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¹9 out of 10 dogs that demonstrated a preference in the studies preferred NexGard Spectra®.

References: 1. Perier N, Carithers DS, Everett WR, et al. Preference of Dogs between Two Oral Formulations of Endectoparasitides: NexGard Spectra® (Afoxolaner and Milbemycin Oxime) and Simparica Trio™ (Sarolaner, Moxidectin and Pyrantel). Open Journal of Veterinary Medicine 2020;10:155-163. 2. Perier N, Carithers DS, Everett WR, et al. Preference in Dogs of Two Oral Endectoparasiticide Formulations: NexGard Spectra® (Afoxolaner and Milbemycin Oxime) and Credelio® Plus (Lotilaner and Milbemycin Oxime). Open Journal of Veterinary Medicine 2021;11:289-298.

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ORIGINAL RESEARCH

Why some canine and feline blood donors do not make the cut: A cohort study

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Abstract

Background: While there has been extensive investigation into the selection and retention of human blood donors, veterinary research in this area is limited. This study aimed to identify the reasons for the rejection and withdrawal of canine and feline blood donors from a blood donation programme.

Methods: Records of cats and dogs presenting as prospective blood donors and/or donating between 2014 and 2019 were analysed. Reasons for rejection at sign-up were categorised into medical and temperament. Reasons why animals left before retirement age were categorised into medical, temperament and owner related.

Results: Data from 362 dogs and 134 cats were analysed. Cats (20.8%) were more likely to be rejected than dogs (5.2%) at sign-up, mostly due to medical reasons. Both species often left the blood donor service early due to temperament reasons. Owner and medical reasons for leaving early were also common.

Limitation: This was a retrospective study with subjective assessment of temperament.

Conclusions: Inability to donate due to temperament and medical reasons is common. When recruiting blood donors, it should be recognised that a fairly high proportion will not be successful. Owner understanding and motivation are essential to ensure successful selection and retention of donors, which allows amortisation of recruitment costs.

KEYWORDS

behaviour, blood donor, cardiomyopathy, transfusion

INTRODUCTION

With advances in small animal critical care, there is increasing demand for feline and canine blood donors.^{1–4} However, the availability of blood products has remained limited.^{1,5,6} This is largely due to low awareness of pet blood donation among the general public and a need to improve recruitment, with feline donors being particularly difficult to recruit.^{6,7}

Blood donation poses an ethical dilemma as, while it benefits the recipient, it does not directly benefit the donor.^{8–10} Therefore, it is essential that the procedure causes as little distress as possible and results in minimal health risks to the donor. To protect recipients of blood products, it is important to screen donors to minimise the risk of transmission of blood-borne diseases.¹¹ Careful selection of donors is therefore

vital, involving screening for medical conditions and for temperament to minimise risk to both donors and recipients. An 'agreeable temperament' should result in easy handling and restraint, but more importantly, it should be further defined as an animal who is not unduly stressed or unhappy during donation.^{12,13}

In human medicine, extensive research has been conducted on blood donor selection and retention in order to drive evidence-based maintenance of a safe blood supply.¹⁴ The percentage of prospective human blood donors rejected at the sign-up appointment, based on interview, medical exam and haemoglobin concentration, varies greatly with geography, but in the European Union, it averages approximately 10% of candidates.¹⁵ Only 38% of new blood donors in England and North Wales return to donate again within 6 months.¹⁶ Human blood units are tested

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post-donation for infectious diseases, with only one in 10,000 units testing positive.¹⁷

Given the difficulty in recruiting donors and the cost of screening tests, it is important to maximise the retention rate of successful canine and feline donors to allow amortisation of the cost of health and infectious disease screening tests.^{13,18} Pet owners' motivations to present their pets for blood donation are similar to those of people donating blood.^{7,9,13,19} The reasons why animals do not pass the selection process for blood donation and why they stop donating before retirement age are not known. This information would be useful to facilitate successful recruitment and retention of donors.

In this retrospective study, we aimed to identify the frequency of, and reasons for, the rejection of animals who present as potential blood donors and why some of those selected leave the scheme before retirement age.

METHODS

This was a retrospective cohort study. The records of a university teaching hospital's blood donor programme (BDP) were searched for all dogs and cats that presented as prospective donors between 1 January 2014 and 31 December 2019 as well as the ones that left the donor programme during this period (for all reasons, including retirement). Animals recruited during this period (via social media posts, posters and leaflets at the hospital and through word of mouth from donor owners, hospital clients and staff) were assessed for donor suitability in an initial appointment that involved assessment of temperament and health (with a physical examination, assessment of complete blood count, biochemical profile, tick-borne disease PCR status and, for cats, feline leukaemia virus antigen, feline immunodeficiency antibody testing and echocardiography—see Appendix 1 for full details). Both cats and dogs were only recruited to the programme if it was felt that they would be able to donate consciously. In some cases, cats were retained on the programme even if they were felt to benefit from 0.2 mg/kg butorphanol intramuscularly or intravenously prior to donation. These cats then donated solely for the purposes of immediate recipient need for blood products. Animals who performed one-off emergency donations for specific recipients were excluded from the study.

Animal signalment, sign-up date, and first and last donation dates were recorded. Animals were categorised as either 'rejected' (not accepted onto the scheme after the assessment appointment), 'left early' (left the programme before they reached retirement age) or standard donors (either still donating at the end of the period or having retired at the standard retirement age). The reasons for the 'rejected' and 'left early' animals leaving the programme were classified as either due to 'temperament' (further subdivided into aggressive and non-aggressive based on the descriptive terms used in the notes), 'medical' or 'owner' reasons (see Figure 1).

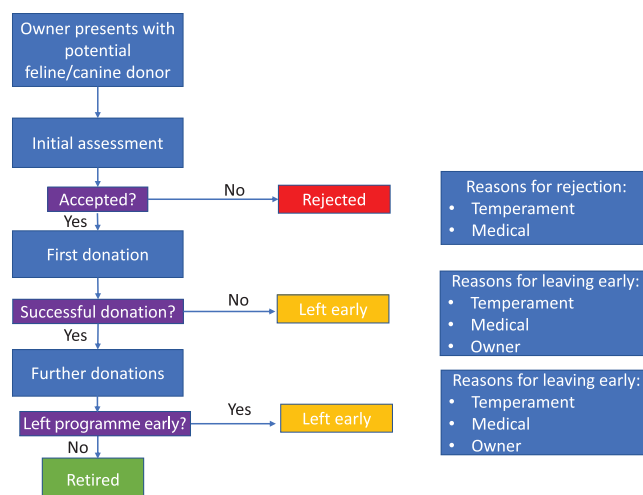


FIGURE 1 Animal progression as a prospective blood donor

Data analysis

Categorical data were entered into an Excel spreadsheet, and proportions and percentages of animals in each category and subcategory were calculated. Kurtosis and skewedness tests were performed on the age of the dogs and cats at sign-up to assess for normal distribution using Excel.

The rejection rates of dogs and cats at initial assessment for medical and temperament reasons were compared. The proportions of animals accepted during the study period who left early for medical, temperament and owner reasons were compared. Chi-square tests were used to evaluate statistical significance (a *p*-value less than 0.05 was deemed significant) between the dogs and cats in each category or subcategory.

RESULTS

Signalment of animals

Records of 362 dogs and 158 cats were reviewed. Twenty-four feline donors who performed one-off emergency donations for specific recipients were excluded, leaving 362 dogs and 134 cats in the study. Labrador retriever ($n = 85$), crossbreed ($n = 52$), greyhound ($n = 37$) and German shepherd ($n = 22$) were the most common dog breeds, and domestic short-haired cat ($n = 88$) was the most common cat breed. The mean age of dogs at the initial assessment appointment was 3.35 years (SD 1.81), and that of cats was 3.28 years (SD 1.87).

Rejection of dogs and cats presented as possible donors

During the study period, 432 dogs and cats were presented as prospective blood donors. Significantly more cats (26/125 [20.8%]) than dogs (16/307 [5.2%]) were rejected at the sign-up appointment ($p < 0.05$) (Figure 2).

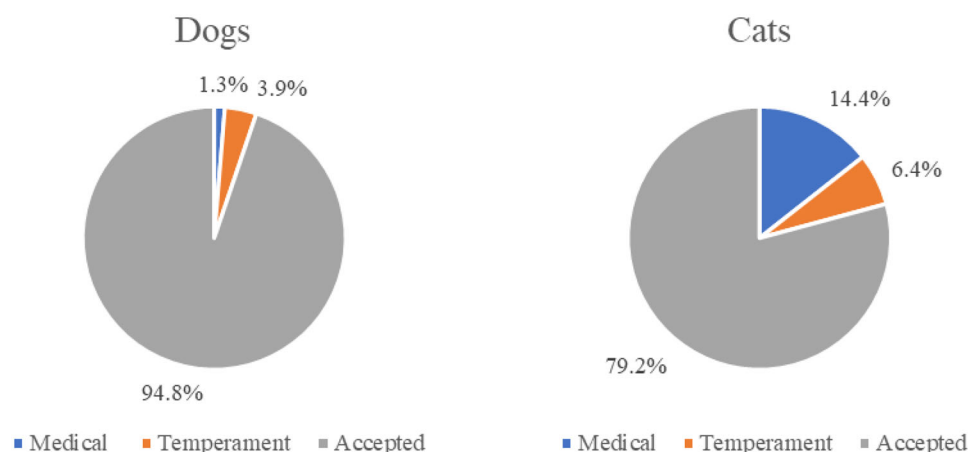


FIGURE 2 Proportion of dogs and cats rejected at sign-up (reasons for rejection divided into medical and temperament categories) out of all those presented during the study period

Out of the 16 dogs rejected, four (25%) were due to medical reasons and 12 (75%) were due to temperament reasons (all non-aggressive). The medical reasons were hepatopathy in two dogs and mitral valve disease and chronic kidney disease in a single dog each. Of the 26 cats rejected, 18 (69.2%) were rejected for medical reasons, and eight (30.8%) were rejected for temperament reasons (three aggressive and five non-aggressive). Of the cats rejected for medical reasons, nine of 18 (50%) had cardiac disease—predominantly hypertrophic cardiomyopathy (HCM). Three cats had a positive *Candidatus Mycoplasma haemominutum* PCR titre, and three cats (from the same household) were feline leukaemia virus (FeLV) antigen positive. Two cats had hepatopathy, and one had feline allergic airway disease. Cats were significantly more likely to be rejected for medical reasons (18/125 [14.4%]) than dogs (4/307 [1.3%]) ($p < 0.05$).

Dogs and cats that left the blood donor programme early

A total of 114 dogs and 48 cats left the BDP earlier than retirement age (once they reached the age of 9 years for dogs and upon reaching 9 years for cats prior to October 2017 and 11 years for cats after this point following a policy change) during the study period. Twenty-nine of 114 dogs (25.4%) and 13 of 48 cats (27.1%) left for medical reasons, with the most common causes being dermatological and cardiac for dogs and sudden death and cardiac disease for cats. One dog was recorded as leaving for medical reasons in the records but with no diagnosis noted (Tables 1 and 2).

Temperament was the reason for 49 of 114 (42%) dogs and 18 of 48 (37.5%) cats leaving early. Two (4%) dogs were aggressive and five (10.4%) cats were aggressive. Of the 49 dogs who left early due to temperament, 31 (63.3%) were described as having mild temperament issues ('slightly anxious/wiggly/excitable') at sign-up, with these traits worsening at donation. However, 18 out of 49 (36.7%) of these dogs were described as having a good temperament at sign-up. Eleven

TABLE 1 Medical conditions of dogs that left the programme early

Medical conditions	No. of dogs
Dermatological (five AD, one MCT)	6
Cardiac (three MVD, one atrial mass)	3
Difficult veins	2
Haematological	2
Inflammatory bowel disease	2
Liver	2
Neurological	2
Died	1
Foreign body ingestion	1
Genitourinary	1
Hypothyroid	1
Joint disease	1
Lungworm	1
Prostate cancer	1
Renal failure	1
Respiratory	1
Unknown	1
Total	29

Abbreviations: AD, atopic dermatitis; MCT, mast cell tumour; MVD, mitral valve disease.

(60.1%) of the 18 cats that left early due to temperament were described as having a good temperament at sign-up but either failed at first donation and were considered unsuitable for further donations (five cats) or became more resistant to donation with time (six cats).

Owner reasons were responsible for 36 of 114 (31.6%) dogs and 17 of 48 (35.4%) cats who left early (Table 3). Owners moving away and owners not responding or cancelling appointments were the common owner-related reasons why dogs left the BDP early. Six owners never returned after their pet was temporarily medically deferred due to an abnormal blood test.

TABLE 2 Medical conditions of cats that left the programme early

Medical conditions	No. of cats
Died	5
Cause unknown	1
Lymphoma	1
Road traffic accident	3
Cardiac	4
Aortic thromboembolism	1
Hypertrophic cardiomyopathy	3
Persistent anaemia	2
Infections	1
<i>Candidatus Mycoplasma haemominutum</i>	1
Other	1
Otitis media and stress cystitis	1
Total	13

TABLE 3 Animals that left early due to owner reasons.

Owner reasons	No. of dogs	No. of cats
Moved away	15	9
Travel outside the UK	3	0
Did not respond/cancelled	10	7
Owner sick	2	0
Medical deferral and did not return	6	0
Anxious about medical risk	0	1
Total	36	17

Nine dogs were accepted but did not make their first donation, either because of owner reasons (two did not return calls, three did not attend their appointment and one owner said they had changed their mind) or because of medical conditions that developed between assessment and first donation (three dogs, one died from meningitis, one had recalcitrant genitourinary infections and one ingested a foreign body that led to numerous hospitalisations). Twenty-five dogs did not return after their first donation (Figure 3).

Seven cats never made it to their first donation, five of these due to the owner not returning calls and two died in a road traffic accident. Figures 3 and 4 demonstrate the number of cats and dogs that left early at various points after being accepted and the reasons why they left.

DISCUSSION

In this retrospective study we aimed to identify the frequency of, and reasons for, rejection of animals who present as potential blood donors as well as the reasons why animals leave a blood donor programme before retirement age. In human medicine,

the deferral (which is generally a temporary rather than permanent rejection) rate for donors is close to 10%.^{20,21} However, the comparison to human blood donors is imprecise, as the animals rejected in this study were not allowed to donate at a later date. Permanent rejection was noted as 1.81% in one human study.²¹ The rejection rate for cats was therefore very high in comparison, at 20.8%, and it was significantly higher than the rejection rate for dogs (5.2%). Cats were more likely to have an occult medical condition than dogs, with HCM being the most common condition detected in prospective feline donors (6.4%). Previous studies, using the same diagnostic criteria, have found HCM prevalence among asymptomatic healthy cats to range between 14.7% and 16%; therefore, this high prevalence is unsurprising.^{22,23}

Infectious diseases resulted in rejection or early loss from the programme in seven cats, with either a positive *Candidatus M. haemominutum* PCR result or FeLV antigen detected (with the latter cats all being from the same household). Tasker et al.²⁴ found that 16.9% of blood samples from 426 sick and healthy UK cats were positive for *M. haemominutum*. The lower prevalence in this study may be due to the requirement for preventative flea treatment for prospective donors. FeLV rates vary greatly between different cat populations, ranging from 0% to 11.4% in the UK.²⁵

Very few dogs were rejected for medical reasons, and there was no predominant condition. None of the dogs was positive for blood-borne infections, consistent with a previous UK study that found 98.5% of 262 dogs were negative on initial PCR testing for haemotropic mycoplasma, *Bartonella*, *Babesia*, *Leishmania*, *Ehrlichia* and *Anaplasma* spp., with the remaining 1.5% testing negative on repeat PCR.²⁶ It is important to note that there is significant geographical variation in these, and other, diseases, so these results will not be applicable to many BDPs, even within the UK, if there are changes in the prevalence of these diseases with increasing pet travel and changes in climate.

Perhaps surprisingly, of the prospective donor animals that were rejected, the percentage of cats that were rejected due to temperament was not higher than that of rejected prospective donor dogs (although a higher proportion of cats presenting as prospective donors was rejected overall). These findings may reflect the fact that cat owners are less likely to volunteer a cat with an unsuitable temperament, as most cat owners perceive a trip to the veterinarian as stressful for their pet.^{7,27} More than 70% of guardians report their cats to be stressed at all stages of the veterinary visit, including during transport and at home afterwards.²⁸ Dogs are generally more tolerant of veterinary visits and are more cooperative, so they may be perceived as coping when in fact they may be distressed. De Luca et al.¹³ found that dog owners may be so keen for their dogs to become blood donors that they do not pick up on their pet's reluctance to participate. Hence, it takes a more relaxed animal for a cat owner to perceive them as having a suitable temperament for donation than it does for a dog owner,

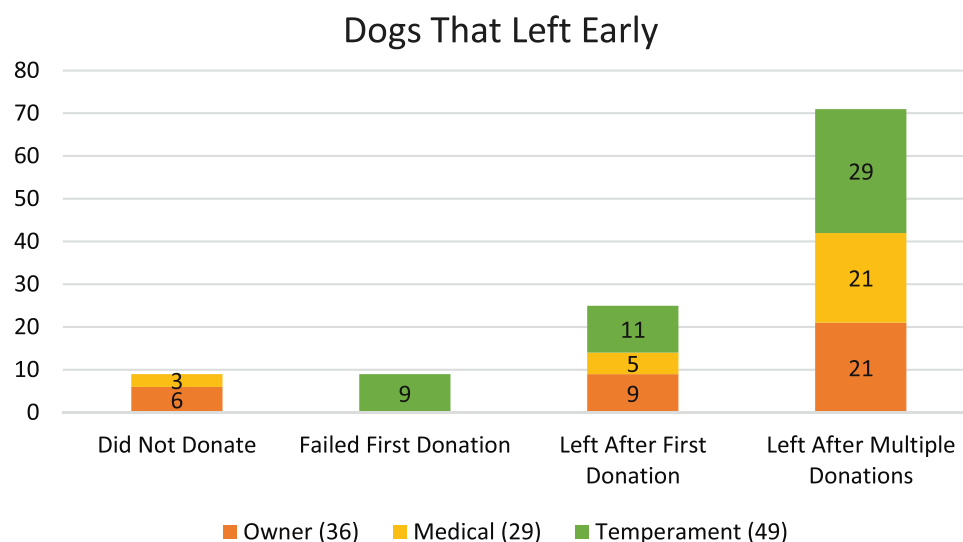


FIGURE 3 All dogs that left early during the study period at various points after being accepted, broken down into owner, medical and temperament reasons. All dogs in the failed first donation category were deemed to have a temperament unsuitable for further attempts

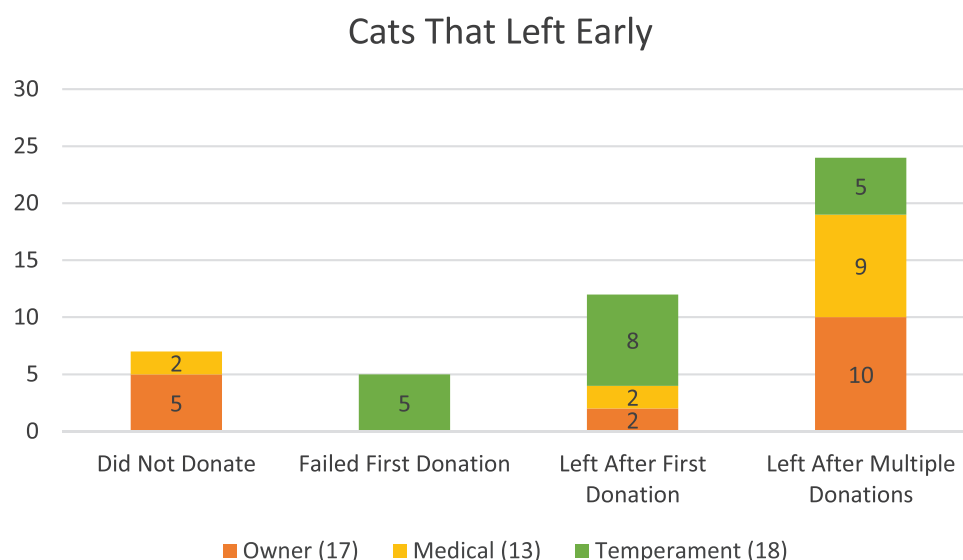


FIGURE 4 All cats that left early during the study period at various points after being accepted, broken down into owner, medical and temperament reasons. All cats in the failed first donation category were deemed to have a temperament unsuitable for further attempts

the latter being more malleable and predictable than cats. When temperament was noted to be unsuitable for donation, aggression was more common in cats, and excitability was more common in dogs.

When considering animals that left the BDP early (prior to retirement age), medical reasons were common. The most common medical problem causing a dog to leave early was atopic dermatitis requiring medication. This is consistent with a high prevalence of dermatological conditions in first-opinion consultations.²⁹ The most common medical reason for cats to leave early was the development of HCM.

It is interesting that some animals, once accepted, never donated because their owners did not return calls or did not attend their appointment. We can only speculate as to the reasons for this. Maybe owner-veterinary communication was suboptimal or perhaps the owner changed their mind after receiving more information. Similarly, some animals did not return

after their first donation, even though they were suitable from a medical and temperament perspective. Parallels are found in human medicine, where 38%–45% of human first-time donors do not return for further donations.^{16,30} Time constraints and inconvenience are the main reasons given, with staff interaction, time spent waiting and physical side effects described as less important factors.^{30,31} This highlights the need for good communication and the need to ensure that both the animal and the owner are suitable. The owner must be committed, flexible and invested.^{32,33}

Some dogs and cats failed at their first donation due to temperament despite being described as having good demeanour at sign-up. A few cats in this category were described as 'relaxed' at sign-up but were 'aggressive' on their first donation appointment. This may be because, although blood donation is simulated at the assessment appointment, blood sampling is less

stressful and shorter in duration than undergoing an actual donation.

Aggression was a more common occurrence in cats (10.4%) who left early for temperament reasons than in dogs (4%). This is unsurprising, as cats are generally less predictable and less cooperative than dogs.²⁷ The assessment of temperament at sign-up did not necessarily correspond with whether a dog or cat would leave due to temperament reasons later on. Many animals' behaviour varied between donations. This highlights the need to reassess animals carefully at each visit as, while some animals can become more tolerant of veterinarian visits, others may become increasingly anxious.³⁴ Furthermore, nurses may have varied in how they assessed temperament, with some more likely to reject animals or indeed accept animals with suboptimal temperaments than others. It is possible therefore that some cats and dogs could have left the programme when they could have gone on to donate successfully and without stress.

The most common owner reason for dogs and cats to leave the BDP early was the owner moving away. This was followed by the owner not responding/cancelling/stating time constraints. Increased distance to the place of donation is also recognised as an impediment to human donors, who cite not having a convenient place to donate as the main barrier to continued donation.³¹ Finding solutions to this and other owner-related barriers to donation would be very beneficial, as, at this point, significant investment in these donors in the form of both money and time has been made. Whereas medical and temperament reasons cannot generally be overcome, owner-related reasons for donor loss could be surmountable.

Non-return after temporary medical deferral is well recognised in human blood donors.^{35–37} We observed a similar group of owners who stopped attending with their animals after they had been temporarily deferred because of an abnormal blood test. Many reasons have been found for this in human medicine, including a feeling of rejection,³⁸ annoyance at having one's time wasted,³⁹ breaking the habit of donation and a perception of added practical and emotional hassle.³⁵ Human donors who originally attended due to social pressure or were not fully committed may also feel relieved.³⁵ All these reasons could apply to animal owners. This again highlights the importance of recruiting fully motivated and engaged owners.^{13,32,33} Careful discussion of the reasons for deferral with owners is clearly therefore important to decrease the risk of losing these potential donors.

This was a retrospective study, meaning that there were several limitations. Probably most importantly, descriptions of behaviour were variable and non-standardised. Assessment of temperament is subjective and will depend on the nurse, owner and animal. There were four blood transfusion nurses during the study period, with likely variations in their assessment and description of temperament. This may in part explain why some animals who passed at sign-up failed for temperament later. This study was per-

formed using data from a single UK blood bank, so it is possible that findings may be different in other blood banks, particularly in other countries where subclinical diseases may differ and where cats may be sedated for donation. However, human blood bank data do suggest similarities worldwide with donor retention.

The finding that cats were more likely to be rejected at sign-up than dogs is important to recognise as this should drive focus on feline blood donor recruitment at small animal blood banks. Little can be done about the medical reasons for rejection or leaving early, but perhaps a more consistent approach to temperament assessment and recognition of the variability in donor behaviour between appointments may decrease the loss of donors due to temperament issues. Also, further research and understanding are needed to explore the demographics of owners who stop attending the donor programme. It is essential to emphasise that it is not only the animal being recruited to the BDP but also an animal-owner combination, and owner commitment and understanding is paramount. By addressing the owner reasons that lead to otherwise suitable animals not returning to donate, retention rate can be improved, which will allow more effective amortisation of screening costs.

AUTHOR CONTRIBUTIONS

Karen Humm and Marjanne Descamps jointly conceived and wrote up this study. Marjanne Descamps was responsible for data collection and analysis.

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CONFLICT OF INTEREST STATEMENT

The authors declare no conflicts of interest.

FUNDING INFORMATION

The authors received no specific funding for this work.

DATA AVAILABILITY STATEMENT

The data that support the findings of this study are available from the corresponding author upon reasonable request. The data are not publicly available due to privacy or ethical restrictions.

ETHICS STATEMENT

This retrospective study involved collection of routinely collected data about pets from hospital blood bank records. Owner consent for data collection was obtained. All patient-identifying information was removed prior to data analysis.

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SUPPORTING INFORMATION

Additional supporting information can be found online in the Supporting Information section at the end of this article.

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