Description and Evaluation of a Canine Volunteer Blood Donor Program

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Human volunteer blood donor programs are commonplace, but the concept of nonhuman animal blood banking is relatively new. Few studies exist regarding efficacy, donor screening, and safety for volunteer companion animals. This retrospective study evaluated a nonprofit, community-based canine volunteer donor program using community blood drives. Of 98 potential donors, 14 were ineligible to donate, including 4 who tested seropositive for blood-borne pathogens. Of 84 donors, 45 were Dog Erythrocyte Antigen (DEA) 1.1 positive and 39 were DEA 1.1 negative. Donations totaling 143 included 29 repeat donors (35%). No serious adverse events occurred. Minor adverse events included acute donor reaction (2.8%), hematoma (4.2%), rebleeding (2.1%), and skin irritation (0.7%). Adverse event rates were comparable to data for human blood donations. A substantial fraction of donors donated multiple times, suggesting that volunteer donors and their guardians perceived the donation process to be safe and effective. This article discusses the issue of donor consent and use of the term *volunteer*. This study indicates that nonprofit, community-based canine volunteer donor programs for animal blood banks can be successful while maintaining high safety standards and ethical treatment of volunteers.

Advances in veterinary medicine have frequently paralleled those in human medicine, and transfusion therapy is no exception. Improvements in safety and

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technique, such as component therapy, blood typing, and infectious disease testing (Wardrop et. al., 2005) have helped to increase the safety of therapy for veterinary patients receiving transfusions (Feldman & Kristensen, 1995; Lucas, Lentz, & Hale, 2004). The demand for blood components for transfusion has led to the creation of a number of veterinary blood banks (Dyck, 1997) that specialize in blood products for canine and feline patients.

Different models for soliciting and maintaining a donor pool have been used, including closed colonies that keep dogs and cats on the premises of the hospital or blood bank (Dodds, 1993; Hohenhaus, 1994), and community programs that model themselves after human blood donor programs (Bucheler & Cotter, 1992). Closed colonies offer the advantages of easy access to donors, isolation from other animals who may be carrying infectious diseases, and the ability to maintain a steady, predictable source of blood products. However, there is legitimate concern for the welfare of donors in such programs. Currently being redrafted are ethical guidelines that call for well-defined terms under which such donors are employed, including limits on period of service as a donor and frequency of blood draws (A. Schneider, personal communication, June 1, 2004). Universal adoption of similar guidelines stalled in the past when some animal blood banks expressed fears that operating under such constraints would prohibitively increase their operating expenses (W. J. Dodds, personal communication, February 15, 2004).

Few data exist on the practices of individual hospitals that maintain in-house donor programs. Anecdotes from our own community have been sobering, including the following:

1. A veterinarian's report of a transfusion-related death because an unscreened donor was chronically infected with *E. platys* (R. Ridge, personal communication, December 4, 2004).
2. An in-house donor who was forced to donate three units of blood over a 10-day period (R. Sitarz, personal communication, January 7, 2006).
3. At least one animal who was obtained from a shelter and exsanguinated to provide several units of blood (K. Gioia, personal communication, March 8, 2004).

Although it is our hope that such incidents are rare and outside the norm, they demonstrate the need not only for a safe and reliable blood supply, but also for programs with high ethical standards for the care and treatment of their donors.

Community-based blood donor programs provide an attractive alternative to closed colonies or hospital-based donor programs. Concerns raised about community donor programs have centered on issues of feasibility. Worries about infectious disease transmission, blood type availability (particularly of rare or universal donor types), and donor retention have all been raised as potential pitfalls in the successful implementation of such programs.

There has been concern that community donor programs would find families reluctant to consent to their pets becoming donors, which could lead to exploitative practices such as paying for blood donations. Data from human donor programs indicate that such practices can result in donor exploitation and that paid donors have higher rates of infectious diseases, thus frequently making them unsuitable donors (Eastlund, 1998).

We describe a nonprofit, community-based, all-volunteer donor program for dogs that we have implemented. We evaluate our program from the aspects of donor safety, cost-effectiveness, complication rates, ethical concerns, and community integration.

METHOD

The study was conducted at an East Coast veterinary blood bank operating a community dog-donor program. A retrospective study design was used. All donor records from the period of October 2003 to December 2004 were included in the study. Data were obtained from computerized blood donor records, donor charts, and logs for infectious disease testing and donor complications. The data on donation complications were obtained by routine telephone follow-up calls placed by blood bank personnel on the afternoon following donations.

Donors had been recruited using a variety of methods, including print ads, referrals by local veterinarians, and direct appeals during community blood drives at dog events sponsored within the community. All families of prospective donors were provided with information on the donation process and signed informed consent prior to donation. Donors were required to meet the following specific criteria:

1. Be at least 1 year of age (vet approval required for donors over 8 years of age).
2. Weigh at least 50 lbs (35 lbs for "half-pint" donors).
3. Possess a good temperament.
4. Be up-to-date on vaccinations.
5. Have no prior history of blood-borne illness.

Prior to donation, the guardian completed a health history form that included questions on medical history, including vaccinations and overall health, to ensure that the donor did not have any medical conditions that might preclude a safe donation experience. Animals were assessed for voluntariness and cooperativeness prior to donation. Donors were judged to be cooperative if they appeared to be at ease, would willingly stay in place on the table prior to donation, were cooperative with the holder, and did not require force to restrain during the donation process. No sedation was used for donation. Guardian participation in

the donation process was strongly encouraged. Phlebotomy was performed using standard phlebotomy equipment (Baxter, Inc., Deerfield, IL; or Terumo, Inc., Somerset, NJ). Donors were provided with encouragement and reassurance during the donation process and treats afterward. The donation process and informed consent process were approved by the managing board of the blood bank, with input from the medical directors and members of the community. This retrospective study was approved by the blood bank's institutional review board.

Infectious disease testing was performed in-house for Lyme disease (*B. burgdorferi*) antibody, *E. canis* antibody, and heartworm (*D. immitis*) antigen using a commercially available test (IDEXX Laboratories, Inc., Westbrook, ME). Serological tests for other diseases (*E. platys, B. canis,* and *Leptospira* serotypes *Bratislava, Canicola, Gryppotyphosa, Hardjo, Ictero, Pomona*) were performed by an outside laboratory (Louisiana State University, Baton Rouge, LA). Blood typing for Dog Erythrocyte Antigen (DEA) 1.1 was performed in-house using a commercially available card-testing system (DMS Laboratories, Inc., Flemington, NJ).

During the enrollment period for this study, there were no published standards for infectious disease testing or blood typing available for animal blood banks. Blood banks screened for infectious diseases thought to be prevalent in their geographic region, so test panels differed considerably depending on the region in which the blood bank operated. Although there was no firm agreement on the frequency of testing required, the other major blood banks conducting community donor programs were also performing annual screening of donors. An interval history was taken at each repeat donation; a full rescreening was done on dogs who had shown any signs of clinical illness since the last donation.

Blood-typing practices varied widely among the different blood banks. There is universal agreement that the DEA 1.1 blood type can cause significant transfusion reactions; however, although several other canine blood types have been identified, their exact clinical significance is unclear (Giger, 2005; Hale, 2004). The policies of the various blood banks range from screening only for DEA 1.1 blood type to accepting only so-called universal donors into donation programs. A similar situation exists in human medicine, where prescreening of recipients for blood type antigens known to cause serious reactions (the ABO and Rh blood groups) is performed for every patient who receives a transfusion, whereas the compatibility of minor antigens (e.g., those of the M, N, and MN blood groups) is not routinely assessed.

RESULTS

Ninety-eight potential donors were screened over the enrollment period. Of these, 14 were disqualified during the screening process for a variety of reasons including the following:

1. Having inadequate venous access ($n = 3$).
2. Leaving blood drives prior to phlebotomy ($n = 2$).
3. Lacking ability to obtain consent ($n = 1$).
4. Being uncooperative ($n = 4$).
5. Testing seropositive for blood-borne pathogens, including *E. canis* ($n = 3$) and *E. platys* ($n = 1$). Of the 84 donors, 45 (54%) were DEA 1.1 positive, and the remaining 39 (46%) were DEA 1.1 negative. A wide variety of dogs was represented in the donor pool, with no predominance of a single breed.

The 84 donors were responsible for 143 donations. Of the 84 donors, 29 (35%) were repeat donors, with a maximum of five donations from one animal. Donors were encouraged to donate as frequently as once every 6 to 8 weeks if they wished to do so, although most repeat donors donated approximately once every 3 months. Although the majority of donors were from the local community, some families drove as long as 4 hr to bring their pets in to donate blood.

Table 1 compares our donor complications with those reported by human donor programs (Hillyer, Silberstein, Ness, & Anderson, 2003). Although no life-threatening, adverse events were reported, the most common complications were the following:

1. Acute donor reactions ($n = 4$).
2. Rebleeding from the phlebotomy site ($n = 3$).
3. Hematoma formation ($n = 6$).
4. Skin irritation ($n = 1$).

Acute donor reactions were treated with fluids (3 IV, 1 PO). No lasting adverse effects were reported.

The total cost of a single donation is outlined in Table 2. The total cost of donor enrollment at the time of the study was approximately $220 per dog. More than

TABLE 1
Donation Complication Rates for Our Donor Program Compared With Human Blood Donor Programs

Complication	Human Programs[a]	Our Program[b]
Acute donor reaction	2% to 3%	4 (2.8%)
Bruising	9% to 16% follow-up	Not reported
Rebleeding	Not reported	3 (2.1%)
Hematoma	0.3% immediate	6 (4.2%)
	0.05% follow-up	
Skin irritation	0.50%	1 (0.7%)

[a]Estimated; from Hillyer, Silberstein, Ness, and Anderson (2003). [b]$n = 143$.

TABLE 2
Cost for an Initial Donation and Donor Screening

	Cost ($)
Blood typing	15
General bloodwork (CBC/organ profile)	50
IDEXX SNAP test (Heartworm/Lyme/*E. canis*)	9
Infectious disease screen (*E. platys*, *B. canis*, Leptospirosis)	80[a]
Adjunct materials (skin prep, sample tubes, plasma cartons, PCV/TP, etc.)	5
Labor (phlebotomist plus 2 assistants)	20
Processing/labwork labor/overhead	25
Total (minus G/A expenses)	220

Note.   DEA = Dog Erythrocyte Antigen; CBC = complete blood count; PCV = packed cell volume; TP = total protein; G/A = general/administrative.
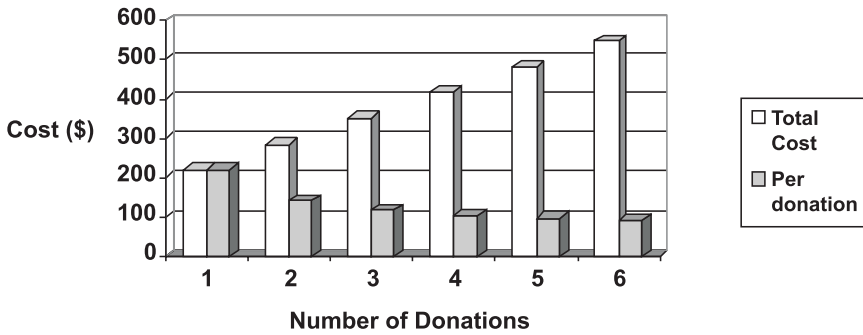

FIGURE 1   Amortizing collection and processing costs over multiple donations.

half of this cost was related to donor screening, with repeat donations resulting in considerable decrements in cost. As can be seen in Figure 1, amortization of the screening costs over multiple donations results in considerable cost savings to the blood bank. A minimum of three to four donations per year is sufficient to gain a large savings benefit from multiple donations per testing period.

A variety of strategies was employed to attract new donors and to encourage repeat donations. Each new donor enrolled received a donor ID tag. Follow-up calls were made to all guardians of animals who were seropositive for blood-borne diseases. Results of laboratory tests were made available to primary care veterinarians—whether or not the potential donor passed infectious disease screening. The blood bank's stated policy was that donors earned one free blood product for each unit donated in the event that they ever required a transfusion: If a dog donated a 450-mL unit of blood and subsequently required a transfusion of packed red blood

cells (PRBCs), the blood bank would provide—free of charge—one unit of PRBCs (the amount of RBCs in one 450 mL donation). We later extended the benefit to family members of blood donors (other pets in the household or who were blood relatives of the donor). In practice, we found such requests were infrequent. It has become the informal policy of the blood bank to provide sufficient blood products to families of blood donors in need regardless of the number of units previously donated.

During the study period, the blood bank received several calls from families seeking to donate blood from their pets in exchange for cash. In one unusual request, an individual contacted the blood bank and offered, "to round up dozens of donors," for a commission of $15 per dog. One animal hospital called, offering the blood bank the option of taking "as much blood as you like" from an animal who was scheduled to be euthanized that day. All these requests were politely, but firmly, declined.

DISCUSSION

We believe this study presents some of the first data published on seroprevalence of various infectious disease agents in canine blood donor programs. This is likely due to several factors, both practical and proprietary. There are relatively few blood banks, and each donor program operates somewhat differently. Therefore, direct comparisons among programs may not be valid. Nonetheless, we did not feel that the prevalence of infectious diseases in our pool of potential donors represented an insurmountable burden in terms of either expense or personnel. Furthermore, we found that routine follow-up calls to families of donors and veterinarians were helpful in educating the community about our presence and in generating goodwill, especially with respect to potential donors who were found to be seropositive for blood-borne diseases.

We found that the prevalence of DEA 1.1 negative and positive donors in our donor pool was similar to that in studies of the general population (Hale, 2004). This suggests that adequate amounts of blood of all types are available and that reliance on so-called universal donors can be avoided.

Human blood donor programs rely heavily on repeat donors, with estimates that as many as 50% of potential donors are repeat donors (Drake, Finkelstein, & Sapolsky, 1982). Our estimate of repeat dog blood donors was lower than this (35%) but may have been an underestimate of our true repeat rate. Eighteen new donors were enrolled within 4 weeks of the study collection cutoff. These donors were not eligible to donate again prior to the end of data collection for the study. Discounting these 18 donors altogether, the repeat rate was 44%.

Our model for donor recruitment and retention was patterned after those of human blood donor programs. Incentives of small monetary value (e.g., blood dona-

tion tags and cookies) allowed us to reward donors without creating potential conflicts of interest that might result in exploitation of donors. In human donor programs, paid donor programs have been largely phased out, as data from the 1970s demonstrated a higher likelihood of infectious disease transmission associated with blood from paid donors than from unpaid volunteers (Eastlund, 1998). Recognizing the possibility for exploitation of human donors, the American Association of Blood Banks has published a list of acceptable and unacceptable incentives for member blood banking programs (Wallas & Lipton, 1994).

The issue of donor as well as familial consent remains a central issue for the blood bank, and our understanding of this process continues to evolve. The issues raised are similar to those associated with human pediatric patients who participate in research or who must undergo clinical procedures (Kodish, 2003). In these cases, consent may be provided by the parent, but the voluntariness of the child to cooperate with the procedure is also an important consideration; where possible, the child's assent—or agreement to go along with the procedure—should be obtained (Fisher, 2004; Protections for Children in Research, 2001).

This area remains even less well-defined in animal medicine. A MEDLINE search using the keywords "informed consent" and "veterinary medicine" found only 25 articles, primarily dealing with liability issues stemming from guardians' expectations of medical therapy and their understanding of risks and benefits of procedures. In comparison, the keywords "informed consent" and "child" yielded 2,653 articles, the majority of which focused on the unique nature of the processes of consent and assent in the pediatric population.

In developing guidelines for our donor program, we chose to use ethical standards that are applied in medical research involving minors or incapacitated individuals who are legally considered unable to give full, informed consent. We believe this situation is analogous to that of companion animals. These animals do not possess full, cognitive ability to understand the blood donation procedure. Therefore, the animals cannot give legal, informed consent; however, their feelings, physical comfort, and health must not be violated in the process of donating blood.

According to U.S. regulations governing human participants' research—situations in which "no greater than minimal risk" is present—research may be conducted on human pediatric patients without the consent of their guardians (Freedman, Fuks, & Weijer, 1993). In research involving "minor increase over minimal risk," with no direct benefit to the participant, a guardian with no competing interest in the research and who is acting in the best interest of the potential research participant must give informed consent. Although the definition of *risk* is subjective, surveys demonstrate that minor procedures such as venipuncture are consistently considered to pose either minimal risk or minor increase over minimal risk (Janofsky & Starfield, 1981; Shah, Whittle, Wilfond, Gensler, & Wendler, 2004). As such, we sought the informed consent of the donor's guardian because guardians may be presumed to hold the best interest of their pets at heart and there-

fore are best able to interpret their animals' attitudes and emotions regarding willingness to donate blood. We also sought as best we could to evaluate the animal's assent to the process, as demonstrated by voluntariness and cooperation.

The language "volunteer donors" is not lightly chosen, and it is not meant to be an inappropriate anthropomorphism of the donor dog. We do not suggest that the animals have the full, cognitive capacity to understand all aspects of their participation. However, animals do express basic emotions such as joy and fear and can express their willingness to participate by being cooperative or uncooperative. By choosing to consciously consider our donors as volunteers, we are constantly reminded that their assent and cooperation is an essential component of their participation in the donation experience.

It is sometimes easier to identify potential donor dogs who are unwilling to volunteer than it is to convince their human guardians that this is, in fact, the case. We have more than once gently explained to disappointed guardians that we were grateful for their generosity in bringing their dogs in to donate but that their dogs did not appear to be willing to do so. We provided reassurance that, if both they and their dogs were willing participants in the donation process, they were welcome to return in the future but that we could not draw from the dogs that day.

Of key importance for us has been the emphasis on a positive donation experience for donors and their guardians. Guardians are encouraged to be active partners during the donation process, in clear sight of their pets and able to provide love and reassurance during the donation process. Although not all guardians wish to watch their pets donate blood, the majority of guardians have found the experience satisfying, and it serves as important reassurance to them that their pets are treated well during all aspects of the blood donation process.

Blood donation is essentially an altruistic process. Those who donate are in good health; because of this, they are less likely to require a blood transfusion themselves. However, there are both direct and indirect benefits to donors and their families. Some donors earned credits at the blood bank that helped siblings who later required transfusion therapy. Families of potential donors who tested seropositive for blood-borne diseases were notified by the blood bank so that their dog could receive follow-up evaluation to rule out (or in some cases treat) chronic, low-level infections that might otherwise have gone undetected until they caused substantial harm to the animal.

Guardians frequently were current or former blood donors themselves, and their stated reasons for bringing their dogs to donate were similar to their own reasons for donating. Some donor families had pets (or pets of relatives or friends) who had required transfusions in the past, which had increased their awareness of the importance of blood donation. Others cited an intrinsic reward from the act of donation or general concern for the community. Some families of donors were aware of the existence of captive donor programs and emphasized the importance of supporting an alternative to such programs.

Because blood donation is not a necessary procedure for the well-being of the donor animal, donor safety and comfort are paramount. We found that our donation complication rates were comparable to those of human blood donor programs.

Acute donor reactions are a common, recognized complication of human blood donations. Symptoms include pallor, light-headedness, and orthostatic symptoms. They are usually treated with rest and oral fluids such as orange juice. In our donors who experienced such reactions, slight pallor was noted at the gums and conjunctivae, and one donor actually exhibited two steps of a wobbly gait after jumping down from the donation table. In the rare instances of acute donor reactions in our program, both oral and intravenous fluids proved to be equally effective treatments. Although fainting has been reported to occur on occasion with human blood donors, none of our canine donors experienced alterations in level of consciousness.

Although we experienced insufficient numbers of such donor reactions to draw firm conclusions as to their etiology, one major concern was that guardians might not know the exact weight of their dogs at enrollment. Scales were not always available when blood drives were held at venues such as public parks. The blood bank addressed this issue by using 250-mL collection devices for dogs for whom an accurate scale weight was not immediately available and who were not clearly over the 50-lb minimum. The blood bank also introduced a "half-pints" program for dogs with a documented scale weight of at least 35 pounds, who could also donate 250 mL. Since the adoption of the 250-mL collection devices, we have had no acute donor reactions in the ensuing year and a half of operation.

Rebleeding and hematomas were not life threatening but, nonetheless, were anxiety provoking. The incidences of these complications were reduced by bandaging of the phlebotomy site and teaching guardians to avoid putting the leash on the collar immediately after donation. A commercial skin prep device (Medi-Flex, Inc., Leawood, KS) was used to reduce the incidence of skin irritation and secondary bacterial infection of irritated sites.

Both psychological and physiological well-being were important for both donor and guardian. Proach (2005) discussed issues of restraint for children undergoing clinical procedures, suggesting that for medical procedures—after employing a variety of distracting techniques—forceful restraint should be used as a last resort. We considered the apparent need for forceful restraint as an unequivocal sign of lack of assent on the part of the donor. However, giving donors time to sniff about and acclimate themselves to the new environment, the provision of reassurance by guardians and staff, and distraction techniques during donation all proved to be useful in helping put prospective donors and their families at ease.

Although we did not formally track the number of inappropriate and potentially exploitative offers we received for blood donations, the regularity and frequency of such requests made them worthy of notice. These incidents served to underscore

the importance of carefully considering the ethical dimensions of building and maintaining a donor pool and ensuring that appropriate policies are in place to protect donor welfare before recruitment begins.

Community Outreach

Although not directly studied in this investigation, it has been our experience that as a nonprofit, community-oriented blood bank, community outreach was an essential part of securing and maintaining a donor pool. Our initial experiences with the local pet community and, in particular, with the rescue organizations, revealed that such organizations were deeply suspicious of animal blood banks. The concerns expressed were primarily ethical ones related to the treatment of donors and animal exploitation. Some members of animal rescue groups expressed particular distaste for the notion of captive donor programs (Friends of Greyhounds, 2006). The community donor model was well embraced by our local rescue community, as evidenced by the large number of rescue staffers whose personal pets signed on as blood donors.

Community outreach was also directed at local veterinarians. Transfusion practices in our community varied widely, from referral practices well versed in component therapy to individual practices that kept an untyped, untested donor "in the back" for donations as needed. Educational programs and materials offered by the blood bank advanced the notion of using typed, tested blood components instead of untyped, untested whole blood.

Finally, community awareness programs of no direct benefit to the blood bank were also offered to the community, most notably in the form of our popular Pet First Aid program, offered in conjunction with the local Department of Parks and Recreation. These classes offered people the opportunity to learn important and life-saving skills for the emergency care of their pets. It also gave them the opportunity to learn about the existence of the blood bank outside the context of a request for a blood donation.

Limitations

This study is limited by the fact that only one blood bank in one geographic area was studied. A multicenter study involving blood banks in multiple communities would allow for a better understanding of how to create community donor programs in diverse geographic and socioeconomic environments.

A long-term, prospective study would allow for the continued evaluation of community donor programs to better understand how these programs would change and grow over longer periods.

CONCLUSIONS

Nonprofit, community-oriented, animal blood banks can be successfully implemented. Adequate numbers of community donors can be successfully enrolled and retained using incentives similar to those provided by human blood banks (e.g., donor tags and medical screening tests) without resorting to potentially exploitative paid-donor programs. Retention rates were comparable to those of human volunteer donor programs.

Nonprofit, volunteer, community donor programs can provide a safe and reliable blood supply without undue cost burden on the veterinary medical community. A relatively small number of donors failed infectious disease screening, and donor retention programs helped amortize the costs of infectious disease screening. The blood bank also performed a service of value to the community by identifying asymptomatic animals who were carriers of blood-borne infectious diseases.

The primary justifications provided for captive donor programs do not appear to be valid, and the implementation and maintenance of such programs should be strongly discouraged in almost all instances. This is especially true of for-profit entities, in which ownership of donors by the blood bank creates an inherent conflict of interest. Community-based programs can provide an affordable, safe, and reliable blood supply while reducing the risk of exploiting animal donors.

Nonprofit animal blood banks are well received by their respective communities. The nonprofit status of the blood bank encouraged donor participation and created the opportunity to engage the community in programs such as the Pet First Aid program. Donor and family satisfaction rates were high, as evidenced by the high repeat donation rate.

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