

Mainstreaming Animal-Assisted Therapy

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Abstract

The term animal-assisted therapy (AAT) commonly refers to the presentation of an animal to one or more persons for the purpose of providing a beneficial impact on human health or well-being. AAT is an ideal example of “One Health” because of numerous studies and widespread testimonials indicating that many humans feel better in the presence of pets and other domesticated animals, and, conversely, that some of those creatures appear to respond positively to human company for their emotional and perhaps physical betterment. Many AAT studies have claimed a wide range of human health benefits, but much of the research is characterized by small-scale interventions among disparate fields, resulting in criticisms about weak study design or inconsistent methodology. Such criticisms contrast with the strongly held belief among many that interaction with friendly animals has a strong and innate value for the persons involved. Consequently the appeal of AAT in human medicine today may be generally characterized as a “push” by enthusiastic advocates rather than a “pull” by prescribing physicians. To fully integrate AAT into conventional medical practice as an accepted therapeutic modality, more convincing intervention studies are necessary to confirm its clinical merits, along with an understanding of the underlying mechanism of the human response to the company of friendly animals.

Key Words: animal-assisted activities (AAA); animal-assisted therapy (AAT); dog; human-animal interaction; One Health; pet therapy; randomized controlled trial

Introduction and Background

According to the American Veterinary Medical Association (AVMA) One Health Initiative Task Force Report, “the mission of One Health is the establish-

ment of closer professional interactions, collaborations, and educational opportunities across the veterinary and medical professions, together with their allied sciences in order to improve public health and animal health” (AVMA 2008). In this regard, animal-assisted therapy (AAT¹) and its related activities could serve as the “poster child” for One Health because AAT provides an excellent example of how human and animal health are inextricably linked. Companion animals are a part of the basic fabric of US society for purposes of pleasure and comfort, and society relies on veterinary care to sustain the health of those companions. In addition, there is widespread belief that human-animal interactions provide some benefit to the injured and infirm, whether in a hospital, nursing home, or hospice. These interactions depend on contributions from both the veterinary and human medical professions. In this article we describe how clinical and basic research can substantiate the claims of AAT and we identify specific components for successful AAT. The fruits of that research could, in turn, serve animals if scientists understand how humans influence the physical and mental health of their animal companions.

Historically, the concept of animals improving human health has evolved from an initial “belief in the supernatural power of animals and animal spirits,” among early hunter-gatherers, to more recent advocacy for animals as “agents of socialization” and as providers of “relaxation and social support” (Serpell 2006). One of the earliest documented therapeutic programs using animals took place in the 1790s at the York (UK) Retreat, where mentally ill patients were encouraged to walk through the gardens and interact with and care for numerous small domestic animals (Burch 1996). By the 19th century, pet animals were commonplace in mental institutions in England (Serpell 2006), and were part of the therapeutic regimen at a treatment center for epileptics founded in 1867 in Bielefeld, Germany (McCulloch 1983). In 1860 Florence Nightingale recorded her observations on the therapeutic role of animals: “a small pet is often an excellent companion for the sick, for long chronic cases especially. A pet bird in a cage is sometimes the only pleasure of an invalid confined for years to the same room. If he can feed and clean the animal himself, he ought always be encouraged to do so” (Nightingale 1860).

From available resources, it appears that in the United States such programs were, until recently, sporadic and discrete.

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¹Abbreviations used in this article: AAA, animal-assisted activities; AAT, animal-assisted therapy; BP, blood pressure; NCCAM, National Center for Complementary and Alternative Medicine

In 1919, animal visitation was used in a mental health program at St. Elizabeth's Hospital in Washington, DC (Burch 1996). And in 1944–1945 a program sponsored by the American Red Cross used animals in the rehabilitation of veterans at the Army Air Force Convalescent Hospital in Pawling, New York; but the program ended after the war (Beck and Katcher 1996).

It was not until the 1960s that the concept of animals' therapeutic value was reinvigorated through the work of an American child psychiatrist, Boris Levinson, who recounted in his book, *Pet-Oriented Child Psychotherapy*, the benefits of having his dog present at counseling sessions with young patients (Kruger et al. 2004). Like Levinson, Samuel Corson, an experimental psychologist, and his wife, Elizabeth, also recognized the therapeutic value of companion animals and evaluated the effects of AAT as an adjunct to conventional therapy in institutional settings (McCulloch 1983). A 1980 study that revealed an association between pet ownership and decreased mortality one year after discharge from a coronary care unit (Friedmann et al. 1980) has been credited with stimulating subsequent scientific interest in the potential human health benefits of animal companionship (Serpell 2006).

During the 1970s and 1980s, the first centers and organizations committed to the study of the human-animal bond were established in five countries (Hines 2003). In 1977, the Center on Interactions of Animals and Society at the University of Pennsylvania veterinary school was the first US center established to research the “way in which people and animals share their lives” (Katcher and Beck 1983), and in 1981 it hosted the first major US symposium on the human-animal bond (Fogle 1983).

Also in 1977, Leo K. Bustad, a veterinarian, and Michael J. McCulloch, a psychiatrist, founded the Delta Society, “a human-services organization dedicated to improving people's health and well-being...through positive interactions with animals” (www.deltasociety.org). They and their colleagues observed that pets had positive effects on pet owners' health and happiness and believed that more could be brought to light by scientific research. The Delta Society has become a leader in establishing training curricula for therapy animals and is now one of the largest organizations providing service and therapy animals (Kruger and Serpell 2006). The Delta Society defines two different types of animal-assisted interventions widely cited in the literature, AAT and animal-assisted activities (AAA¹):

AAT is a goal-directed intervention in which an animal that meets specific criteria is an integral part of the treatment process. AAT is directed and/or delivered by a health/human service professional with specialized expertise, and within the scope of practice of his/her profession. AAT is designed to promote improvement in human physical, social, emotional, and/or cognitive functioning. AAT is provided in a variety of settings and may be group or individual in nature. This process is documented and evaluated....

By contrast, AAA are less structured and typically consist primarily of pet visitation:

AAA provide opportunities for motivational, educational, recreational, and/or therapeutic benefits to enhance quality of life. AAA are delivered in a variety of environments by specially trained professionals, paraprofessionals, and/or volunteers, in association with animals that meet specific criteria.

Although the terms AAT and AAA appear frequently in the literature, their use is not standardized. In numerous papers reviewed for this essay, AAT referred to animal-related interventions ranging from pet visitation and placement of a resident dog or a fish aquarium in a nursing home to integration in therapeutic services in rehabilitation and mental health settings. Other terms such as pet therapy, pet-facilitated therapy, dog-assisted therapy, dog visitation therapy, and pet-assisted therapy, to name a few, were also used to describe the same range of activities. In this article we use the term AAT to cover both pet visitation and animal-assisted therapy intended to promote health and well-being of human patients in healthcare facilities. We do not address the use of service dogs, assistance dogs, dolphin therapy, and hippo-therapy (horses).

The practice of AAT is fairly common in healthcare facilities throughout the United States (Lefebvre et al. 2008; Souter and Miller 2007); for example, seven major teaching hospitals in the Boston area (LSP personal telephone and email communications, March-June 2009) have in-house pet visitation or pet therapy programs. AAT programs also exist in Canada, India, Japan, Korea, Mexico, Sweden, and elsewhere.² Numerous national and local AAT programs provide certified handlers and animal teams for healthcare facilities in the United States. Two of the largest organizations, the Delta Society and Therapy Dogs International (www.tdi-dog.org), have over 10,000 and 20,000 registered handler/animal teams, respectively (personal email communication between LSP and Michelle Cobey of the Delta Society, August 17, 2009).

The growing popularity of AAT is supported by numerous books on the subject as well as the availability of educational opportunities through university-based AAT certificate programs such as the Oakland University School of Nursing (Rochester, MI),³ the University of Denver Graduate School of Social Work,⁴ and Harcum College (Bryn Mawr, PA).⁵ Some universities with established research centers devoted to exploring the human-animal relationship incorporate AAT as a key program area; examples include the Center for the Interaction of Animals and Society's pet visitation program at the University of Pennsylvania School of Veterinary Medicine⁶ and the Center for Human-Animal Interaction's AAT program that serves Virginia Commonwealth University Medical Center⁷ patients and staff.

²Information from the Delta Society website, under Programs/Pet Partners Program (accessed March 26, 2010).

³www.oakland.edu/upload/docs/SON/brochure_final.pdf

⁴www.du.edu/socialwork/programs/ce/Animals%20and%20Human%20He.html

⁵www.harcum.edu/CS_ACD_School_of_Continuing_Studies.aspx

⁶<http://research.vet.upenn.edu/cias/Projects/tabid/1908/Default.aspx>

⁷www.jlinasdesign.com/VCU_site/programs_services/dogsoncall.html#

The increasing use of AAT in healthcare facilities corresponds with the emergence of numerous patient safety advisories and policies concerning infection control, critical care, and veterinary considerations (AVMA 2007a,b; Davidson et al. 2007; Lefebvre et al. 2008; Sehulster and Chinn 2003). Guidelines that address all aspects associated with the use of AAT in a particular healthcare setting should be established and training provided for all AAT program staff. Preventing the transmission of zoonotic pathogens from companion animals to human patients and from patients to animals is critical and should be addressed through a team approach that draws on the expertise of infectious disease professionals, veterinarians, risk management staff, and other relevant healthcare personnel. This team should be cognizant of new potential pathogens and the changing face of existing ones, such as methicillin-resistant *Staphylococcus aureus* (Friedmann and Son 2008; Lefebvre et al. 2009; Weese 2010).

AAT Health Benefits and Questions

The AAT literature was surveyed for this article using the OvidSP search engine to access MEDLINE (1996–present) and PsycINFO databases (1967–present) with “pet therapy” and “animal-assisted therapy” as key words, along with recent review articles on AAT. Our findings revealed that the AAT literature is diverse and composed of studies that vary widely by type of intervention, participants, and study settings, a conclusion supported by others (Barker and Wolen 2008). The most common animal species used in AAT is the dog, but reports also cited other vertebrate species, such as cats, birds, and fish. The studies described a wide range of patient age groups—pediatric, adolescent, adult, and geriatric—and took place in acute and long-term care facilities, rehabilitation facilities, psychiatric facilities, and a burn unit. Participating patients’ medical conditions in these studies included but were not limited to dementia, schizophrenia and other psychiatric disorders, cancer, and heart failure.

While most of the published AAT interventions took place in a healthcare facility, several experimental studies explored the physiological impact of presenting an animal (usually a dog) to a person in a laboratory setting (Baun et al. 1984; Craig et al. 2000; DeMello 1999; Kingwell et al. 2001). Some of these studies included physiological stressors (e.g., computer-based cognitive tasks) as part of the experimental design to determine whether the presence of a dog had an ameliorative effect on stress-induced elevations of blood pressure (BP¹) and other cardiovascular parameters.

There was encouraging evidence from these studies for a variety of positive human health and well-being benefits from AAT. Some of these outcomes (including no effect in some cases) include improvements in mood (Lutwick-Blook et al. 2005) and depression, but not in anxiety (LeRoux and Kemp 2009) and loneliness (Banks and Banks 2002), in geriatric patients in long-term care facilities. In a summary of nine AAT studies involving geriatric patients with dementia,

decreased agitated behaviors and increased social interaction were the most common findings (Perkins et al. 2008). An examination of the mental state in dementia patients after AAT with a dog showed a statistically significant reduction in apathy, but no statistically significant differences in the irritability and depression scales, mini-mental state examination, and activities of daily living (Motomura et al. 2004). Increased nutritional intake and body weight were observed in Alzheimer’s patients after the introduction of a fish aquarium in their dining area (Edwards and Beck 2002).

After a visit with a volunteer and a dog, hospitalized adult patients with congestive heart failure showed reductions in pulmonary capillary wedge pressure, systolic pulmonary artery pressure, anxiety, and catecholamine levels, without significant effects on BP or heart rate (Cole et al. 2007). Also described were decreased usage of analgesics and pulse rate, but not other types of as-needed medications or other parameters measured in young adult to older adult patients in a rehabilitation facility (Lust et al. 2007). Reduced depressive symptoms were documented in nursing home and psychiatric patients (Souter and Miller 2007). While hospitalized psychiatric patients reported reduced anxiety after either AAT or recreation therapy, AAT had an effect across more types of psychiatric disorders compared to recreation therapy (Barker and Dawson 1998). Studies in hospitalized children after AAT showed improved mood, elevated heart rates (Kaminski 2002), and decreased pain, along with no effect on BP or heart rate, and elevated respiratory rates (Braun et al. 2009).

Review articles involving these and additional studies (Friedmann and Son 2009; Halm 2008) as well as meta-analyses of multiple AAT studies (Nimer and Lundahl 2007) provide a further breakdown of AAT results and some additional evidence of its benefits.

As evident from the overview above of some study outcomes in various age groups and medical conditions, AAT may not have any health-related effects. The reader is also advised that the AAT literature is replete with contradictory findings (Barker and Wolen 2008), even when intuitively obvious endpoints and presumptive benefits are involved. Although one of the earliest studies showed that interacting with pet dogs lowered BP (Katcher 1981; Katcher et al. 1983), other studies have not shown a pet-related effect. For example, in a review of AAA and cardiovascular benefits (Barker and Wolen 2008), the authors pointed out inconsistent outcomes for BP changes in the presence of a dog with or without applied cardiovascular stressors (e.g., mental arithmetic or other problem-solving tasks). Some studies revealed that the presence of a friendly unfamiliar dog or even a pet dog had no effect on BP during exposure to a stressor (Craig et al. 2000; Grossberg et al. 1988; Kingwell et al. 2001); others reported a decrease during (Allen et al. 1991; Friedmann et al. 1983) and after termination of a stressor (DeMello 1999); and still others reported lower BP in subjects who petted a friendly unknown or pet dog without being exposed to a stressor (Baun et al. 1984; Wilson 1987). In some cases AAT intervention with a dog had no effect on

BP but was associated with other positive health and well-being benefits in diverse groups of participants: children in an acute pediatric setting (Braun et al. 2009), adult inpatients (Coakley and Mahoney 2009), heart failure patients (Cole et al. 2007), and rehabilitation patients (Lust et al. 2007). However, a statistically significant decrease in BP was found after elderly nursing home patients received AAT with a cat when compared to preintervention values (Stasi et al. 2004).

Another cluster of contradictions involves BP and hormones and neurochemicals (oxytocin, β -endorphin, prolactin, and β -phenylethylamine) associated with affiliative behaviors in animal or human studies. One would expect a person to exhibit lower BP and higher levels of such proteins if AAT were a pleasant experience, and indeed one study showed both these effects during a positive interaction with a dog when compared to preinteraction levels (Odendaal and Meintjes 2003). In the same study, a control group of quiet readers without a dog interaction also showed elevations of these hormones and neurochemicals, but there were statistically significant differences in the degree of increase for β -endorphin, oxytocin, and prolactin between this control group and the positive dog interaction group.

Other studies have shown elevated levels of oxytocin after owners' interactions with their dogs (Miller et al. 2009; Nagasawa et al. 2009). Increased urinary oxytocin concentrations in owners correlated with a longer duration of their dog's gaze during an interaction, with no corresponding effect on BP or heart rate (Nagasawa et al. 2009). Miller and colleagues (2009) measured serum oxytocin levels in men and women before and after interacting with their pet dogs after arriving home from work, and compared those to oxytocin levels drawn before and after a 25-minute reading session. They reported an overall increase in oxytocin levels in women after the dog interaction and a statistically significant increase when compared to the reading levels; conversely, men experienced an overall decrease in oxytocin levels after interacting with their pet dogs, but it was less than the decrease after the reading session. In both men and women, oxytocin levels declined after the reading session (Miller et al. 2009).

Similarly, one would expect levels of physiochemical markers of stress to drop after a presumably positive AAT intervention. One study reported lower levels of serum and salivary cortisol, but no change in serum epinephrine, serum norepinephrine, or salivary immunoglobulin A (IgA) in healthcare professionals after both a 5- and 20-minute interaction with a therapy dog; there was no significant difference in cortisol levels when comparing the AAT interventions and a 20-minute rest condition without a therapy dog (Barker et al. 2005). Conversely, salivary IgA increased in college students after petting a dog when compared to control groups (Charnetski et al. 2004).

Compounding these conflicting findings is the fact that much of the existing AAT literature is characterized by small sample sizes, lack of randomization, and either inappropriate or no control groups (Barker and Wolen 2008;

Kruger and Serpell 2006; NICHD 2008). Souter and Miller (2007) noted that the lack of randomization and control groups had a negative impact on the number of studies suitable for their meta-analysis on the effectiveness of AAT on depression.

Reasonable explanations for discrepancies between study outcomes may include variability of study methods (e.g., type, duration, and frequency of AAT intervention), sample numbers, outcome measures, types of stressors (in cardiovascular studies), demographic and pet attachment characteristics of study subjects, clinical conditions, or other factors such as the presence of the animal handler or the type and physical attributes of the animal. In addition, there may be unidentified confounding variables, human attributes, or motivating factors beyond the usual study design considerations that may affect outcomes, statistical power, and repeatability.

Although AAT is becoming more common in healthcare settings and some results indicate positive contributions to health, more and better evidence-based research is required before AAT will be accepted as a valid treatment modality and mainstreamed into human medicine. Physicians who prescribe an AAT intervention should know not only which diseases and patient subpopulations are most responsive but also the recommended animal species as well as the most effective frequency and duration of treatment. Critics of published reports of clinical benefits from AAT have been calling for more scientifically rigorous research in this field since the 1980s (Barker and Wolen 2008; Beck and Katcher 1984; Katcher and Beck 2006; Kruger and Serpell 2006; NIH 1987; Wilson 2006; Wilson and Barker 2003). Fortunately, the number of randomized controlled studies involving AAT appears to be increasing (Barak et al. 2001; Berger 2006; Berget et al. 2008; Cole et al. 2007; Le Roux and Kemp 2009; Villalta-Gil et al. 2009). But the results from these studies will require confirmation by others to be truly convincing.

Mainstreaming AAT

The reasons for performing clinical AAT research extend beyond merely substantiating the putative benefits of AAT touted in the literature. With rising costs that threaten the availability and affordability of health care for many, a potentially simple and inexpensive modality like AAT could have a significant impact on those costs in several ways. For example, if AAT improves patients' attitudes and sense of well-being, it may also improve fidelity to prescribed treatments and ultimately shorten hospital stays. Increased physical activity in the hospital as a component of rehabilitation regimens could also result in fewer therapeutic interventions. And if AAT can reduce healthcare costs in these and other situations in an obvious way, it might become a reimbursable expense by third-party payers.

Efforts to establish the legitimacy of AAT as a clinical option might draw on both the research framework proposed

at a 2008 workshop, cosponsored by the Eunice Kennedy Shriver National Institute of Child Health and Human Development (NICHD) and the Waltham Centre for Pet Nutrition (NICHD 2008), and the strategy of the National Center for Complementary and Alternative Medicine (NCCAM¹; 2004). These two endeavors call for the establishment of a comprehensive research agenda that has at its core the performance of scientifically rigorous studies. In addition, both include systematic and interdisciplinary evaluations of the pertinent literature to better define research initiatives in specific diseases or for specific patient populations. Workshops to advance AAT in the areas of adolescent mental health (Kruger et al. 2004) and youth at risk (Jackman and Rowan 2007) reached similar conclusions.

NCCAM's 2005–2009 strategic plan (NCCAM 2004) includes a review of challenges and lessons learned since the publication of its first 5-year plan (NCCAM 2000). One of the ongoing challenges (NCCAM 2004) concerns the application of conventional research methods to complementary and alternative medicine (CAM). In response, NCCAM “agrees that the gold standard of the double-blind, placebo-controlled clinical trial is neither appropriate nor feasible for all CAM therapies, but it is also not an appropriate design for all conventional therapies” and “believes that while certain classes of interventions can be challenging to study—in both CAM and conventional medicine—existing methodologies usually suffice to allow fair and credible, yet rigorous, tests of CAM therapies” (NCCAM 2004).

What are the challenges in designing and implementing small- and large-scale, longitudinal, randomized, controlled clinical trials involving AAT? The ideal randomized clinical study is one in which a very specific dosed intervention with unambiguous measurable effects is applied to a homogeneous population and the results are then compared to those of an equivalent homogeneous control group that did not receive the intervention. Unfortunately, the study of AAT in medical care settings presents a far from ideal situation with respect to the three basic components of any clinical study: the patient population, the medical intervention, and the endpoints to be measured.

What is an appropriate study population? If the goal were to assess AAT in a broad population of patients in a multiplicity of care settings, the number of subjects in both the treatment (AAT) and control arms would have to be enormous to accommodate the heterogeneity of the study population. The study subjects would present huge variance in terms of, for example, age, race, socioeconomic status, severity and chronicity of disease, general health status, and hospitalization experience. Therefore, it is more practical to design studies with a limited population, such as hospitalized adult patients with congestive heart failure, children in an oncology ward, or elderly patients with Alzheimer's in a chronic care setting. But even with a more medically defined study population, subjects will likely have a variety of prior experiences with animals that may bias their responses to the study intervention. There is also the challenge of identifying a reasonable control group. Patients not subjected to animal

interventions but otherwise identical to the treatment group would be suitable in this regard. But if those patients are devoted pet owners or animal lovers, would they feel badly enough about being excluded from animal visits to reduce their willingness to participate? Or might the lack of interaction with an animal have a negative impact on the control participant and confound the results?

Even if it were possible to identify a reasonably homogeneous study group, the study intervention itself also has potentially numerous variables. Consider, for example, what type of animal is to be used. If a dog, how big and what breed? Is the animal known or unknown to the patient? What will the animal-patient interaction actually involve? Will a handler be present with the animal? What is the role of the handler and will that role be standardized for all interventions? Will the trial use one animal with a single patient, or with a group of patients? How long will the animal be in the room? Will there be physical contact? Furthermore, the animal itself is not a static intervention. Individual animals will have different reactions to different people and could exhibit different levels of energy and interest between the first and last patient visits on the same day.

The final required element is a measurable endpoint. AAT study designs have used a number of patient population-specific endpoints such as changes in physiologic values (e.g., blood pressure, catecholamine levels), improved mood, reduced loneliness and depression, and decreased pain, with justification for each. In every case, the endpoints chosen should be medically relevant to the study population.

The heterogeneity of the three essential components discussed above does not mean that a large randomized trial is impossible, but the massive numbers of participants required to control for the inherent variability would render such an undertaking unreasonable. It seems that the best options would be to find ways to maximize the application of results from small and medium-sized studies. We present three such options. In addition, we address creation of a national AAT database and considerations to ensure both the protection of human participants and animal welfare.

First, it would be helpful to agree to defined standards of AAT as used in research. Standardization of the human-animal interaction is posed as an essential consideration in a well-designed AAT research study (Wilson and Barker 2003). For example, the use of a single animal species as well as specification of the duration and frequency of AAT, the role of the animal handler, and the nature of the interaction would allow better comparison between studies. But there is no such standard today and the specifics of any defined standard will be unavoidably arbitrary. As long as investigators and practitioners are required to define the specifics of their own AAT, mainstreaming of AAT will be hampered. We suggest the convening of a consensus panel to develop guidelines for standardized AAT interventions. The panel would first need to review current practice and the literature to understand what approaches have proven feasible and effective in various settings. This review would then inform the development of AAT guidelines for several specific

situations such as chronic care, rehabilitation, acute care, and those involving children and the elderly. In addition, distinct guidelines for different animal species (e.g., cats, dogs) should be included. While it is unreasonable to think that this panel would set a single standard for the practice of AAT, it could provide useful general standards for AAT research.

The selection of appropriate animals for AAT interventions is also critical for standardization. Persons assigned this responsibility should follow guidelines established by organizations such as the Delta Society for animal selection and screening, including source, temperament, behavior, and health. The Delta Society has established standards of practice for AAT programs and also provides rigorous training for handler and animal teams. In addition, AAT program and animal wellness guidelines are available from the AVMA (2007a,b).

Second, a universal research subject descriptor tool for AAT would be useful. It would capture standard information about human subjects, including not only pertinent health status data but also details of relevant previous animal experiences.

And third, the development of standard endpoints would enhance the utility of AAT studies. In the study of any specific patient population, research physicians should be driving the choice of appropriate outcome measures, which should be of the greatest value to the patients' conditions and standardized so that results can be compared among studies in that clinical specialty. For example, a study of AAT in postmyocardial infarction patients will likely include cardiac function measurements as an endpoint, so there should be some agreement about which specific cardiac function metrics would be used in any AAT study that uses such measures as an endpoint. In addition to disease- or condition-specific endpoints, some standard endpoints may be suitable for inclusion in most AAT studies regardless of the specificity of the study population. For example, validated survey tools and physiologic measurements could become accepted metrics of general clinical relevance. As discussed below, changes in the levels of neurotransmitters and stress hormones may eventually prove to be an excellent means to assess the psychological effects of AAT with greater uniformity and precision.

Small and medium-size studies of distinct patient populations will likely continue to be the most practical approach to evaluate AAT. The standardization of research participant evaluation tools would not only confirm the importance of small, focused AAT studies but could also expand their applicability to broader populations.

In addition to prospective study designs, the creation of a national AAT database could be an invaluable research tool. A similar repository for AAT and youth violence prevention program information was recommended at the National Technology Assessment Workshop on Animal Assisted Programs for Youth at Risk (Randour 2007). Such a database ideally would include standard documentation of routine AAT provided in any medical setting. An analogous concept involving the collection of human health and companion ani-

mal data concurrently was put forth by an NIH Working Group assessing the health benefits of pets 23 years ago; its summary report states that "future studies of human health should consider the presence or absence of a pet in the home and the nature of this relationship with the pet as a significant variable" (NIH 1987). If possible, a formal code for AAT, with standardized specifics of the AAT interaction, could be developed and included in the medical charts. An AAT database would then allow retrospective studies comparing persons who did or did not receive AAT.

There are a number of new and more powerful approaches to retrospective data analysis, but their validity is dependent on the quality of the documentation. Therefore, any standardization of both the practice and documentation of AAT could prove very useful. These data could also be used to monitor for any unanticipated deleterious effects—the desire to demonstrate the positive effect of AAT does not negate the need for ongoing assessments for patient risk.

Protection of patients and other human research subjects from undue risk is the responsibility of institutional review boards (IRBs) (Bankert and Amdur 2006), which must assess the risk versus benefit of the proposed research for the human subject(s) involved. This assessment takes into consideration all aspects of the study design and subject involvement. For randomized AAT studies in which some subjects have an animal interaction and others do not, the IRB should review the risk/benefit for both groups.

There must also be consideration for preventing undue stress on therapy animals. Animal health and welfare is of paramount concern and it is imperative to establish policies for animal source, health, temperament, and behavior and handler/animal training based on available guidelines (e.g., AVMA 2007a,b; Delta Society website). In addition, efforts to mainstream AAT will benefit from guidelines that address evaluation of therapy animals during sessions as well as limitations on the duration and frequency of therapy sessions. Handlers and other study personnel should be trained to identify signs of stress and should rest animals at appropriate intervals or terminate therapy sessions if indicated. Animal handlers and their dogs have been shown to have increased salivary cortisol during therapy work days compared to non-therapy control days. Further, cortisol level increases in handlers were directly proportional to the length of the session, while dog levels increased with the number of sessions and showed various peaks after certain session lengths (Haubenhofer and Kirchengast 2007). Institutional animal care and use committees should review AAT research protocols with regards to any potentially deleterious impacts on the animals involved (ARENA/OLAW 2002).

Finally, one should not forget that medical facilities expend a lot of resources on evaluating quality improvement and patient satisfaction and AAT should be a part of these evaluations. AAT providers should work with their institutions to query patients about their experience with it. The ultimate question is whether or not AAT benefits patients. Secondary questions should include whether such beneficial effects could have an impact on frequency and duration of

medical intervention and, ultimately, healthcare costs. Adoption of some or all of the suggestions outlined in the preceding sections will yield information that can accelerate the answers to these questions.

Beyond Clinical Endpoints

It is commonly believed that the efficacy of AAT involves a positive emotional response by the patient to the animal. Therefore, while both the NICHD/Waltham Centre and NCCAM positions understandably focus on clinical investigations, the AAT research agenda should expand to include basic studies exploring the neurological mechanism(s) underlying human-animal interactions that result in positive moods and putative health effects. Although elucidating mechanisms of action is a priority in NCCAM's strategic plan, to our knowledge there is only brief mention in the AAT literature of the use of modern neuroscience tools to explain *why* many persons feel better around pets and other animals (Kazdin 2007; Lockwood 2007). Do those who are ill or seriously injured feel differently from others around companion animals? Do they feel differently around pets than they did before their afflictions? If so, how and why?

To answer those questions, we envision a multifaceted approach that comprises neuroimaging, neurochemistry, and sociology. Advanced imaging techniques such as functional magnetic resonance imaging (fMRI) have been used in social affective neuroscience research to identify which regions of the brain are involved in various forms of human social bonding or attachment such as maternal love, unconditional love, and romantic love.

In one study, participants experiencing romantic love underwent fMRI scans while viewing photos of their partner's face and then while viewing photos of friends' faces. The friends were the same gender as the participants' romantic partners and their relationships were of the same or longer duration than those with the romantic partners (Bartels and Zeki 2000). Viewing photos of friends controlled for the effects of friendly feelings, familiarity, and visual input so that a comparison of blood oxygen level-dependent signals from the two types of images revealed attachment-specific activity in the regions of the brain unique to romantic love (Bartels and Zeki 2004). Some activated regions of the brain are shared among maternal love, unconditional love, and romantic love while others are unique to each attachment type. Some of these shared areas also overlap with the brain's reward system, which is hypothesized to facilitate the creation of strong attachments between people, presumably through pleasurable or rewarding effects (Bartels and Zeki 2000; Beauregard et al. 2009). Associations can also be made between some of these shared regions of the brain and receptors for neuropeptides such as oxytocin and vasopressin, which have been implicated in pair bonding and maternal attachment behaviors in animals (Bartels and Zeki 2004).

Furthermore, human and animal studies have shown that oxytocin has anxiolytic properties and a role in mediating

pain perception (Lee et al. 2009). The use of fMRI to study human-animal bonding, in the same way that social bonding is studied between humans, might reveal which, if any, of the brain regions associated with human-human affection are similarly involved in human responses to animals. Physiological measurements and assays for neurochemicals associated with attachment and emotion (e.g., oxytocin, serotonin, vasopressin, dopamine) coupled with pet attachment scales and demographic assessments could be performed in parallel with neuroimaging to shed further light on the interactions between human neural, endocrine, and behavioral responses to animals. And one should not ignore pet ownership and AAT intervention studies that have shown inconsistent or no health benefits, as they may shed additional light on the basis of human responses to animals.

Understanding the social context in which the human-animal bond develops may further optimize proven AAT indications. Changing health-related risk behaviors (e.g., tobacco use or the consumption of a high-fat diet) without understanding the social context in which they develop can lead to less effective intervention outcomes (Glass and McAtee 2006). Similarly, understanding the social context in which human connections to animals develop or the motivations for those connections may help elucidate the underlying mechanism of the connections. Such an understanding could provide physicians and AAT advocates with more reliable ways of customizing AAT to individual patients. Matching patients most likely to respond positively to animals with optimal AAT components (e.g., species, age, sex, breed of animal; type, frequency, duration of interactions) should translate to better and more consistent results.

Analysis of "trans-species" communication and interaction could also provide insight into some of the positive health benefits of AAT (Franklin et al. 2007). According to Franklin and colleagues, this approach would entail recording human-animal interactions, using video, audio, or direct observation coupled with human reports, and analyzing "verbal" and nonverbal interactions between the species. Although some research of this type has focused on the human side of the interaction (Franklin et al. 2007), deciphering both sides of the "dialogue" by specialists in human and animal behavior may reveal previously unknown or unappreciated aspects of this interaction and further advance AAT.

Conclusion

Animal-assisted therapy continues to grow in popularity in many healthcare settings, partly in response to published accounts of its benefits to patients that are enthusiastically embraced by AAT advocates. But those accounts often fail to employ acceptable standards for clinical research. This lack of acceptable standards results in continued doubts about the value of AAT and failure by physicians to routinely consider it in their treatments. Appropriately designed clinical studies must be encouraged to counter these perceptions and elevate the status of AAT as a logical and effective treatment modality. Establishing

standards for AAT interventions would not only facilitate the execution and reproducibility of clinical studies but also enable interpretation of results across studies and the eventual integration of AAT in medical practice. To identify which diseases or injuries and which patient populations may most likely benefit from AAT, an interdisciplinary team should perform a systematic evaluation of the AAT literature in advance of such studies. Attention should also be focused on elucidating the underlying mechanism of the human-animal interaction as those findings may help researchers and clinicians identify markers or attributes that may optimize proven AAT applications.

If AAT can be convincingly established as an efficacious, safe, and cost-effective treatment option, it could advance health care in many ways for many patients.

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