

Risk factors and behaviors associated with separation anxiety in dogs

Gerrard Flannigan, DVM, MSc, and Nicholas H. Dodman, BVMS, DACVB, DACVA

Objectives—To determine potential risk factors and behaviors associated with separation anxiety and develop a practical index to help in the diagnosis of separation anxiety in dogs.

Design—Case-control study.

Animals—200 dogs with separation anxiety and 200 control dogs with other behavior problems.

Procedures—Medical records were reviewed for signalment, history of behavior problems, home environment, management, potentially associated behaviors, and concurrent problems.

Results—Dogs from a home with a single adult human were approximately 2.5 times as likely to have separation anxiety as dogs from multiple owner homes, and sexually intact dogs were a third as likely to have separation anxiety as neutered dogs. Several factors associated with hyperattachment to the owner were significantly associated with separation anxiety. Spoiling activities, sex of the dog, and the presence of other pets in the home were not associated with separation anxiety.

Conclusions and Clinical Relevance—Results do not support the theory that early separation from the dam leads to future development of separation anxiety. Hyperattachment to the owner was significantly associated with separation anxiety; extreme following of the owner, departure cue anxiety, and excessive greeting may help clinicians distinguish between canine separation anxiety and other separation-related problems. (*J Am Vet Med Assoc* 2001;219:460-466)

By definition, separation anxiety is severe distress when an individual is distanced from other group members, but in canine behavioral terminology this term is most often restricted to dogs that become upset when separated from their owner. Separation anxiety is 1 of the most common canine behavior problems and is diagnosed in 20 to 40% of dogs referred to animal behavior practices in North America.^{1,2} The most common complaints are destructive behavior directed at the home, self-inflicted trauma, inappropriate elimination, and excessive vocalization (whining, barking, or howling) only in the owner's absence.²⁻⁶ Problems that occur when the owner is absent represent 1 of the principal causes for the breakdown of the human-companion animal bond and lead to surrender of numerous dogs to shelters.^{7,8} In a survey⁹ of factors associated with canine relinquishment to a humane society, 3 of the 10 most commonly reported problems were consistent with sep-

aration anxiety. Within 6 months of adoption from a shelter in southern England, 22.3% of dogs had at least 1 behavior indicative of separation anxiety.¹⁰

There are a large number of differential diagnoses for separation-related problems that do not have a basis in the anxiety of separation¹⁻³; therefore, the condition can be difficult to diagnose correctly. The potential causes of separation anxiety are numerous, may not be exclusive, and may overlap.¹¹ These causes include pathologic overattachment to the owner, negative early experiences such as too early separation from their dam, a traumatic experience while alone, and a change in family circumstances. Dogs may also have a genetic predisposition to develop the condition, because they have been bred to be socially dependent, devoted, and infantile.¹²

Little has been published in peer reviewed journals regarding potential risk factors or behaviors associated with canine separation anxiety; as a result, much of the information available on separation anxiety is found in review articles or conference abstracts.^{1,3,10,13,14} McCrave³ reported that dogs with separation anxiety were likely to be of mixed breed, be a stray or from a shelter, follow their owners excessively, and display increased greeting behavior, although there was no association with spoiling activities such as allowing the dog to sleep on the owner's bed, feeding the dog from the table, or taking the dog on errands. In a prospective study¹⁴ of 36 dogs with separation anxiety and 64 dogs with other behavioral problems, the only significant finding was that dogs with separation anxiety were more likely to have increased greeting behavior, and many followed their owner excessively. Significant differences between these 2 groups of dogs were not detected in sex, age at referral, age at acquisition, source, number of adult humans in the home, a recent move, or how long the dog was owned. In a prospective study¹⁰ of shelter dogs performed 6 months after adoption, an association was found between separation anxiety and the presence of a cat in the home and attachment to 1 person. Factors not associated with separation anxiety included sex, neuter status, amount of time at the shelter, number of previous homes, and the presence of other dogs in the home.

The objectives of the study reported here were to determine potential risk factors and behaviors associated with separation anxiety and develop a practical index that may aid in the diagnosis of canine separation anxiety.

Materials and Methods

Case selection—A retrospective case-control study of 200 dogs with separation anxiety and 200 control dogs with other behavioral problems was performed, using records from the Tufts University School of Veterinary Medicine

From the Department of Clinical Studies, School of Veterinary Medicine, Tufts University, North Grafton, MA 01536. Dr. Flannigan's present address is Carolina Veterinary Specialists, 501 Nicholas Rd, Greensboro, NC 27409.

Behavior Clinic (from either in-clinic or fax services), to determine potential risk factors and behaviors associated with canine separation anxiety. Records of dogs with separation anxiety from January 1996 to December 1998 were included in this study. Each client filled out an 8-page behavioral history form prior to clinical evaluation. Diagnosis was based on either a behavioral resident's or a board certified behaviorist's judgment of the history in consultation with the client or referring veterinarian. For a diagnosis, dogs needed to have signs of anxiety (destruction, inappropriate elimination, or excessive vocalization) that occurred only while the owner was absent. Only separation-related problems in which other differential diagnoses could not be established were included in the analysis. Signs indicative of hyperattachment (excessive following, predeparture cue anxiety, and excessive greeting behavior) were not necessary for a diagnosis. Control cases were collected at random from other behavior-related cases, with the provision that owners filled out the separation anxiety section of the history form and met matching criteria. Because a large number of associated factors were under study, control cases were matched with study cases by 2 factors: the type of behavior service used and the approximate time of year of referral or evaluation.

Variables—For all dogs, factors collected included signalment, history of the behavioral problem, structure of the home environment, management, behaviors potentially associated with separation anxiety, and potential concurrent behavior problems. The dependent variable was the presence or absence of a diagnosis of separation anxiety. Independent variables included: age of onset (years; some owners could not determine age of onset, because the problem was present when the dog was acquired); sex (male vs female); reproductive status (sexually intact vs neutered); age at referral (years); age at acquisition (years); breed (entered as individual breeds [including the closest cross when a mixed breed] and separately as either purebred or mixed breed); weight (kilograms and pounds); gender of the owners in the home (male, female, or both); number of adults in the home (1 adult vs multiple adults; ≤ 2 adults vs > 2 adults [children older than 15 years were considered adults]); number of children in the home; number of previous owners (none vs ≥ 1); source (breeder, family or friends, pet store, shelter, rescue organization, or veterinary hospital; and shelter, rescue organizations, and veterinary hospitals vs all others); number of dogs and cats in the household (each as a continuous variable and as present or absent); dog allowed on the bed, fed from the table, or taken to obedience class (yes or no); recent changes in the home at the time of onset of the problem (multiple or recent move, divorce, work schedule change, less exercise than normal, new dog in the household, increased traveling by the owner without the dog, loss of a canine housemate, new infant, return from being with a conformation handler, accidental confinement, or previous owner died); and recent changes versus no recent changes.

Several behaviors were presented to the owner on a chart within the history form recorded as not present, mild, moderate, or severe. These behaviors included following the owner, increased greeting behavior > 2 to 3 minutes' duration, anxiety at the noise of keys, anxiety when the owner put on shoes or coat, destruction only in the absence of the owner, elimination only in the absence of the owner, barking or whining following the owner's departure, decreased activity after the owner departs, anorexia following owner departure, excessive salivation in the owner's absence, and signs of depression after the owner departs. Some clients used the form as a sliding scale and checked 2 sections (eg, mild and moderate) or put a check mark on the line between the categories. When queried about this practice, clients indicated that their dog's behavior fell in between the categories; there-

fore, numeric values were assigned as follows: not present, 0; mild, 1; mild to moderate, 2; moderate, 3; moderate to severe, 4; severe, 5. If the owner was unsure or left the section blank, the data were not included in the analysis. The factors were also recorded as binary variables (absent to mild vs moderate to severe).

Because multiple behaviors should be evaluated for confirmation of a diagnosis of separation anxiety in dogs, an index was devised in an attempt to aid veterinarians in the determination of this behavior problem. The index included extreme following behavior, departure cue anxiety (at the sound of the owner's keys or when the owner put on shoes or coat), and excessive greeting on a scale in which absence of the behavior = 0, mild = 1, mild to moderate = 2, moderate = 3, moderate to severe = 4, and severe = 5.

Statistical analyses—Data were analyzed statistically by use of computer software.^a Factors were compared between affected and control dogs by use of either a rank sum 2-sample (Mann-Whitney) test for continuous variables or a Pearson χ^2 test for heterogeneity or independence for categorical variables. For the Pearson χ^2 test, an odds ratio (OR) was used to determine the strength of associations; to maintain an overall significance value of $P < 0.05$, the adjusted alpha level for each test was based on the alpha level of the overall study divided by the number of factors under study (Bonferroni correction).¹⁵ As a result, significance for each test was $P < 0.002$ for the categorical variables. In some instances, information on the history form was incomplete; therefore, some factors were analyzed with data from < 200 cases. Because a potential cause of separation anxiety is removal from the dam at an early age, the age at which the dog was acquired was analyzed in the subpopulation of dogs obtained by the present owner prior to 12 weeks of age to determine whether there was an association between separation anxiety and early acquisition (at < 7 weeks of age vs those acquired between 7 and 12 weeks of age).

Results

Control dogs—A wide variety of behavior problems were diagnosed in control dogs. Aggression was the most common category of behavior problem found in control dogs, with dominance to people (29.9% of reported problems) and territorial aggression (13.9%) most prominent among categories of aggression. Fears and phobias constituted 11% of problems reported in control dogs, whereas compulsive disorders constituted slightly $> 10\%$ of reported problems. Behaviors such as inappropriate elimination, excessive vocalization, and self-induced trauma reported in dogs with separation anxiety were also observed in control dogs. However, in control dogs, these behaviors were evident in the presence of the owner as well as when the dog was left alone.

Although control dogs were only matched with affected dogs by type of behavioral service and approximate date of referral to the behavior clinic, the 2 groups of dogs were remarkably similar. Mean weight, age at referral, age when acquired, number of children in the home, and number of other pets in the home were not significantly different between groups. In both groups, approximately a quarter of dogs had the behavior problem when acquired (41/159 affected vs 44/182 control dogs). Distribution between sexes was also similar; 58% (116/200) of control dogs and 60% (120/200) of dogs with separation anxiety were male. Separation anxiety developed at any age in these dogs,

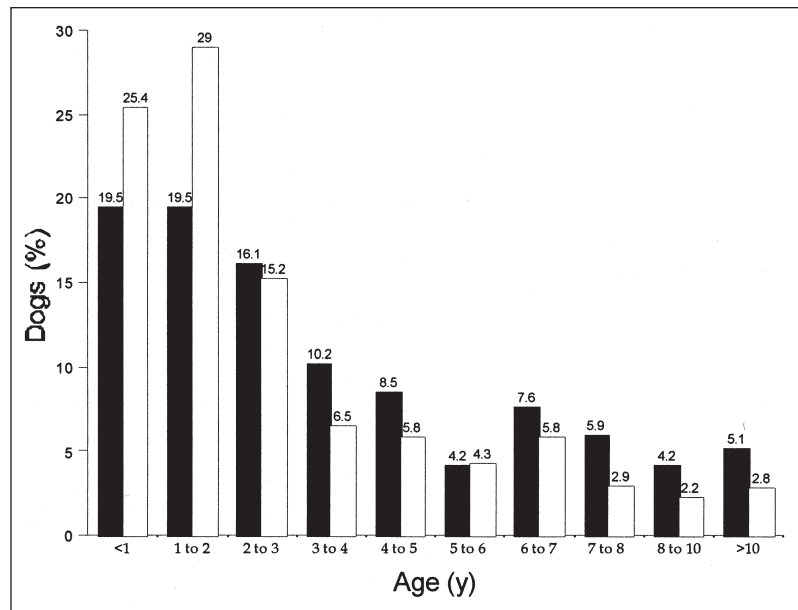


Figure 1—Distribution of age of onset for behavior problems in dogs with separation anxiety (solid bars; $n = 118$) and control dogs with other behavior problems (open bars; 138). Approximately 25% of dogs in both groups had the behavior problem when obtained.

Table 1—Incidence of behaviors used for diagnosis of separation anxiety in control dogs with various behavior problems and dogs with separation anxiety

Behavior	Control dogs			Dogs with separation anxiety		
	No. of dogs*	Moderate to severe (%)*	Owner unsure (%)	No. of dogs*	Moderate to severe (%)*	Owner unsure (%)
Dog attributes						
Follow owner	200	64.0	0	199	83.8	0.5
Increased greeting	200	31.0	0	199	62.8	0.5
Signs of angst at sound of keys	197	26.9	1.5	197	62.5	1.5
Signs of angst when owner puts on coat or shoes	199	32.1	0.5	197	69.5	1.5
After owner departs						
Decreased activity	153	34.0	23.5	139	33.8	30.5
Signs of depression	154	16.2	23.0	139	59.0	30.5
Will not eat	170	20.6	15.0	161	46.6	19.5
Hypersalivation/vomiting/diarrhea	199	0	0.5	197	19.3	1.5
Undesirable behavior† (only in owner's absence)						
Destruction	198	3.0	1.0	198	71.7	1.0
Elimination	195	1.5	2.5	192	28.1	4.0
Vocalization	191	5.2	4.5	178	61.2	11.0

*Excludes data for which owners were unsure.
†Some dogs had more than 1 undesirable behavior.

but mean age of onset for affected dogs was significantly ($P = 0.029$) greater than for other behavior problems that developed in control dogs (Fig 1).

Undesirable behaviors—The most common complaint (71.7%) in dogs with separation anxiety was destruction in the home (Table 1). Excessive vocalization was reported in 61.2% of dogs, and inappropriate elimination was reported in 28.1%. A small percentage of control dogs had destructive behavior, inappropriate elimination, and increased vocalization only in the owners' absence. These undesirable behaviors were

never the owners' primary complaint at referral, nor did the behavioral clinician believe that the signs constituted a diagnosis of separation anxiety.

Factors associated with separation anxiety—There were 2 potential risk factors that had a significant ($P < 0.002$) association with the incidence of separation anxiety in this population of dogs. More than three quarters (76.5%) of dogs with separation anxiety lived in homes that had multiple adults (Fig 2); however, dogs referred to the behavior clinic and kept by a single owner were approximately 2.5 times

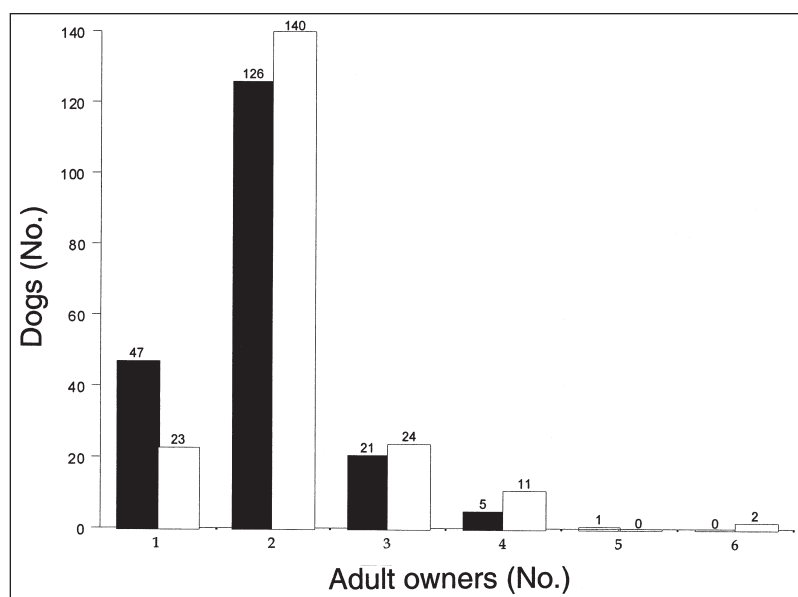


Figure 2—No. of adults in the homes of dogs with separation anxiety (solid bars) and control dogs with other behavioral problems (open bars; $n = 200/\text{group}$).

as likely to have separation anxiety ($P < 0.002$; OR, 2.364).

Overall, 91% of dogs in this study were neutered (86.5% of control dogs and 95.5% of affected dogs). Prior to analysis of the data, we hoped that potential associations of separation anxiety between spayed females, castrated males, and their sexually intact counterparts could be evaluated, but sample size of sexually intact dogs was too small; therefore, the data were pooled. Sexually intact dogs (male or female) were > 3 times less likely to have separation anxiety ($P < 0.002$; OR, 3.312) than neutered dogs.

Other potentially associated factors—For several factors, association with separation anxiety approached significance but did not meet the significance requirements of this study ($P < 0.002$). Dogs from shelters or rescue groups and those adopted from veterinary hospitals or found abandoned more commonly ($P = 0.017$; OR, 1.663) had separation anxiety than dogs from other sources (breeders, family or friends, and pet stores collectively); 41.1% (79/192) of dogs with separation anxiety versus 29.6% (58/196) of control dogs were from shelter-type environments. Only 16% of owners could recall a change in the home when separation anxiety initially developed, whereas 10% of owners of control dogs had an environmental change when their dog's particular problem developed ($P = 0.01$; OR, 2.162). Recent changes included divorce, multiple or recent moves, change in work schedule, the dog receiving less exercise, increased traveling by the owner without the dog, introduction of a new dog, loss of canine or human housemate, a new infant in the home, and accidental confinement. Dogs with separation anxiety were less likely to have attended an obedience class than dogs with other behavior problems, although the difference between groups was small ($P = 0.02$; OR, 1.614).

Purebred dogs were predominant in affected and control groups. Separation anxiety was reported in 69

mixed-breed dogs and 131 purebred dogs of 56 breeds. In comparison, control dogs comprised 45 mixed-breed dogs and 155 purebred dogs representing 62 breeds. German Shepherd Dogs and German Shepherd Dog crosses, followed by Labrador Retrievers and Labrador Retriever crosses, were the most common breeds in both groups. In the separation anxiety group, the subsequent order of breed incidence was Golden Retrievers, English Springer Spaniels, and English Cocker Spaniels. In the control group, the subsequent order of breed incidence was English Springer Spaniels, English Cocker Spaniels, and Doberman Pinschers. During the time of this study, these breeds were among the most popular breeds, as judged by use of American Kennel Club registration data.¹⁶ Overall, more mixed-breed dogs had separation anxiety than did purebred dogs, although this difference was not significant ($P = 0.008$; OR, 1.814).

Factors not associated with separation anxiety—Several factors were not associated with separation anxiety. Sex of dog, age when acquired, presence of other pets in the home, gender of the owner, and having at least 1 previous owner were not associated with separation anxiety. Spoiling activities such as allowing the dog on the owner's bed or feeding the dog from the table also were not associated with separation anxiety. Acquiring a dog from a pet shop was not significantly associated with an increased incidence of separation anxiety. Approximately half of the study dogs (101 affected dogs and 105 control dogs) were acquired by the owner before 12 weeks of age. In this subpopulation, there was no statistical association between acquiring the puppy at a young age (< 7 weeks of age) and the future development of separation anxiety.

Noise phobias—Many dogs in this study had some fear of noises, but noise phobia was significantly more common in dogs with separation anxiety; almost

half (97/200 [48.5%]) of dogs with separation anxiety were fearful of noises, whereas less than a third (63/200 [31.5%]) of control dogs had a similar fear.

Other behaviors associated with separation anxiety—Dogs with separation anxiety had other behaviors more commonly than control dogs did ($P < 0.001$; Table 1). Dogs with separation anxiety were 3 times more likely to follow their owner excessively, compared with control dogs (OR, 2.936), and almost 4 times more likely to have excited greeting behavior of duration > 2 to 3 minutes (OR, 3.76). Dogs with separation anxiety were 4.5 to 5 times more likely to be anxious at the time of departure. After the owner departed, affected dogs were > 7 times more likely to have signs of depression (OR, 7.432) and > 3 times more likely to not eat while their owner was absent (OR, 3.364).

Diagnostic index—Following analysis of diagnostic index data, cut-off value for a diagnosis was determined to be 10, using the described scale. On the basis of this index, a dog that the owner believed had severe problems in all 3 behavioral categories would have an index of 15. Approximately three quarters (75.2%) of dogs with separation anxiety had an index of 10 or greater, whereas only 28.9% of control dogs had an index of 10 or greater. Dogs that met this criterion were 7.6 times more likely to have separation anxiety than control dogs were ($P < 0.001$; OR, 7.653).

Although highly associated with separation anxiety, behaviors that occur after the owner leaves such as signs of depression and anorexia were not included in the index, because approximately a quarter of owners in both groups were unable to confirm these behaviors, because they may have occurred when other family members were also absent. Repeated hypersalivation, vomiting, and diarrhea when the owner left the home were not a commonly expressed behavior in dogs with separation anxiety and were found in only 19.3% of these dogs. However, when present, these behaviors were an excellent supportive sign of separation anxiety, because not a single control dog had these behaviors.

Discussion

Retrospective case-controlled studies may be extremely useful for uncovering potential causal factors and behaviors associated with primary behavioral problems if bias is not introduced in the history of exposure to the factors of interest or in the selection of cases and controls.¹⁷ Because we depended on the owner to fill out the history form, we believed that the information given was accurate. The proportion of various behavior diagnoses among the control dogs was similar to published data for other animal behavior clinics when separation anxiety was excluded. A strong association between 2 factors lends support to but does not prove causation¹⁷; there could be a third factor impacting both components, uncertainty regarding which factor was present first, or a factor that was present in an attempt to treat the behavior problem.

Principal complaints at referral for dogs with separation anxiety in our study were destruction, excessive vocalization, and inappropriate elimination, in

that order. In a prospective study¹⁰ of dogs adopted from a shelter, a slightly greater proportion of dogs were destructive, compared with results of our study (84 vs 71.4%, respectively), and a smaller proportion had excessive vocalization (41 vs 61.2%) and inappropriate elimination (18 vs 28.1%), although differences may be a consequence of the source of the dogs. Because our study had a large population of dogs acquired prior to 12 weeks of age (approx 50%), perhaps this had an effect on the type of complaint reported at referral. Podberscek et al¹⁸ reported the problems at referral of 49 dogs in a study of the effectiveness of clomipramine as an adjunct to behavior modification; the proportions of dogs with destruction (73.5%), excessive vocalization (69.4%), and inappropriate elimination (42.8%) were quite similar to those in our study. In contrast, in a study¹⁴ of 36 dogs with separation anxiety, vocalization was the most common behavior (90%), followed by destruction (80%) and inappropriate elimination (55%).

In the study reported here, sex distribution of dogs with separation anxiety was similar to that reported in other studies^{1,6,16,18-20} and that of control dogs with other behavior problems. Many studies investigating sex distribution among dogs with behavior problems (separation anxiety or others) have found that approximately 60% of the dogs were male. The common conclusion by other authors is that male dogs are more prone to behavior problems. However, an alternate explanation is that males are more severely affected than females, prompting owners to seek treatment from a behavior specialist in higher numbers.

To the authors' knowledge, this is the first study to reveal a significant association between separation anxiety and a dog being kept by a single adult owner. Similar to other studies, affected dogs typically had > 1 owner in the home. Other studies^{1,10,18} that found no association between the number of adults in the home and separation anxiety had < 50 affected dogs. Because a typical home has > 1 adult, our large sample size ($n = 200$) may have been essential to uncover this association.

For the period of this study, neutering pet dogs was a common practice in the canine population referred to the Tufts University Behavior Clinic. Only 1 North American study²⁰ has examined this factor with respect to separation anxiety; no association was found, but this may be another factor that requires a large sample of affected dogs to detect an association, because of canine population dynamics. Separation anxiety represents a lower proportion of behavior referrals to European behaviorists, which corresponds to a higher proportion of sexually intact dogs.^{11,19}

Other investigators^{3,a,b} have detected a much stronger relationship between source of the dog and canine separation anxiety than was detected in our study, demonstrating as much as a 3-fold greater incidence of separation anxiety in strays or dogs from shelters. Although separation anxiety is often reported as a sequela to a sudden change in the household,^{1,5,11,21} a direct association has been considered in only 1 report¹⁴ and was not found to be significant. We found that few owners could remember a change in the home

that coincided with initiation of separation anxiety, but it was more common in affected dogs than in control dogs.

Voith et al²² and Takeuchi et al²⁰ found that behavior problems such as separation anxiety were unrelated to obedience training. However, Clark and Boyer²³ found that obedience training improved the relationship between owner and dog and detected less separation anxiety in obedience-trained dogs, compared with dogs with no obedience instruction. In our study, obedience training may have been less common in dogs with separation anxiety, compared with control dogs, because of the type of behavior problems in the control dogs, rather than as a protective effect induced by obedience training. Because aggression was the most common behavioral problem in the control group, obedience training may have been used by owners more commonly in these dogs in an attempt to curb the condition.

Whether separation anxiety is more common in mixed-breed dogs, compared with purebred dogs, differs among studies. In 3 studies^{3,14,20} comparing dogs with separation anxiety and dogs with other behavior problems, mixed-breed dogs were more likely to have separation anxiety, but in a further study,¹³ separation anxiety was more common in purebred dogs. In another study,^b distribution between purebred and mixed-breed dogs did not differ between dogs with separation anxiety and those referred for medical or surgical problems. Unfortunately, results of our study did not resolve the debate.

In agreement with our study, other authors have not found an association between canine separation anxiety and spoiling activities,³ sex of the dog,^{10,14} age at referral,¹⁴ and presence of other dogs in the home.^{10,14} In contradiction to our findings, McCrave³ did not find an association between separation anxiety and thunderstorm phobia. However, Overall²⁴ found that 40% of dogs with a noise phobia also had separation anxiety and that 8% of dogs with separation anxiety had thunderstorm phobia. Results of our study indicated that a fear of noises may be more common in dogs than previously observed and that almost half of dogs with separation anxiety have this fear.

Although there is no evidence to support the claim, a commonly cited potential cause of canine separation anxiety is early separation from the dam.^{11,12} Several authors have advised that puppies should not be separated from the dam and littermates until 7 to 8 weeks of age,^{4,5} because development of social attachment in the puppy is dependent on early experience with littermates between the ages of 5 and 7 weeks.²⁵ Compared with dogs that are acquired from other sources, we found that separation anxiety was not more common in dogs that are acquired from pet stores, although such dogs may have been separated from their dam and littermates at an early age.²⁶ In addition, puppies that were acquired by the owner at 6 weeks of age or younger (no matter what the source) were no more likely to develop separation anxiety than were dogs acquired between 6 and 12 weeks of age. The results of our study do not support the theory that early separation from the dam and littermates leads to

the development of separation anxiety. Perhaps puppies acquired at a young age are equally susceptible to behavior problems in general.

Hyperattachment to the owner has been cited most commonly and is believed to be a necessary component of the disorder.^{3,27,c} However, at least 1 author⁴ has questioned it as a necessary and sufficient condition for a diagnosis, because many dogs with the disorder lack elements of extreme attachment. It is also argued that owner behaviors considered as spoiling activities such as feeding the dog from the table or allowing the dog to sleep on the owner's bed are not more common in affected dogs,²² possibly because these behaviors need not lead to overattachment of the dog to the owner. Evidence seen within our study supports the contention that hyperattachment is a component of separation anxiety. In addition, separation anxiety was significantly associated with dogs dwelling in homes in which there was only 1 adult. Therefore, we believe that use of the diagnostic index aids in the diagnosis of separation anxiety.

The index was designed as a diagnostic tool. Because some dogs without hyperattachment to the owner may have separation anxiety, the index should not be used to the exclusion of good clinical judgment. The index should be applied when a dog has behaviors suggestive of separation anxiety such as moderate to severe destruction, inappropriate elimination, or excessive vocalization taking place only in the owners' absence. For dogs with behaviors that result in a diagnostic index value less than the cut-off value of 10, we suggest the clinician consider another cause for the problem behavior.

^aAnalytical Software, version 4.1, Statistix, Tallahassee, Fla.

^bVoith VL, Ganster D. Separation anxiety: review of 42 cases (abstr). *Appl Anim Behav Sci* 1993;37:84–85.

^cDehasse J. The systematic approach to companion animal problem behaviour (abstr), in *Proceedings*. 1st Int Conf Vet Behav Med 1997;223.

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