associated with otitis externa in dogs, in an intensive
care nursery. Investigators found that the disease was
spread to neonates by health care workers whose hands
had been colonized by the organism from contact with their
pet dogs.\textsuperscript{57}

\section*{Mutual Health Care}

Marty Becker, D.V.M., a veterinarian, media consultant,
and author based in Bonner’s Ferry, Idaho, notes that “the
cross-species connection can be emphasized for mutual
health. If the owner is a couch potato, so is his pet, and the
lifestyle changes necessary to prolong the life of the human
are the same for the animal, too.”\textsuperscript{20} This logic was validated
in the People and Pets Exercising Together (PPET) study
that addressed the double epidemic of obesity in humans and
their pets. After 1 year of exercise and dietary counseling,
people with participating pets (n = 36) increased physical ac-
tivity more than those without pets (n = 56). The dogs, who
were on a special diet, also lost weight.\textsuperscript{58}

\section*{Conclusion}

A growing body of research supports the generally beneficial
mind–body health effects of the trans–species bond that many
children and adults have with their pets and service animals.
Further research could help identify which patients would
most benefit from animal-assisted adjunctive therapy. Further
investigation of the purported ability of dogs to act as early
warning systems to alert patients of impending seizures and
detect cancerous tumors is also warranted.

\section*{References}

line document at: www.avma.org/reference/marketstats/ownership.asp Accessed
May 18, 2008.
3. Kahn PH. Developmental psychology and the biophilia hypothesis: Chil-
4. Triebenbacher SL. Pets as transitional objects: Their role in children’s emo-
5. Mader B, Hart LA, Bergin B. Social acknowledgments for children with
6. Fine AH, Beiler PF. Therapists and animals: Demystifying animal-assisted
therapy. In: Strozier AL, Carpenter J, eds. Introduction to Alternative and
7. Hart LA. The Role of Pets in Enhancing Human Well-Being: Effects for
Older People. Online document at: www.deltasociety.org/download/hart.rtf
8. Odendaal JS, Meinties RA. Neuropsychological correlates of affiliative be-
9. Anderson WP, Reid CM, Jennings GL. Pet ownership and risk factors for
10. Yabroff KR, Trolano RP, Berrigan D. Walking the dog: Is pet ownership asso-
11. Curt H, Giles-Corti B, Knuiman M, et al. Understanding dog owners’ in-
creased levels of physical activity: Results from RESIDE. \textit{Am J Public Health}
12. Mundell EJ. Cats Help Shield Owners from Heart Attack. Online docu-
ment at: www.healthfinder.gov/news/printnewstory.asp?docID=612800 Ac-
cessed April 17, 2008.
animal interaction: Theoretical issues and long-term interaction effects. \textit{J Nerv
Ment Dis} 2006;194:52–57.
15. Allen K, Shykoff BE, Izzo JL. Pet ownership, but not ACE inhibitor
therapy, blunts home blood pressure responses to mental stress. \textit{Hypertension}
16. Friedmann E, Thomas SA. Pet ownership, social support, and on-year
survival after acute myocardial infarction in the Cardiac Arrhythmia Suppres-
17. Cole KM, Gawlinski A, Steers N, Kotlerman J. Animal-assisted therapy in
18. Allen K, Blascovich J, Mendes WB. Cardiovascular reactivity and the pres-
ence of pets, friends, and spouses: The truth about cats and dogs. \textit{Psychosom
Med} 2002;64:727–739.
20. Becker M. The Healing Power of Pets: Harnessing the Amazing Ability of
22. Castelli P, Hart LA, Zasloff RL. Companion cats and the social support
23. Orlandi M, Trangeled K, Mambrini A, et al. Pet therapy effects on onco-
logical day treatment patients undergoing chemotherapy treatment. \textit{Antican-
24. Caprilli S, Messeri A. Animal-assisted activity at A. Meyer Children’s
Hospital: A pilot study. \textit{Evid-Based Complement Alternat Med} 2006;3:
379–383.
25. Wu AS, Niedra R, Pendergast L, McCrindle BW. Acceptability and im-
 pact of pet visitation on a pediatric cardiology inpatient unit. \textit{J Pediatr
therapy program for children with cancer: A descriptive study [in English &
27. Sobo EJ, Eng B, Kassity-Krich N. Canine visitation (pet) therapy: Pilot
28. Nagengast SL, Baun MM, Megel M, Leibowitz JM. The effects of the
presence of a companion animal on physiological arousal and behav-
ioral distress in children during a physical examination. \textit{J Pediatr Nurs}

To order reprints of this article, e-mail Karen Ballen at: Kballen@liebertpub.com or call at (914) 740-2100.