Association of pruritus with anxiety or aggression in dogs

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Objective—To evaluate the association between pruritus and anxiety-related and aggressive behaviors in dogs.

Design—Cross-sectional survey.

Animals—238 dogs between 1 and 8 years old.

Procedures—Information including a score for general degree of pruritus (visual analogue scale from 0 to 10) and frequency of anxiety-related and aggressive behaviors was collected via a survey distributed to clients at 3 privately owned practices.

Results—Median score for pruritus was 2.4. Dogs were assigned to 2 groups on the basis of pruritus score (nonpruritic [0 to 2.4] and pruritic [2.5 to 10]). There was no significant difference between pruritic and nonpruritic dogs with regard to aggression or with regard to reactivity to being alone; to thunderstorms or noises; or to unfamiliar people, animals, or objects. Post hoc analysis revealed significantly more reactivity to thunderstorms or noises in dogs treated with glucocorticoids (18/37 [49%]) than in those not administered glucocorticoids (57/197 [29%]).

Conclusions and Clinical Relevance—An association was not detected between pruritus and aggressive, anxious, or fearful behavior in dogs. There was greater reactivity to thunderstorms or noises in glucocorticoid-treated dogs. These findings do not preclude the possibility of a relationship between certain dermatoses or pruritic conditions and behavior. However, a concurrent behavioral abnormality cannot be assumed to result from a dermatosis and be expected to resolve with treatment of only the skin disease. Dogs with behavioral disorders and pruritic disease require primary treatment of both conditions. Additional studies to examine the effect of disease and glucocorticoids on canine behavior are warranted. (J Am Vet Med Assoc 2008;233:1105–1111)

Aggression of dogs toward humans or other animals is a serious public health issue. Fear- or anxiety-related behaviors, such as property destruction, inappropriate elimination, escape, excessive barking, and aggression, are leading causes of pet relinquishment and euthanasia. These problem behaviors also constitute most of the concerns expressed by owners when bringing their dogs to veterinary behaviorists for evaluation and treatment.

In humans, there is an association between mood or anxiety disorders and pruritic skin disease. An increase in the prevalence of anxiety, depression, excitability, and suicidal ideation, as well as a decreased ability to cope with stress, has been reported in patients with atopic dermatitis. Emotional and social well-being may be affected by pruritic skin disease; conversely, personality and stress may have a modulating effect on immune function, particularly in the skin. Skin sensation is affected by temperament and stress via mediating effects of cells in the dorsal horn of the spinal cord (gate control theory). Centrally controlled alterations in immune function may be mediated by neuropeptides. Neuropeptides involved in neurogenic inflammation include substance P, calcitonin gene–related peptide, vasoactive intestinal peptide, and neuropeptide Y. Substance P mediates pruritus and may be involved in pain sensation. In addition, increased numbers of substance P–containing neurons can be found in skin lesions associated with atopic dermatitis and psoriasis in humans, and stress can alter release of substance P. Associations between stressful events and onset or exacerbation of psoriasis, urticaria, and alopecia areata and between stressful events and severity of symptoms in human patients with atopic dermatitis have been supported in studies.

Pruritic skin disease in dogs commonly is secondary to infection, parasitic infestation, allergy, or other causes. Physical discomfort associated with disease is assumed to increase irritability and aggression in dogs. It is logical that heightened skin sensitivity or painful events could lead to learned fear of contact with the family that owns the dog (petting and other physical interactions may cause discomfort, and owners may apply unpleasant topical treatments) as well as with unfamiliar people. In children with atopic dermatitis, this phenomenon has been linked to development of emotional disturbances. Aggression is often a manifestation of fear in dogs. If temperament and stress affect the central perception of skin sensations and immune activity in the skin of dogs in the same manner as in humans, it is plausible that behavioral disorders characterized by anxiety could also predispose dogs to an increase in pruritis or altered sensation in the skin.
The latter has not been proven experimentally, and although the neurogenic pathway involving substance P has been implicated in humans with atopic dermatitis, a study in dogs did not support a substance P–based neurogenic pathway for atopic dermatitis.

Quantifying the association between skin discomfort or pruritus and aggression or anxiety should allow for more effective management and treatment of animals with these disorders. The study reported here was conducted to compare the prevalence of pruritic behavior and skin lesions with the frequency of behaviors associated with aggression, anxiety, and fear in dogs. We hypothesized that there would be an increased prevalence of aggression and anxiety– and fear-related behaviors in pruritic dogs, compared with the prevalence in dogs without pruritus.

Materials and Methods

The study was reviewed by the Institutional Review Board of the University of Pennsylvania. It was exempted from Institutional Review Board oversight.

Study population—The study was conducted in 2 phases. In the first, a 13-page questionnaire designed to measure pruritus, aggressive behaviors, and manifestations of fear and anxiety was distributed to each owner who was registering their dog for an appointment at a single privately owned veterinary practice in southern New Jersey (practice A). The questionnaire incited a request for feedback on ease of use and clarity.

Each questionnaire was assigned a unique number. Clients were given the questionnaire at the time of registration and asked to review and complete it while in the waiting room. Clients were not asked to complete the survey when they were registering their dog for euthanasia or for treatment of a life-threatening emergency. Potential respondents were also offered the option of declining to complete the survey, in which case the questionnaire was marked as declined to allow estimation of the response rate for the survey. Respondents were directed to place completed or declined surveys in a labeled box in the waiting room.

The first phase of the study lasted for 3 weeks. Minor revisions to the questionnaire and study design were made on the basis of responses received.

For the second phase, the revised, 12-page survey was distributed and collected in the aforementioned manner to clients who were registering their dog for an appointment at 3 privately owned veterinary practices (practice A, practice B in Maryland, and practice C in Delaware). Prior to initiation of the study, one of the authors (MPK) visited each practice and informed staff who worked at the reception desk about the study protocol and the importance of providing a survey to each eligible client for the purpose of determining an accurate response rate and to prevent the introduction of bias that could result from allowing respondents to be determined by other factors. Survey distribution was begun at each clinic only after consent of the practice owner was obtained and after staff was educated on the purpose of the study and distribution guidelines.

Similar to the first phase, each client, except for those who were registering their dog for euthanasia or for treatment of a life-threatening emergency, was invited to complete the survey. The survey was administered in 2007 from April through August at practice A, the end of May through August at practice B, and June through August and again in December at practice C. The period for administration of the survey was determined by the number of surveys collected at each practice (ie, an additional period of survey distribution was used at practice C to increase the number of clients from that practice who were invited to participate).

Survey instrument—An introductory cover page explained the objectives of the study and screened potential subjects for inclusion. Inclusion criteria were that the person completing the survey had owned the dog for at least 2 months, the dog lived indoors, and the dog was between 1 and 8 years of age. This age range was selected to reduce the likelihood that destructive or biting behavior was associated with normal exploratory and mouthing behavior of puppies, to decrease the probability that any reported housesoiling was attributable to lack of housetraining in puppies or to health conditions in geriatric dogs, and to lessen the potential for behavioral effects of age-related disease (such as osteoarthritis) to impact study results. Dogs that did not live indoors were excluded because their interactions with family members would be limited.

The typical degree of pruritus in the month preceding completion of the survey was ranked by owners on a 10-point visual analogue scale. For the study, 0 indicated that the dog did not scratch, rub, or chew on itself; 5 indicated that the dog spent half of the time during which it was awake performing these activities; and 10 indicated that the dog engaged in these pruritic behaviors all of the time during which it was awake. Respondents were asked to record the presence or absence of specific skin lesions, such as scabs or crusts, pustules, redness, and alopecia. Clients were asked whether their dog had received any medications (which were listed by category) within the last 3 months. Questions regarding aggressive behavior were prefaced with an explanation that the specific behaviors for which information was requested were a typical part of canine communication and social interactions and were expected to be seen in behaviorally normal dogs in certain contexts. Respondents were asked to record the number of incidents of growling, snarling, lunging, snapping, or biting directed toward familiar and unfamiliar people and animals as well as the number of days on which these incidents were detected during the month prior to completion of the survey. Biting was defined as any contact of the dog’s teeth on human skin or clothing, excluding only that which happened during play or accidental contact (eg, a client put their hand in the dog’s mouth for a specific purpose, such as brushing the dog’s teeth). They were also asked to record any episodes of destructiveness, rearranging of household items, raiding of the garbage, housesoiling, excessive vocalization, attempting to escape, restlessness, attention-seeking behavior, or other anxiety- or fear-related behaviors displayed during the month prior to completion of the survey. Specifically, clients were asked whether any of these behaviors occurred when the dog was alone or separated from the family; when the dog was exposed to thunderstorms or loud or unusual noises; when the dog saw an unfamiliar person, animal, or object; or whether the behavior was in another context. Because it was regarded as a possible confounder, owners were asked to describe
any household or management changes during the 6 months prior to survey completion.

Information was collected anonymously, and respondents were told that results of the study would include only breed, age, sex, medical disease and treatment, and behavior-related information for the dogs and that publications and presentations would reveal no identifying information. However, respondents were asked to provide their dog’s name and their own name and contact information for the purpose of verifying medical history information during the 3 months preceding completion of the survey. This information was requested to determine whether any dog had been treated with medications likely to modify behavior (and therefore impact survey results) and to confirm that the treatments reported by respondents were accurate. Clients were given the option to decline to provide this information; however, they were also offered the option of receiving a preliminary report of the study results as an incentive to comply.

Statistical analysis—To determine differences between groups of dogs with regard to various behavioral problems, a $\chi^2$ or Fisher exact test ($2 \times 2$ tables) was used. To assess the relationship between pruritus score and skin lesions, the Cochran-Armitage trend test was used. A value of $P < 0.05$ was considered significant. All analyses were performed by use of commercially available statistical software.

Results

Four hundred seventy-one surveys were distributed, which included the preliminary questionnaires (263 at practice A, 130 at practice B, and 78 at practice C). Two hundred thirty-one (49%) were completed and met inclusion criteria. Seven additional questionnaires were incomplete but met inclusion criteria and contained sufficient information on signalment, pruritus, medications, and aggression or anxiety-related behaviors to be included in some or all analyses, which yielded 238 (51%) surveys in the study. Seventy-six (16%) owners declined, and 157 (33%) surveys were excluded because they did not meet inclusion criteria ($n = 135 \ [86\%]$) or they were incomplete or filled out improperly ($22 \ [14\%]$). Of the dogs that did not meet inclusion criteria, most were excluded on the basis of age ($128/135 \ [95\%]$). None were excluded because they were kept outdoors.

Of the 237 dogs for which sex and neuter status were reported, there were slightly more females than males, and most were spayed or neutered (117 [49%] spayed females, 93 [39%] neutered males, 8 [3%] sexually intact females, and 19 [8%] sexually intact males). Dogs represented 55 breeds, which included 69 (29%) mixed-breed dogs, 24 (10%) Labrador Retrievers, 12 (5%) English Bulldogs, 9 (4%) German Shepherd Dogs, 7 (3%) Jack Russell Terriers, 7 (3%) Golden Retrievers, 7 (3%) Dachshunds, 7 (3%) American Pit Bull Terriers, 5 (2%) Beagles, 5 (2%) Boxers, 5 (2%) Rottweilers, 5 (2%) Pugs, and 5 (2%) Shetland Sheepdogs. Mean ± SD age was $4.4 \pm 2.4$ years.

Median pruritus score reported by use of the visual analogue scale was 2.4 (interquartile range, 0.95 to 5.00). One hundred five (44%) dogs had some type of skin lesion. The proportion of dogs that had skin lesions differed significantly ($P < 0.001$) among pruritus scores. The proportion of dogs that had skin lesions was 26%, 47%, and 70% for pruritus scores of 0 to 2.4, 2.5 to 4.9, and 5.0 to 10.0, respectively.

Most respondents (158/238 [66%]) consented to the review of their pet’s medical record. All medication used in the 3 months prior to survey completion was noted for each dog, regardless of whether it was reported by the owner in the survey or recorded in the medical record. In dogs for which consent was not given to review the medical record, information on medication or medications administered was retrieved solely from the owner responses in the survey. Owner reporting of medication use was consistent with information regarding medication use in the medical records, which suggested that self-reporting was accurate. Thus, in the interest of maximizing the number of dogs included in analyses, dogs were not excluded when their owners did not consent to medical record review.

Seventy-six (32%) dogs were currently being treated or had been treated with medications that had the potential to affect behavior during the 3 months preceding the survey. These medications included glucocorticoids, antihistamines, seizure medications, various drugs with sedative effects, sex hormones, thyroid or other hormones, selective serotonin reuptake inhibitors, and tricyclic antidepressants. The proportion of dogs receiving treatment with a drug that could affect behavior differed significantly ($P < 0.001$) on the basis of pruritus score. The proportion of dogs receiving treatment was 21%, 30%, and 51% for pruritus scores of 0 to 2.4, 2.5 to 4.9, and 5.0 to 10.0, respectively. When dogs treated only with medications for skin disease (glucocorticoids and antihistamines) were excluded from the analysis, there was no longer a significant ($P = 0.64$) difference in the proportion of dogs treated with a behavior-modifying drug on the basis of pruritus score (12%, 11%, and 9% for pruritus scores of 0 to 2.4, 2.5 to 4.9, and 5.0 to 10.0, respectively).

Dogs were allocated into 3 groups (dogs treated with sedatives, opioids, benzodiazepines, seizure-control medications, levothyroxine, diethylstilbestrol, phenylpropanolamine, or desoxycorticosterone but not glucocorticoids or antihistamines; dogs treated with any behavior-modifying medications; and dogs treated with antihistamines and glucocorticoids but no other drugs with potential behavior-modifying effects). The proportion of dogs with pruritus in the third group (76%) was significantly ($P < 0.001$) higher than the proportion in the first or second groups (46% and 42%, respectively). For purposes of analysis, the pruritus scale was collapsed to form 2 categories (nonpruritic [pruritus score of 0 to 2.4] and pruritic [pruritus score of 2.5 to 10]) on the basis that 2.4 was the median pruritus score and scratching < 25% of the time was considered fairly typical behavior for dogs. In the subpopulation of dogs that had received treatment with any behavior-modifying medication, a significantly ($P = 0.01$) higher proportion of dogs in the nonpruritic group (54%) were treated with sedatives, opioids, benzodiazepines, seizure-control medications, levothyroxine, diethylstilbestrol, phenylpropanolamine, or desoxycorticosterone, compared with the proportion of dogs in the pruritic group (24%) that were treated with those medications.
During the month preceding survey completion, 102 (43%) dogs displayed some form of aggression (growing [n = 93 (40%)]; snarling, lunging, or snapping [51 (22%)]; or biting [10 (4%)]). For the dogs that displayed aggression, targets were unfamiliar animals (n = 51 [50%]), unfamiliar people (n = 49 [48%]), familiar animals (n = 39 [38%]), or familiar people (n = 23 [23%]). Of the dogs that displayed any aggressive behavior, 49 (49%) had growled but had not displayed snarling, lunging, snapping, or biting behavior. The number of incidents of aggression per dog ranged from 1 to 11. Of the dogs that displayed aggression, 51 (50%) were in the pruritic group and 33 (32%) had been treated with behavior-modifying drugs. Dogs that had snarled, lunged, snapped, or bitten were not significantly more likely to have pruritis (P = 0.55) than those that had only growled (43%). There was no significant (P = 0.96) difference between pruritic and nonpruritic dogs in the number of incidents of aggression (20% and 17%, 38% and 45%, 27% and 26%, and 16% and 14% for pruritic and nonpruritic dogs, respectively, for 1, 2, 3 to 5, and > 5 incidents, respectively).

One hundred thirty-seven (59%) dogs had displayed 1 or more clinical signs consistent with distress, such as destructiveness (n = 61 [47%]), inappropriate urination or defecation (n = 41 [32%]), vocalization (n = 54 [41%]), or other signs (eg, rearranging household items [n = 30 [24%]], attempting to escape [n = 21 [17%]], or raiding the garbage [n = 72 [55%]]) when alone or separated from the social group. In addition, 75 (32%) dogs displayed 1 or more of these signs of fear or anxiety in response to thunderstorms and loud or sudden noises. Ninety-five (40%) dogs displayed some type of reactivity to unfamiliar objects, animals, or people. In the case of exposure to unfamiliar people and animals, this was characterized primarily by excessive vocalization (n = 68 [72%]), attempting to escape from the stimulus (n = 14 [15%]), or other indications of fear (eg, trembling [n = 13 [14%]]), and in the case of exposure to unfamiliar objects, it was characterized primarily by excessive vocalization (n = 22 [24%]).

Pruritic and nonpruritic dogs did not differ in aggressive behavior; reactivity to being alone; reactivity to thunderstorms or noises; or reactivity to unfamiliar people, animals, or objects (Table 1). For dogs treated with potentially behavior-modifying medications, nonpruritic dogs displayed significantly more aggressive behavior but did not differ with regard to other categories (Table 2). When dogs treated with behavior-modifying drugs other than antihistamines and glucocorticoids were analyzed separately, there was not a significant (P = 0.11) difference in prevalence of aggression between the nonpruritic dogs (79%) and pruritic dogs (42%). For dogs treated with antihistamines and glucocorticoids, there was not a significant (P = 0.73) difference in prevalence of aggression between the nonpruritic dogs (42%) and pruritic dogs (32%).

Dogs not receiving any behavior-modifying medications did not differ significantly on the basis of pruritus score for any category of behavior (Table 3). Thirty-eight (16%) dogs had been treated with glucocorticoids. Treatment with glucocorticoids was significantly associated with increased reactivity to thunderstorms and noises but was not significantly associated with any other category of behavior (Table 4).

### Table 1—Comparisons of behaviors associated with aggression and fear in 117 pruritic and 119 nonpruritic dogs.

<table>
<thead>
<tr>
<th>Behavior*</th>
<th>Pruritic</th>
<th>Nonpruritic</th>
</tr>
</thead>
<tbody>
<tr>
<td>Aggression</td>
<td>51 (44%)</td>
<td>51 (43%)</td>
</tr>
<tr>
<td>Reactivity to being alone or separated</td>
<td>71 (61%)</td>
<td>66 (56%)</td>
</tr>
<tr>
<td>Reactivity to thunderstorms or noises</td>
<td>41 (35%)</td>
<td>34 (29%)</td>
</tr>
<tr>
<td>Reactivity to unfamiliar people, animals, or objects</td>
<td>54 (46%)</td>
<td>41 (35%)</td>
</tr>
</tbody>
</table>

*For each dog, > 1 behavior could have been recorded.

### Table 2—Comparisons of behaviors associated with aggression and fear in 51 pruritic and 25 nonpruritic dogs treated with behavior-altering drugs.

<table>
<thead>
<tr>
<th>Behavior*</th>
<th>Pruritic</th>
<th>Nonpruritic</th>
</tr>
</thead>
<tbody>
<tr>
<td>Aggression†</td>
<td>17 (34%)</td>
<td>16 (64%)</td>
</tr>
<tr>
<td>Reactivity to being alone or separated</td>
<td>33 (65%)</td>
<td>14 (58%)</td>
</tr>
<tr>
<td>Reactivity to thunderstorms or noises</td>
<td>19 (37%)</td>
<td>7 (29%)</td>
</tr>
<tr>
<td>Reactivity to unfamiliar people, animals, or objects</td>
<td>21 (41%)</td>
<td>9 (38%)</td>
</tr>
</tbody>
</table>

†Significant (P = 0.03) difference between pruritic and nonpruritic dogs. See Table 1 for remainder of key.

### Table 3—Comparisons of behaviors associated with aggression and fear in 66 pruritic and 94 nonpruritic dogs that did not receive treatment with behavior-altering drugs.

<table>
<thead>
<tr>
<th>Behavior*</th>
<th>Pruritic</th>
<th>Nonpruritic</th>
</tr>
</thead>
<tbody>
<tr>
<td>Aggression</td>
<td>34 (52%)</td>
<td>35 (37%)</td>
</tr>
<tr>
<td>Reactivity to being alone or separated</td>
<td>38 (58%)</td>
<td>52 (56%)</td>
</tr>
<tr>
<td>Reactivity to thunderstorms or noises</td>
<td>22 (33%)</td>
<td>27 (29%)</td>
</tr>
<tr>
<td>Reactivity to unfamiliar people, animals, or objects</td>
<td>33 (50%)</td>
<td>32 (34%)</td>
</tr>
</tbody>
</table>

See Table 1 for key.

### Table 4—Comparisons of behaviors associated with aggression and fear in 38 dogs treated with glucocorticoids and 197 dogs that did not receive treatment with glucocorticoids.

<table>
<thead>
<tr>
<th>Behavior*</th>
<th>Treated</th>
<th>Not treated</th>
</tr>
</thead>
<tbody>
<tr>
<td>Aggression</td>
<td>18 (47%)</td>
<td>84 (43%)</td>
</tr>
<tr>
<td>Reactivity to being alone or separated</td>
<td>24 (65%)</td>
<td>113 (57%)</td>
</tr>
<tr>
<td>Reactivity to thunderstorms or noises†</td>
<td>18 (49%)</td>
<td>57 (29%)</td>
</tr>
<tr>
<td>Reactivity to unfamiliar people, animals, or objects</td>
<td>16 (43%)</td>
<td>79 (40%)</td>
</tr>
</tbody>
</table>

†Significant (P = 0.02) difference between glucocorticoid-treated and untreated dogs. See Table 1 for remainder of key.
Discussion

General veterinary practices were selected for the study reported here to ensure that the results were representative of the population of canine patients examined by veterinarians in general practices. It was hoped that a lower number of these dogs would already be receiving medical treatments that could affect behavior (a potential confounder of our results) than would be receiving these medications had a population of dogs at referral clinics been selected (eg, dogs examined by a board-certified veterinary dermatologist) or had dogs been selected on the basis of an initial complaint of pruritus or skin disease. Few of the dogs for which a survey was completed were actually examined because of a dermatologic problem by a veterinarian at the time of survey completion.

Although survey intervals were staggered among the 3 practices, this was not believed to have been likely to skew the study results. The factor most likely to have been affected was the number of dogs ranked as pruritic. Although it is possible that seasonal allergies would have resulted in increased numbers of pruritic dogs being reported at practices A and B, compared with the number at practice C because of the survey period in December at practice C, this should not have had an effect on associations between pruritus and behavior or between medication administered and behavior.

Approximately equal proportions of male and female dogs were included in the study. The breed distribution was not surprising, with most respondents owning mixed-breed dogs, followed by several of the more popular dog breeds. The breed that was overrepresented was the English Bulldog, which was attributable to the fact that an unusually high proportion of the clients at 1 practice were breeders of these dogs. However, because they accounted for only 12 of 238 (5%) dogs in the sample population, overrepresentation of English Bulldogs was not likely to have much, if any, effect on our results. A large number of dogs were excluded from the study on the basis of age, which should not have had deleterious effects on the study results.

Significant differences were detected among pruritic dogs on the basis of whether they had received (or were currently receiving) treatment with a drug that could have behavioral effects. However, this appeared to be attributable to the fact that a large number of dogs were being treated with glucocorticoids and antihistamines. Dogs treated with glucocorticoids and antihistamines had a significantly higher pruritis score than did dogs treated with other medications that could influence behavior (eg, sedatives, seizure-control medications, and sex hormones), which would be expected.

In the overall population, pruritus was not associated with aggression, and among the subpopulation of dogs that had displayed aggressive behavior, pruritus was not associated with a higher frequency or a greater severity of aggression. When dogs treated with potentially behavior-modifying medications were excluded from the analysis, there was still no association between pruritus and aggression. However, in the subset of dogs treated with behavior-modifying drugs, nonpruritic dogs had a higher prevalence of aggression than did pruritic dogs. This finding was unexpected. Dogs in the nonpruritic group that reportedly displayed aggression differed from those that had not displayed aggression in that they were more likely to have been receiving medications that could cause sedation (with the potential for disinhibition of aggression), treatment for underlying conditions (eg, seizure or endocrine disorders) that could increase the risk of aggression, drugs that may be associated with increased irritability (eg, phenylpropanolamine), or antidepressant drugs (2 dogs; 1 dog was treated with fluoxetine and the other with amitriptyline) that had likely been prescribed for an underlying aggression or anxiety disorder.21–23 Therefore, it is probable that the higher prevalence of aggression in nonpruritic dogs in the subset of dogs that received behavior-modifying medications resulted from a combination of irritability attributable to the underlying illness (other than dermatologic disease); irritability and disinhibition of aggression attributable to specific medications; and, in part, inclusion of dogs with preexisting behavioral problems. The specific impact of certain illnesses on behavior, as well as the potential for some medications to adversely affect behavior, warrants further investigation. No association was detected between pruritus and fear of thunderstorms or noises; being alone or separated from the social group; or exposure to unfamiliar people, animals, or objects, whether in the overall population or in the group of dogs not receiving medications that could affect behavior. The lack of an association between pruritus and aggressive, anxious, or fearful behavior was contrary to our expectations. To our knowledge, no studies have directly examined the relationship between pruritus and behavioral problems in dogs. However, a study26 of dogs that had bitten children revealed that many of those dogs (20%) had dermatoses. The literature on canine behavior presumes an association between pain or discomfort and aggression, and a connection between dermatologic disease and mood and behavior is supported in the human literature.7–28

Most reactivity to unfamiliar people and animals was manifested as excessive vocalization. Barking can be consistent with increased arousal, and it is possible that some dogs that vocalized in response to unfamiliar people and dogs were, in fact, reacting aggressively. We did not include barking when reporting aggression because it may be difficult for owners to distinguish between alarm barking (ie, barking to alert members of the social group about the presence of a person or animal that is not a household member), barking attributable to excitement or for other reasons, and barking as a sign of aggression. Omitting this behavior could have contributed to the lack of an association between pruritus and aggression in the study reported here.

We detected a significant increase in reactivity to thunderstorms and noises in dogs treated with glucocorticoids, but no other differences in behavior were evident between dogs treated with glucocorticoids and dogs not treated with glucocorticoids. In humans, glucocorticoid administration has been associated with disturbances in sleep, cognition, mood, and behavior, including irritability, psychosis, manic behavior, and depression. These effects reportedly are related to dosage, onset or cessation of treatment, and chronicity of treatment.27–29 Although studies in dogs have not specifically evaluated this effect, it would be logical to assume that glucocorticoid use in dogs could have behavioral effects similar to those reported in humans. The lack of an increase in other anxiety-related, fear-related, and aggressive behaviors in the
dogs of our study may have been attributable to the small number treated with glucocorticoids or to confounding effects of other medications in dogs not treated with corticosteroids. It is also possible that glucocorticoids had little effect on behavior because the glucocorticoid-treated group included dogs that received any oral, injectable, or topical medication containing glucocorticoids, which meant that the systemic concentrations of the medication in some dogs could have been extremely low and any systemic effects minimal.

A number of limitations are inherent in a survey study. Selective distribution could have introduced bias into the study by possibly artificially increasing the number of dogs with known skin disease or behavioral problems. It is clear from the number of surveys distributed that every owner who registered their dog for an appointment at each of the practices during the study period did not receive a survey. During the course of the study, this concern was discussed with the staff at each practice, and this result was reportedly caused by the relative workload of the staff at any given time (ie, at those times when front desk personnel were extremely busy, they did not distribute surveys). The staff did not believe they were selectively distributing surveys. However, it is possible that they were more likely to target owners of pruritic dogs or dogs with behavioral problems because of the focus of the study and the potential that they did not offer surveys to clients whom the staff expected to decline.

The survey-based study reported here may have introduced inaccuracies associated with self-reporting and recall bias. Although aggressive behaviors were clearly defined and explained to be normal in some contexts in all dogs, such behaviors are undesirable in pets and owners may view them as something that should be hidden. Therefore, owners may have been reluctant to report aggressive behaviors objectively, even anonymously. Approximately a third of owners to whom a survey was distributed declined it, did not complete it, or completed it incorrectly so that it could not be used. Some may have declined or left surveys incomplete as a result of a reluctance to report problem behaviors. This could have introduced bias into our results by causing an artificially low number of dogs with reported aggressive, fearful, or anxious behaviors. Alternatively, owners may have underreported aggression in their pet purposefully or because of biased recall (ie, owners may have neglected to report aggressive behaviors because they believed those behaviors were excusable or lacked aggressive intent). It appears logical that behaviors associated with fear would have been less likely than aggressive behaviors to be underreported by owners. Destructiveness, attempting to escape, housesoiling, vocalization, and other fear-related behaviors may be less objectionable to society than is aggression. Assuming this is true, the prevalence of aggression would have been more likely than the prevalence of fear-related behaviors to be artificially low because of recall bias, bias associated with response rate, and bias as a result of owners failing to complete the survey. Minor manifestations of aggression, such as growling and snarling, were considered typical canine behaviors that would have been quite likely to have occurred during the reporting period (ie, 1 month), and the proportion of dogs with reported aggression was moderately high (43%). This suggests that reporting of this type of behavior may have been fairly accurate.

Owners were asked to report frequency of pruritic behavior. Although the degree of pruritus was defined, the ranking was subjective and likely influenced by factors such as the amount of time the respondent spent with the dog, how observant the owner was of the dog’s behavior, and the owner’s expectations of what constituted a normal amount of scratching or self-grooming behavior in a dog. Visual analogue scales have been used effectively to measure behavior for comparison between subjects, and results have revealed good interrater reliability.20 One problem with use of visual analogue scales is that subjects may not treat the scale as a continuum, which may result in trimodal scores (concentrated at either end and in the middle). This is more likely when the midpoint is marked on the scale,20 which it was in the survey instrument used here. This could have skewed our results, but it was hoped that combining rating scores into 2 groups (nonpruritic and pruritic) would reduce this effect. Because there were more dogs with skin lesions in the higher pruritus groupings and skin lesions were likely to have caused or been caused by pruritus, it appears that the scale used here was probably fairly accurate in measuring pruritus.

Self-reporting of medications may not have been entirely accurate (eg, the family member completing the survey was not the one who administered treatments); thus, some dogs may have been given medications that could have affected behavior without the use of the medications being reported. Therefore, it is possible that the use of medications that could have affected behavior was underreported. Assuming that to be true, it could have decreased any difference in aggression between the pruritic and nonpruritic groups, particularly in light of the fact that the subgroup of dogs within the nonpruritic group that were receiving medications with potential behavioral effects had an increased frequency of aggression.

Results of the study reported here do not support an association between pruritus and aggression in dogs or between pruritus and frequency or severity of aggressive behavior. A relationship was not confirmed between pruritus and fearful responses or reactivity to thunderstorms; noises; or unfamiliar people, animals, or objects. However, we did detect a significant increase in the prevalence of reactivity to noises and thunderstorms in dogs treated with glucocorticoids. Although we did not detect an association between pruritic skin disease and common behavioral problems, such as aggressive and fearful or anxious behavior, our results do not confirm the lack of a connection between pruritic diseases and these behaviors. Additional studies will be of benefit to evaluate the possibility of a relationship between specific disease conditions and behavior. Many conditions can cause pruritus and skin pain, and some may be more likely than others to be associated with behavioral changes. In particular, certain pruritic dermatologic conditions (such as otitis externa) may elicit aggression in conjunction with the administration of topical treatments. The aggression in these dogs would likely be secondary to pain or to learned fear of this type of handling. The numbers of dogs with reported aggressive behavior to specific targets (eg, familiar or unfamiliar humans or animals) were not
high enough for analysis of an association between pruritus and specific categories of aggression (eg, owner-directed aggression). It is also possible, even if pruritus is not associated with aggressive behavior in general, that there may be an effect of pruritus on certain categories of aggression. Another definition of aggression or the inclusion of clearly defined classes of vocalization suggestive of aggression in the category of aggressive behavior may reveal an association between pruritus and some types of aggression. Future studies could also be conducted on a population of dogs with specific known behavioral problems and concurrent skin disease to evaluate a relationship between the onset or exacerbation of dermatologic signs and worsening or improvement in the behavior.

The integration of behavioral and medical diagnostics as well as treatment is essential for ensuring optimal patient care at general and referral practices. Thorough evaluation of patients is necessary to identify all factors contributing to an ailment, regardless of whether such an ailment is primarily behavioral. The impact of disease on psychologic well-being has been established in humans, and mental diseases may adversely affect the management of medical diseases.31,32 The study reported here was conducted with the goal of elucidating an association, if it existed, between pruritus and behavior. Information on the relationship between pruritus and behavior would be important in the management of dogs with behavioral and dermatologic disorders. An association would provide a warning to owners that dogs with uncontrolled pruritic dermatologic disease, in addition to being agitated and distressed, could be more likely to display certain behaviors that are undesirable or dangerous to the pet, the owner, other humans, or other animals. However, the lack of association in our results does not eliminate the need to recognize that physical discomfort or disease can aggravate aggression, anxiety, and fear.33 Additionally, it may provide a more compelling argument for clinicians to directly address behavioral problems that are concurrent with dermatologic disease, rather than expecting the behavioral condition to resolve with treatment of the physical disease alone. The focus of this study was on the possibility that discomfort from pruritus could be associated with abnormal behavior. We did not attempt to distinguish among causes of pruritus, and it is possible that certain underlying disease processes could be more likely than others to result in an increase in aggression or anxiety. Studies to examine the relationship between behavior and specific diseases are warranted.

SAS version 9.1, SAS Institute Inc, Cary, NC.

References