

# Interdog household aggression: 38 cases (2006–2007)

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**Objective**—To analyze factors associated with interdog household aggression and determine treatment outcomes.

**Design**—Retrospective case series and survey.

**Animals**—38 pairs of dogs with interdog household aggression. Each pair of dogs was considered 1 case.

**Procedures**—Records of dogs with interdog household aggression that were examined during initial or follow-up consultations at a veterinary teaching hospital from December 5, 2006, to December 5, 2007, were analyzed for clinical features. Data regarding outcome, owner compliance, and efficacy of recommended treatments obtained by use of a follow-up survey were evaluated.

**Results**—Most cases (30/38 [79%]) of interdog household aggression involved same-sex pairs; 26 of 38 (68%) cases involved 1 female or a pair of females. Instigators and recipients of aggression were clearly identified in 27 of 38 (71%) cases; most instigators were the younger of the pair (20/27 [74%]) or were newer additions to the household (19/27 [70%]). Fight-eliciting triggers included owner attention, food, excitement, and found items. Some dogs had risk factors for behavior problems such as a history of living in multiple households (21/51 [41%]), adoption after 12 weeks of age (20/51 [39%]), or being acquired from a shelter (17/51 [33%]). Effective treatment recommendations included implementing a so-called nothing-in-life-is-free program, giving 1 dog priority access to resources, and administering psychotropic medication. Frequency and severity of fighting were significantly reduced after consultation. Owners reported a 69% overall improvement following treatment.

**Conclusions and Clinical Relevance**—Most treatment strategies were considered effective. Consistency and predictability of social interactions are essential in resolving interdog household aggression. (*J Am Vet Med Assoc* 2011;238:731–740)

Interdog household aggression (sometimes described as sibling rivalry, whether or not the dogs involved are genetically related) is a distressing problem for dog owners and a common reason that owners seek behavioral advice or veterinary medical treatment. It is not uncommon for 1 or both dogs to require treatment for injuries or for owners to need medical attention for injuries received while interceding in a dog fight. Interdog household aggression tends to result in more severe injuries than do fights between dogs from separate households.<sup>1</sup>

The authors of several publications have examined the issue of interdog household aggression.<sup>1–8</sup> The most thorough description of the problem with treatment and outcome assessment was published in 1996 by Sherman et al.<sup>1</sup> The authors reported that typically 1 dog instigates fights and that often this is the younger of the 2

## ABBREVIATIONS

|     |                       |
|-----|-----------------------|
| AKC | American Kennel Club  |
| CI  | Confidence interval   |
| VAS | Visual analogue scale |

dogs or is a newer addition to the household. The study also found that fights most often occur between dogs of the same sex (usually pairs of females). Fight-eliciting triggers include physical resources, owner proximity or attention, and access to confined spaces; another common trigger for fights is excitement, which may occur during greetings, play sessions, walks, or automobile rides.<sup>1</sup> In addition to actual fights, typical behaviors observed in cases of interdog household aggression include mounting, blocking, standing over the other dog, posturing, staring, and vocalization.

It has been postulated that interdog household aggression occurs when dogs attempt to establish or reestablish a hierarchy<sup>2,5</sup> or when a dominant-subordinate relationship is contested.<sup>1</sup> Fighting in interdog household aggression cases often begins when circumstances are changing (eg, an older dog becomes sick or dies, a new dog is added to the household, or a younger dog becomes socially mature). Hierarchies are dynamic and are established by many factors including competition over resources that are valuable to 1 or both dogs, mem-

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ories of past encounters over resources, motivational differences, and responsiveness to threat or deference behaviors.<sup>9</sup>

The outcome for interdog household aggression is reported to be worse if the instigating dog is the younger of the 2 dogs, if a human has been bitten, or if the owner cannot predict when the aggression will occur.<sup>1</sup> If an older dog in the home cannot fend off the challenge of a younger dog or a dog does not recognize deference and becomes a chronic instigator, severe injuries may result. In such circumstances, dogs may need to be kept separated for safety purposes.

Alliance aggression is a type of interdog household aggression in which dogs fight in the presence of their owners and are frequently reported to coexist peacefully when left unsupervised in the household.<sup>10</sup> Dogs with alliance aggression typically fight over owner attention, and many skirmishes occur around doorways or hallways when the dogs simultaneously try to greet their owners. These fights may be intense because the owner is associated with valuable resources. It has been postulated that owners may contribute to interdog household aggression and leave unresolved conflict between the dogs if they treat their dogs equally, show sympathy to a dog that instigates fights, or punish a dog that instigates fights.<sup>1-5</sup> Domestic canines are sensitive to inequity in offering rewards,<sup>11</sup> and this could lead to subsequent conflict. Interdog household aggression can be a response to inconsistent interactions in the household, which may create anxiety and tension between the dogs. Dogs that have lived in multiple households or shelters may have received mixed messages from previous owners or cohabitating dogs. Also, owners in the same home may behave inconsistently and respond differently in the same situation.

Interdog household aggression may also result from a lack of communication or miscommunication between the dogs involved.<sup>8</sup> If a dog does not display or recognize communication signals properly, its inappropriate actions may lead to an aggressive encounter. A dog may be at risk to act inappropriately if it was not well socialized with other dogs, was orphaned or hand-raised, or was born without littermates.

After examination to rule out physical disorders such as endocrine abnormalities or pain, treatments for interdog household aggression include avoidance of fight-eliciting triggers, the use of a head collar or trailing leash for physical control, and the use of an aversive citronella spray or a physical barrier such as a board to separate fighting dogs. Use of a muzzle is not typically advised as it may increase anxiety or give 1 dog a physical advantage.

A common behavioral approach to resolving interdog household aggression includes selection of 1 dog to consistently receive the first access to resources and the best resources (eg, food, treats, toys, owner attention, having a leash put on, and access to doorways and furniture). Determination of which of the 2 dogs to support (ie, which dog will be provided priority access to resources) is typically based on age, sex, health, and tenacity<sup>2</sup>; this may be difficult in a clinical setting where time spent with the dogs is limited and owners may not describe behavioral interactions accurately.

One method is to support the younger, healthier, larger, or more confident dog, and the aggressor may possess these qualities.<sup>3</sup> Alternatively, a senior support program may be suggested in which the eldest dog or the dog that was acquired first receives support.<sup>5</sup> It has been recommended that clinicians wait up to 6 weeks before reversing the rank order in cases where this approach appears ineffective.<sup>5</sup>

A so-called nothing-in-life-is-free program may be incorporated into the treatment plan to create better communication and consistent interactions between the dogs and owner. This entails making 1 or both dogs work for their resources (including petting and attention) by obeying commands. Owners are instructed to ignore attention-seeking behavior and to initiate and terminate interactions with 1 or both dogs.

Other behavioral approaches to reduce interdog household aggression include systematic desensitization and counterconditioning methods.<sup>1</sup> These techniques involve gradually, incrementally, and repeatedly exposing the dogs to each other and teaching them that pleasant experiences occur when the other dog is near. In extreme cases, separation and gradual reintroduction of the dogs may be advised.

If a dog has extreme emotional attachment to its owner and this results in fights, independence training may provide a solution. This method involves encouraging, rewarding, and training the dog to do things independently (away from the owner) and can be particularly helpful in cases of alliance aggression.

Medications that increase circulating concentrations of serotonin in the brain can reduce reactivity, anxiety, and responsiveness to aggression or fight-eliciting triggers. The serotonergic system is involved in impulsive aggression.<sup>12</sup> Studies have shown that serotonin agonists decrease aggression and that lower concentrations of serotonin metabolites are found in the CSF of aggressive dogs than in that of nonaggressive dogs.<sup>13</sup> Fluoxetine, a selective serotonin reuptake inhibitor, is a commonly administered medication that is useful for treatment of aggression problems and is reported to reduce aggression in dogs after approximately 3 weeks of treatment.<sup>14</sup>

Research suggests that a low-protein, all-natural diet can reduce some forms of aggression in dogs; high circulating concentrations of protein are thought to block serotonin precursors from crossing the blood-brain barrier, and certain artificial preservatives are thought to have negative effects on behavior.<sup>15</sup> Exercise also helps to relax an anxious dog and to increase concentrations of serotonin in the brain, which helps to reduce reactivity.<sup>16</sup>

Few scientific studies in the literature have focused on interdog household aggression. The purpose of the study reported here was to examine interdog household aggression in detail from signalment to outcome and to provide in-depth information on the history of the dogs involved and other comorbid diagnoses that could contribute to the problem. We also sought to evaluate various treatment recommendations by use of a follow-up survey to assess outcomes, owner compliance, and efficacy of the recommended treatments, and to describe an effective treatment strategy for improving interdog household aggression problems on the basis of these findings.

## Materials and Methods

**Case selection**—Hard-copy and computer database files of the Animal Behavior Clinic at Tufts University Cummings School of Veterinary Medicine, Grafton, Mass, were searched for records of dogs with interdog household aggression that were examined during initial or follow-up visits from December 5, 2006, to December 5, 2007. Each pair of dogs involved in interdog aggression was considered 1 case. Although some dogs (9/38 [24%]) had individual records, in the majority of cases (29/38 [76%]), 1 record contained information for both dogs. One case was excluded from the study because the owner had been provided a written remote consultation prior to the dogs' initial examination at the clinic.

**Behavior consultations**—Both dogs in each case were examined during a 90-minute consultation, which included review of a detailed history form completed by the owner prior to consultation, discussion of behavioral issues and history with the owners, and observation of the dogs. A suitable treatment plan was developed for each pair of dogs. Owners were offered 6 months of unlimited follow-up by telephone or e-mail as part of the consultation process, and recheck appointments were scheduled in 6-month increments. Each consultation was performed by a veterinary behaviorist (NHD; 19/38 [50%] cases), a certified applied animal behaviorist (AM-F; 16/38 [42%]), or both clinicians (3/38 [8%]). All dogs in the study were healthy, and medical records were obtained from the referring veterinarian. If medication was recommended, the veterinary behaviorist examined the dog and prescribed the drug. Dogs that received medication were examined every 6 months, and blood samples were obtained at each of these visits for biochemical analysis as a measure of liver function (circulating activities of ALP, ALT, AST, and GGT; concentrations of albumin, total protein, globulin, bilirubin [total, direct, and indirect], triglycerides, glucose, chloride, potassium, sodium, and total CO<sub>2</sub>; and calculation of the albumin-globulin ratio and anion gap).

**Study design and records review**—The 2-part study included a detailed analysis of consultation records and of the results of postconsultation outcome surveys. Data collected from case records included signalment and history information provided in a questionnaire completed by clients, discharge orders that detailed the clinician's observations, and recommendations approved by the primary clinician in charge of the case. Outcome surveys were sent via mail to owners on April 24, 2008, with a follow-up sent to those who did not respond by July 23, 2008. Information collected from surveys included self-reported owner compliance and case outcomes.

**History questionnaire**—Descriptive data recorded in history forms<sup>a</sup> by dog owners included age, weight, breed, sex, and neuter status of each dog as well as information regarding duration of ownership and sources from which dogs were obtained. A chart in the history form allowed owners to indicate applicable risk factors for behavior problems for their dogs, which included

a history of living in multiple households, adoption of the dog when it was > 12 weeks old (ie, after the sensitive period for socialization<sup>17</sup>), acquisition from a shelter or pet shop, and being orphaned or born with no littermates.

Owners provided information about the dogs by responding to open-ended questions. This included the number of dogs in the household and the overall social relationship between the dogs. Owners were asked to describe the fighting in general and to provide details regarding the most recent fight. If multiple fights were described, all were included in the analysis. Information reported regarding incidents of interdog household aggression included age of onset; whether 1 dog was known to consistently instigate fights; number, frequency, duration, and intensity of fights; whether fights resulted in injuries to dogs or owners; and the types of injuries acquired, if applicable. Owners also described fight-eliciting triggers and the methods they had used to stop fights. Owners were asked whether the fighting had increased or decreased in intensity, frequency, or duration.

A diagnostic form<sup>18</sup> used to rate aggressive behavior in 28 situations that typically elicit owner-directed aggression from dogs was evaluated as part of each record. Owners checked the most severe category of response (not tried, no aggressive response, growling, lip-lifting, snapping, and biting) for each situation. Situations described on the form were designed to assess resource guarding, guarding of personal space (ie, the area immediately around the dog), and responses to human behaviors potentially perceived as threatening by the dog. If multiple responses were indicated for a particular situation, the 1 category that indicated the strongest aggression response was used for analysis. For purposes of analysis, owner-directed aggression was considered clinically relevant in dogs that had growling, lip-lifting, snapping, or biting responses indicated for > 5 of the 28 listed situations.

Owner assessments indicated on a chart<sup>19</sup> used to obtain diagnostic information for separation anxiety were also analyzed. Owners rated each dog's response as none, mild, moderate, or severe for each of 13 situations used to determine the dog's responses to owner preparations to leave the house, what the dog's actions were when the owners were not at home, and how the dog behaved when owners returned. Dogs for which 3 or more responses on the separation anxiety chart were indicated as mild, moderate, or severe were considered to have clinically relevant separation anxiety for purposes of analysis. Owners were also asked whether their dog appeared to be excessively frightened by various (listed) items and situations, which included noises, vehicles, people carrying things, car rides, appliances, stairs, and slippery floors; they were also allowed to describe other items or situations.

The history form included open-ended questions that asked for descriptions of each dog's medical history and details regarding lifestyle and training history. Questions were asked concerning the dog's social interactions with humans and other animals (ie, whether the dog had aggressive or fearful behaviors toward members of the household, unfamiliar humans or animals, or veterinary staff).

**Follow-up surveys**—Follow-up surveys<sup>a</sup> that contained 28 questions were sent via mail to the owners of all dogs identified in the first part of the study to gain information on owner compliance and treatment outcome. Surveys were returned by owners 8 to 62 months after the initial consultation. Owners were asked how often fights had occurred between the dogs before and after consultation and what the triggers were for fights. Severity of fights was assessed by use of a scoring system modified from a 6-point bite assessment scale<sup>20</sup> (Appendix). Owners scored the dogs' bites on a scale of 1 to 6 (where 1 = least severe and 6 = most severe; a bite of this severity may have occurred once or multiple times), and the highest number recorded was subsequently analyzed. Owners were also asked open-ended questions regarding which treatment recommendations they had implemented and which they found to be most helpful. If medication was prescribed, the owner was asked to indicate the type of medication and the duration of time that it had been given. A 15-cm VAS was used to subjectively assess the amount of overall change in interdog household aggression from 0 (left end of the scale, which indicated that fighting was much worse) to 15 cm (right end of the scale, which indicated substantial improvement). A neutral response (ie, mark at 7.5 cm) represented no change. Owners were asked to place a mark anywhere on the line that indicated the amount of overall improvement or regression in the interdog household aggression problem, after considering the number, intensity, and duration of fights. Locations of marks on the lines were measured in centimeters to determine the perceived amount of change. A monetary incentive, which consisted of a \$50 discount for a recheck appointment, was offered for all owners who returned the follow-up survey. Investigators were aware of the sources of surveys at the time of evaluation.

**Statistical analysis**—Because it was assumed that the data were not normally distributed, nonparametric statistical tests were used to analyze the data, including medians with 95% CIs, Wilcoxon signed rank tests for 2 nonindependent groups, and McNemar  $\chi^2$  analysis for matched pairs. For each record, 81 pieces of descriptive data were entered for analysis.

## Results

The records search revealed 38 cases of interdog household aggression for which dogs were evaluated during initial or recheck appointments from December 5, 2006, to December 5, 2007. All cases identified were analyzed for the study except for 1 case, which was excluded because the owner had been provided a remote consultation via e-mail from the Tufts Behavior Clinic before the initial clinical evaluation was performed at the hospital. Dogs that were examined during recheck appointments in the time frame of the study had first been evaluated between May 8, 2003, and July 12, 2006. All cases seen prior to 2007 were recheck appointments except for 1 case seen in late December 2006.

At the time of data collection, 25 of 38 (66%) cases involved a single consultation, 9 (24%) had a single consultation and 1 follow-up appointment, and 4

(11%) had 2 to 4 follow-up appointments. Of the cases that had follow-up appointments, 3 pairs of dogs were first evaluated between 2003 and 2005, and 7 were first evaluated in 2006; the remaining 3 cases had an initial consultation in 2007 with the follow-up appointment during the same year. In these cases, the original detailed history form and data from the clinician's discharge orders at the time of the initial appointment were entered for analysis, as well as recommendations made to clients at follow-up appointments.

Both dogs in each case were evaluated at the clinic and had information in the record, but not all information was available in the records for every dog. In cases where information was more complete for 1 dog, this was typically for the instigator of the fights.

**Ancillary diagnoses**—There were ancillary behavioral diagnoses made by clinicians for 1 or both dogs at the time of the behavioral consultation in 16 of 38 (42%) cases. These included owner-directed aggression, generalized anxiety, hyperactivity, poor self-control, excessive barking, fear aggression toward humans, separation anxiety, fear aggression toward unfamiliar dogs, redirected aggression, urine marking, predatory aggression, and fear of humans. Because medical histories on the questionnaires were provided by the owners and not all were complete, other medical history was not analyzed further.

**Breed, weight, sex, and neuter status**—On the basis of owner descriptions, dogs in the study were grouped according to AKC breed group definitions. Most (56/76 [74%]) dogs in the study were purebred. All AKC breed groups were represented in the study as follows: sporting (n = 14), hound (12), working (9), herding (8), terrier (6), toy (5), and nonsporting (2). Three dogs were of breeds not recognized by the AKC, and 12 were of mixed breeds. Breeds of 5 dogs in the study were unknown. Pairs of dogs that fought with each other were of the same breed in 38 of 76 (50%) cases and were related to each other in 6 of 38 (16%) cases.

Dogs ranged in weight from 3.2 to 75.0 kg (7 to 165 lb; median, 23 kg [51 lb]; n = 47 dogs). Pairs of dogs that fought with each other were females in 18 of 38 (47%) cases, males in 12 of 38 (32%) cases, and both sexes in 8 of 38 (21%) cases. Overall, female dogs were involved in 26 of 38 (68%) interdog household aggression cases. Neuter status was available for 70 of 76 (92%) dogs, and of these, 67 (96%) were neutered (1 female and 2 males were sexually intact). Both sexually intact males in the study were in the same household, and the sexually intact female lived with a spayed female.

**Age of onset**—Median age of dogs at the time of the initial consultation was 51 months (95% CI, 39 to 60 months; n = 75 dogs). Median age of dogs at onset of interdog household aggression was 36 months (95% CI, 15 to 42 months; n = 33 dogs).

**Number of dogs in household**—The median number of dogs in each household was 2 (range, 2 to 5; n = 36 cases). The dogs involved in interdog household aggression were the only dogs in the home in 21 of 38

(55%) cases. In a small number of cases, other dogs in the household had been in fights with one of the pair involved in the interdog household aggression, but this had only happened rarely.

**Instigators and recipients of aggression**—Instigators and recipients of aggression were clearly identified in 27 of 38 (71%) cases. Instigators were a newer addition to the household than were recipients in 19 of these 27 (70%) cases, and instigators were younger than the recipients of aggression in 20 (74%) of these cases. At the time of initial consultation, the median age of instigators was 48 months (95% CI, 29 to 60 months;  $n = 26$ ), and median age of recipients of aggression was 72 months (95% CI, 41 to 84 months; 26). Complete records were available for 26 of 27 instigators of aggression and for 7 of 27 recipients; because of this disparity, statistical analysis of the differences between these groups could not be performed.

**Training and social relationships between dogs**—Some form of training (obedience training, agility classes, or flyball) had been provided for 30 of 48 (63%) dogs. Information was obtained from 28 of 38 owners regarding the overall relationship between dogs with interdog household aggression. Fifteen owners (54%) reported that their dogs were not compatible in general or appeared to ignore each other most of the time or that 1 dog seemed afraid of the other dog. Eleven owners (39%) reported that their dogs were compatible most of the time, and 2 owners (7%) reported that their dogs were sometimes compatible.

**Fight-eliciting triggers**—The most commonly reported triggers for fights between dogs with interdog household aggression were owner attention (16/35 [46%]), food (16/35 [46%]), excitement (11/35 [31%]), and found items or toys (9/35 [26%]). Other fight-eliciting triggers that were identified included changes in the home environment; 1 dog becoming weak or injured; loud or sudden noises; passing through doorways or sharing walkways; access to dog beds, furniture, or crates; confinement in tight spaces; and the presence of crowds or visitors.

**Duration, number, and frequency of fights**—The owner-estimated duration of fights ranged from 3 seconds to 30 minutes; however, further analysis was not performed because many owners reported that fights would have continued if they did not intervene. At the time of the initial assessment, the median total number of fights reported was 4 (95% CI, 3 to 5;  $n = 10$ ). Further analysis of this variable was not performed because quantifiable information in the records was deemed insufficient.

Owners reported frequency of fights in 17 cases. Of these owners, 12 indicated that their dogs fought several times each week, and 5 reported that fights occurred  $\leq 2$  times monthly (range, 1/d to 1/y). Of 18 owners that reported the duration of intervals between fights, 10 indicated intervals of  $\leq 1$  week, 5 described intervals of 2 weeks to 1 month, and 3 reported that fights occurred 1 to 1.5 years apart. When asked if there had been a change in the frequency or intensity of fights prior to the initial consultation, 20 of 28 (72%) owners reported

that fights had become more frequent, more intense, or both (without a specified time frame); in 4 of 28 (14%) cases, no change in frequency was reported, and fights had become less frequent in 4 of 28 (14%) cases because owners had avoided triggers or kept their dogs separated for periods of time.

**Severity of fights**—The severity of fights described in preconsultation history forms ranged from no bites (eg, only growling and lunging) to those in which at least 1 of the dogs received substantial injuries and might have been killed. Injuries to dogs described by owners included scratches, lacerations, lost teeth, puncture wounds, and severe ocular trauma; some injuries required surgical repair and some infections were reported. Owners indicated that veterinary medical treatment was needed for 1 or both dogs after a fight in 15 of 30 (50%) cases, and in 6 (40%) of these cases, 1 or both dogs had required veterinary treatment after  $> 1$  fight. Owners reported that they required medical treatment themselves at least once after attempting to intercede in fights in 3 of 30 (10%) cases.

**Methods used to manage and prevent fights**—Information was available regarding preconsultation management and prevention of dogfights for 35 of 38 cases. Methods owners reported they had used to manage fights prior to the initial consultation included non-intervention, physically separating the dogs (ie, pulling them away from each other during fights), keeping 1 dog leashed, throwing blankets to separate the dogs, giving obedience commands, muzzling 1 or both dogs, and aversive methods (eg, citronella spray, water spray, or shock collars) or responses (eg, striking, shouting, or physically forcing a dog down on its side or back). Nineteen of 35 (54%) owners reported physically separating the dogs from each other during fights, 18 (51%) indicated that aversive methods or responses were used, and 8 (23%) used obedience commands to attempt intervention. Fifteen of 36 (42%) owners that responded to the question of whether fights could be interrupted without physically intervening replied that they could not; 18 (50%) reported it was very difficult to interrupt fights or that they had to physically pull the dogs away from each other. Owners could usually interrupt fights without physically intervening in 3 of 36 (8%) cases.

Methods used to prevent fights between the dogs prior to consultation included avoidance of triggers, praising the dogs for nonaggressive behavior when together, giving consistent preference to 1 dog in terms of priority access to resources, isolation for short periods of time in response to undesired or aggressive behavior, crating 1 or both dogs, and keeping the dogs separated in the household. Nine of 35 (26%) owners kept the dogs separated in their households as a method of fight prevention.

**Risk factors for behavior problems**—Of 51 dogs in the study for which these data were available, 21 (41%) were reported to have lived in multiple households, 20 (39%) were  $\geq 12$  weeks of age when adopted, 17 (33%) were acquired from pet shelters, 8 (16%) were acquired from pet shops, and 3 (6%) were orphaned or had no littermates. These data were not statistically analyzed because of the lack of a control population for comparison.

**Comorbid behavior problems related to social interactions**—Dogs in the study were assessed for problems with social interactions involving aggressive or fearful behaviors on the basis of owners' reports. Of 48 dogs in the study for which these data were reported, 19 (40%) were reported to act aggressively toward unfamiliar dogs, 13 (27%) had some type of aggressive behavior toward human members of the household, 13 (27%) had aggressive behavior toward unfamiliar humans, and 3 (6%) had aggressive behavior toward humans at the referring veterinarian's office. Fearful behaviors were reported for 17 of 48 (35%) dogs when unfamiliar humans were encountered, for 15 of 48 (31%) when the veterinarian's office was visited, and for 11 of 48 (23%) when unfamiliar dogs were encountered. No dogs were reported to act fearful of human members in the household.

**Owner-directed aggression, separation anxiety, and other behavioral diagnoses**—Owners completed diagnostic charts for owner-directed aggression and separation anxiety for 44 dogs in the study; of these, 9 (20%) had a clinical diagnosis of owner-directed aggression, and 22 (50%) were considered to have clinically relevant separation anxiety. Twenty-three of 76 (30%) dogs in the study were determined to have phobias or severe anxiety. Phobias were triggered by noises in 20 of these 23 (87%) dogs; 1 dog had a phobia regarding insects, and 2 dogs each had a diagnosis of generalized anxiety.

**Treatment recommendations**—Recommendations most commonly made to owners of dogs involved in interdog household aggression cases included giving 1 dog priority access to resources (36/38 [95%] cases) and implementation of a nothing-in-life-is-free program for 1 or both dogs (32/38 [84%]). Use of a head collar, trailing leash, or both to improve physical control of 1 or both dogs (30/38 [79%]); psychotropic medication for 1 or both dogs (30/38 [79%]); obedience training to improve the dogs' responses to commands (27/38 [71%]); and avoidance of triggers for fights (23/38 [61%]) were also recommended to most owners.

Instructions for giving 1 dog priority access to resources included consistently providing this dog with the first and best resources. Owners were told to attend to this dog after a fight and give this dog praise in front of the other dog. The dog chosen to be supported (ie, to receive first and best access to resources) was determined by 1 of the 2 investigators (NHD or AM-F) after consideration of many factors including each dog's temperament, level of independence, and presence of any comorbid fear- or anxiety-related conditions. In most cases for which this treatment was recommended, clinicians advised use of a senior support program (32/36 [89%] cases) in which the older dog of the pair (30/32 [94%] cases) or the dog that had lived in the household for the greatest amount of time (2/32 [6%]) was chosen to receive support. The younger or newer dog in the household was recommended to receive this support at a later time in 4 of 32 (13%) cases in which the senior support program was initially implemented. Neither dog was chosen to receive priority access to resources in 2 of 38 (5%) cases; the dogs were siblings in 1 of

these cases, and dogs in the remaining case were of the same age and had been obtained at the same time.

Owners were instructed to implement a nonconfrontational nothing-in-life-is-free program in which 1 or both dogs were required to work for resources, attention-seeking behavior was to be ignored, and owners were to initiate and terminate interactions with the dogs in 32 of 38 (84%) cases. Medication was prescribed by the veterinary behaviorist (NHD) for 1 or both dogs in 30 of 38 (79%) cases in which underlying anxiety was thought to contribute to reactivity or aggression. The most frequently prescribed medication was fluoxetine. Owners were advised on how to avoid and eliminate fight-eliciting triggers. Owners were also instructed on methods to safely intervene or break up fights. A head collar was recommended and fitted for the fight instigator or for both dogs in 30 of 38 (79%) cases.

Nonpunitive, positively reinforced training methods were recommended to owners in 27 of 38 (71%) cases. Other recommendations included feeding a preservative-free, low-protein diet; increasing the amount of exercise the dogs received; implementing independence training; and, in severe cases, separating and reintroducing the dogs.

**Follow-up survey responses and analysis**—Twenty-five of 38 (66%) owners completed and returned follow-up surveys regarding the outcome of treatment for interdog household aggression. Surveys were returned a median of 15 months (range, 8 to 62 months) after the initial consultation.

Owners that returned outcome surveys reported that presence of a human member of the household was a fight-eliciting trigger in 14 of 25 (56%) cases. Both dogs passing through doorways simultaneously were a trigger in 9 of 25 (36%) cases.

Six of 20 (30%) owners reported that they did not leave their dogs together unsupervised. Of those that did leave the dogs alone together and could state with certainty whether fights occurred in this situation, 13 of 14 reported that their dogs did not fight when left alone together. Owners were asked whether there had been a change after the consultation in which dog instigated the majority of fights, and 15 of 16 owners indicated that there was no change.

Data obtained from the survey regarding the frequency of fights before and after consultation were transformed into number of fights that occurred each month. Dogs for which the survey was returned ( $n = 19$  cases) had a median of 4 fights/month (95% CI, 0 to 10) prior to consultation and  $< 1$  fight/month (median, 0.4 fights/mo [95% CI, 0 to 1]) after consultation. Results of a Wilcoxon matched pairs signed rank test indicated that the frequency of fights declined significantly ( $P = 0.001$ ) after consultation.

Twelve of 25 (48%) survey respondents reported that prior to consultation, 1 or both of their dogs required veterinary treatment as a result of injuries incurred from fights. After consultation, 4 of 22 (18%) owners reported that 1 or both of their dogs required veterinary treatment as a result of injuries incurred from fights. However, results of a McNemar  $\chi^2$  analysis for matched pairs did not meet the criteria for significance ( $P = 0.05$ ).

The median score for severity of fights prior to consultation (determined by use of a modified 6-point bite assessment scale) was 3 (95% CI, 2 to 3;  $n = 25$ ). The median severity score after consultation was 2 (95% CI, 1 to 2;  $n = 25$ ). Results of a Wilcoxon matched pairs signed rank test indicated that fights were significantly ( $P < 0.001$ ) less severe after consultation.

**Overall change in aggressive behaviors**—The VAS scores indicative of the overall change in the interdog household aggression problem were measured in centimeters from the center (7.5 cm; indicative of no change), and median values were determined. None of the 24 respondents indicated that the problem had worsened after consultation. The 15-cm mark was accepted as 100% improvement; a median overall improvement of 69% was indicated by owners (95% CI, 46% to 93%). Owners reported some amount of improvement in 23 of 24 (96%) cases, and the minimum improvement reported was 15% better than no change. When owners were asked to estimate the interval of time between the initial consultation and a noticeable improvement in the aggression problem, the median response was 5.2 weeks (95% CI, 2 to 13 weeks;  $n = 12$  responses). Owners of dogs from 2 of 3 cases that were first assessed between 2003 and 2005 returned surveys for this part of the study; 1 owner indicated a 70% overall improvement, and the other indicated a 21% overall improvement. Owners reported a 72% overall improvement in cases in which 2 male dogs were fighting ( $n = 7$ ), a 75% overall improvement in cases in which a male and female dog were fighting (5), and a 57% overall improvement in cases in which 2 female dogs were fighting (11).

Owners who implemented a nothing-in-life-is-free program for their dogs ( $n = 15$ ) indicated an 89% improvement from no change on the VAS, whereas owners who were not advised to implement the program or chose not to do so (8) indicated a 28% improvement. Owners who implemented a senior support program (18) indicated a 67% improvement from no change on the VAS.

In cases in which medication was prescribed for both dogs ( $n = 8$ ), owners indicated a 57% improvement from no change on the VAS, and in cases where medication was prescribed for only 1 dog (12), an 88% improvement was indicated; in cases in which no medication was prescribed (3), a 91% improvement was indicated.

**Negative outcomes**—Two of 25 (8%) survey respondents reported that their dogs were living separately in their households all of the time prior to the initial consultation (median duration, 4.3 months), and 3 of 24 (13%) owners reported that their dogs were living separately after consultation (median duration, 4.2 years). One of the dogs had been placed in a different household by the owner because of the interdog household aggression problem in 1 of 24 (4%) cases. None of the dogs in the study were euthanized because of interdog household aggression; however, 1 dog was euthanized for another behavior problem.

**Self-reported owner compliance**—Clients had been offered 6 months of unlimited follow-up via telephone

or e-mail as part of the consultation process; 20 of 25 (80%) survey respondents indicated that they had used 1 or both of these options. Owners were asked to report the treatment recommendations that they implemented for their dogs; the treatments most commonly implemented were psychotropic medication (21/24 [88%]), giving 1 dog priority access to resources (19/24 [79%]), a nothing-in-life-is-free program (15/24 [63%]), use of a head collar for 1 or both dogs (12/24 [50%]), increased exercise (12/24 [50%]), and keeping the dogs separated and gradually reintroducing them (11/24 [46%]).

**Helpful recommendations**—Owners were asked which clinician recommendations they found most helpful. They reported that the most useful recommendations were medication (15/23 [65%]), implementing a nothing-in-life-is-free program (11/23 [48%]), giving 1 dog priority access to resources (11/23 [48%]), use of a head collar for 1 or both dogs (5/23 [22%]), and keeping the dogs separated and gradually reintroducing them (6/23 [26%]).

**Medication**—Survey respondents indicated that psychotropic medication had been prescribed for 1 or both dogs in 22 of 25 (88%) cases. Prescribed medications included fluoxetine, paroxetine, amitriptyline, sertraline, and buspirone. One dog received medication in 14 of 22 (64%) cases, and both dogs received medication in 8 of 22 (36%) cases. Fluoxetine was prescribed for 25 of 30 (83%) dogs that received medication. In 2 cases, the medication was changed because of poor results or adverse effects associated with the first drug administered. At the time of survey administration, 20 of 22 (91%) owners were still administering psychotropic medication to their dogs, and the median duration of this treatment was 17 months (95% CI, 10 to 24 months).

## Discussion

A study of free-ranging dogs found that agonistic interactions among group members were scarce and communication was subtle; aggression was typically in the form of threats by means of growling and snarling, and chasing and severe fighting behaviors were not observed.<sup>21</sup> A household environment induces physical restrictions and limitations on dogs that can contribute to the development of interdog household aggression (ie, a dog cannot leave). Limited resources in a household can cause them to have a higher value, which may result in tension between cohabiting dogs.<sup>8</sup>

Owner attention and intervention can be integral in interdog household aggression problems, and 13 of 14 owners that responded in follow-up surveys in the present study reported that their dogs did not fight when left alone together, indicating that most of these cases likely involved alliance aggression. Dogs are also sensitive to inequity of reward, and if an owner provides differential treatment, dogs will recognize this.<sup>11</sup> More resources are available when an owner is present; thus, the simple presence of the owner may not be the sole trigger that elicits the fight, although the owner's attention is a resource worth competing over.

The results of the study reported here concur with those of previous studies<sup>1,22,23</sup> that indicated interdog

household aggression is more common between dogs of the same sex and that female-female pairs are most often affected. In the present study, responses from owners that returned the follow-up survey indicated a 72% overall improvement in cases in which 2 male dogs were fighting ( $n = 7$ ), a 75% overall improvement in cases in which a male and female dog were fighting (5), and a 57% overall improvement in cases in which 2 female dogs were fighting (11). Sherman et al<sup>1</sup> reported that fights among female dogs tended to be the most intense, but outcome results in that study indicated that female-female pairs did not have worse behavioral outcomes than those of other sex combinations. It has been suggested that an owner can reduce the risk of having an interdog household aggression problem by means of adding a male dog to the household.<sup>1</sup> Results of the present study revealed that the median age of onset of interdog household aggression is 36 months, which is approximately the time that dogs reach social maturity and develop the confidence to use aggression to control a situation in which they are uncomfortable.

According to the findings of Sherman et al<sup>1</sup> and of the present study, approximately half of all cases of interdog household aggression involve dogs of the same breed. Emotional responses, physiologic and behavioral arousal, and the tendency toward aggression vary among dog breeds.<sup>17,24,25</sup> Dogs of the same breed may be similarly motivated for particular resources or perceive value in the same resources, including time and attention from the owner, which is limited in the confines of a household. This may also be true for dogs of different breeds in the same household. These factors could lead to competition, stress, anxiety, and conflict.

Dogs involved in interdog household aggression cases in the study reported here were found to have several risk factors for behavior problems. Of 51 dogs for which the information was reported, 21 (41%) had lived in multiple households, 20 (39%) were adopted after the sensitive period for socialization<sup>17</sup> (ie, after 12 weeks of age), 17 (33%) were acquired from a shelter, 8 (16%) were acquired from pet shops, and 3 (6%) were orphaned or had no littermates. These dogs could have developed anxiety because of previous suboptimal life experiences. Factors such as these could result in a dog's not learning proper signals for communication with other dogs that could otherwise diffuse potentially agonistic situations. There is, however, evidence to suggest that animals raised in isolation are able to demonstrate normal social behavior when introduced to conspecifics several months later.<sup>26</sup> Dogs that have lived in multiple households could have anxiety about what to expect in their surroundings. Inconsistent interactions or lack of leadership in the current or a previous home could also worsen an already fragile situation. Unfortunately, we were unable to analyze differences between dogs with interdog household aggression and a control population, so it is unknown whether dogs in the present study had a higher percentage of these risk factors than did unaffected dogs.

Ancillary diagnoses had been determined for dogs in 16 of 38 (42%) interdog household aggression cases. Many dogs in the present study (22/44 [50%]) had some degree of separation anxiety. These dogs may

have formed a very strong attachment to their owners, which could be linked to the apparent prevalence of alliance aggression among dogs reported here. The unexpectedly high number of dogs with separation anxiety in our study may also be a reflection of generalized anxiety underlying the competitive aspects of interdog household aggression.

In agreement with the findings of another study,<sup>1</sup> 9 of 44 (20%) dogs in the present study with interdog household aggression also had owner-directed aggression, indicating that a proportion of these dogs also have conflict with their owners and are confident using aggression to try to control situations in which they are uncomfortable. Of dogs in the present study, 19 of 48 (40%) had aggressive behavior toward unfamiliar dogs, and 11 of 48 (23%) had fearful behaviors toward unfamiliar dogs. These dogs may not have been properly socialized with other dogs or may have had previous negative learning experiences with other dogs, so some fights between household dogs could have been attributable to tension and difficulty in establishment of trust with a cohabiting dog. Other behavior problems involving fear and anxiety were also commonly reported. Of dogs in the study reported here, 13 of 48 (27%) had some aggressive behavior toward unfamiliar humans, and 17 of 48 (35%) were reported to have some fearful behavior around strangers. Twenty-three of 76 (30%) study dogs had phobias or generalized anxiety. One limitation of this retrospective study was that we were unable to perform statistical analysis for features of dogs categorized as instigators of aggression versus those categorized as recipients, which would have provided some interesting insight into this issue. Future studies should investigate differences between instigators and recipients in regard to risk factors, social interactions, aggression, or anxiety in other contexts.

The most commonly recommended treatments in the present study (ie, giving 1 dog priority access to resources, a nothing-in-life-is-free program, and psychotropic medications) were also rated most effective by survey respondents. The frequency and severity of fights decreased significantly after consultation; the number of cases in which veterinary medical treatment was needed as a result of injuries incurred during fights decreased by 30% after consultation. Owners reported some amount of improvement in the interdog household aggression problem in 96% (23/24) of cases, with a minimum improvement of 15% and a median 69% improvement over no change after consultation.

Sherman et al<sup>1</sup> reported some degree of improvement in 39 of 66 (59%) interdog household aggression cases; in that study, 27 of 66 (41%) owners reported that there was no change or that the situation had worsened. The most commonly recommended treatments in that study were systematic desensitization and counterconditioning methods, and owner compliance with these methods is often poor,<sup>7</sup> which may explain the difference in outcomes between that study and the study reported here.

Survey respondents in cases in which a nothing-in-life-is-free program was implemented reported an 89% improvement in interdog household aggression, whereas those who were not recommended to use the



program or chose not to do so reported only a 28% improvement. The nothing-in-life-is-free program used in the present study did not involve making the dog assume progressively more submissive postures to earn resources or exposure techniques, which some programs with the same name entail<sup>27</sup>; instead, it involved making owners interact with their dog in a cue-response-reward format when valuable resources were present.<sup>24</sup> This program provides structure and consistency in the household through enhanced communication and predictable social interactions around resources, which substantially reduces conflict and anxiety in the authors' clinical experience. Owners help dogs to learn appropriate behavior in this program by offering resources as rewards for desired behavior and by not rewarding inappropriate behavior. This program also improves the predictability of the cohabiting dogs' behaviors, which reduces conflict.

In the present study, a 67% improvement was reported for cases in which a senior support program (wherein the oldest dog in the house or the dog that was in the home first received priority access to resources) was implemented. The fact that the fight instigator was often the younger of the 2 dogs or a newer addition to the household could be the reason for the success of this program because that dog may be comparatively insecure and thus instigate conflict. In a study<sup>21</sup> of free-ranging dogs, adult males and females were not observed to have submissive behaviors toward juvenile dogs. Giving 1 dog priority access to resources reduces conflicts that result in aggressive behavior because it allows the dogs to successfully coexist in a household without the stress of living in an unpredictable environment.

It is important to be aware that dominance is a relative measure, rather than an absolute property of individuals, and dominance hierarchies among dogs are not absolute and strict.<sup>28–30</sup> Pack structure is thought to be dynamic and marked by continuous change. It has been reported<sup>31</sup> that dogs living in households may maintain several competitive hierarchies determined separately for each resource. It has also been suggested<sup>32</sup> that dogs have no real hierarchy but have preferences for different resources in the environment; however, the stability of the social structure is also a highly valued resource, and dogs may relinquish a resource to maintain social harmony.

Use of a nothing-in-life-is-free program and giving 1 dog priority access to resources may also initiate counterconditioning protocols for each dog. Dogs learn the order in which each will receive valuable resources, and the dog that receives a resource second must wait until the first dog has an opportunity to earn the resource. Also, both dogs may be asked to engage in a behavior such as sitting or lying down when a valuable resource is present, which could diffuse tension during situations that might have elicited fights in the past because the dogs must behave in a controlled manner and thus have more relaxed behavior around resources.

In the majority of cases of interdog household aggression in the present study, 1 or both dogs received psychotropic medication. The cases in which neither dog was prescribed medication were rated as having the most success, followed by cases in which 1 dog was pre-

scribed medication; cases in which both dogs were prescribed medication were rated as having the least success. In cases in which medication was prescribed for 1 or both dogs, the fights were severe or there was reason to believe that underlying anxiety was severe enough to warrant pharmacological intervention. This type of medication would help to make these dogs less reactive and, ideally, less aggressive.

It has been reported<sup>24</sup> that most dogs that have a diagnosis of owner-directed aggression are not so-called dominant dogs with confident personalities. In agreement with the findings of the present study, those authors reported that aggressive dogs often act uncertain, fearful, or submissive in some situations but become aggressive when conflict arises. They suggested this may be attributable to inconsistent interactions that lead to a dog's inability to predict what will happen next. In dogs of the present study, giving 1 dog priority access to resources and enforcing a nothing-in-life-is-free program reduced conflict, likely because these methods provide consistency and predictability; the dog learns how to successfully behave in the environment in order to receive resources. Our study revealed that psychotropic medication, which may reduce a dog's reactivity to anxiety-eliciting triggers, was also an effective adjunctive treatment to reduce interdog household altercations attributed to lack of environmental or social predictability. In a typical household, dogs rely on their owners to provide everything they need, and owners themselves can become a resource to fight over. The findings of the present study indicate that interdog household aggression can be successfully treated and that consistency and predictability of social interactions are essential in resolving the issue.

a. Copies of forms are available on request from the corresponding author.

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## Appendix

Modified bite assessment scale.

| Severity level | Threat or bite characteristics   |
|----------------|--|
| 1              | Growling, lunging, or snarling behavior occurred without teeth touching skin (ie, mostly intimidation behavior).   |
| 2              | Teeth touched skin, but no puncture wounds were inflicted. Marks or minor scratches from paws and nails (minor surface abrasions) may have been incurred.  |
| 3              | Punctures were half the length of a canine tooth and resulted in 1 to 4 holes from a single bite. No tears or slashes were incurred, and the recipient was not shaken side to side.  |
| 4              | One to 4 holes from a single bite, with 1 or more holes deeper than half the length of a canine tooth. Contact and punctures were incurred from more than the canine teeth. Tears, slash wounds, or both resulted. One dog clamped its teeth down and the other dog was shaken or slashed. |
| 5              | Multiple bites at severity level 4 or greater incurred in a concerted, repeated attack.  |
| 6              | Any bite that resulted in death of a dog.  |

Information was modified from a 6-point bite assessment scale.<sup>20</sup> The scoring system was used by owners of dogs with interdog household aggression to score the severity of fights as part of a follow-up survey to determine owner compliance and efficacy of recommended treatments. The highest number recorded from a single bite or multiple biting episodes was analyzed.