

Effects of gender and parental status on knowledge and attitudes of dog owners regarding dog aggression toward children

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Objective—To assess the effects of gender and parental status of dog owners on knowledge of and attitudes toward factors associated with dog aggression directed toward children.

Design—Prevalence survey.

Population—804 dog owners.

Procedures—A questionnaire was distributed to owners of all dogs examined at a university veterinary hospital between January and April 2007. Respondents were asked to indicate whether they agreed or disagreed with 37 statements regarding dog behavior and safety practices for dog-child interactions. Responses were compared between women and men and between parents and nonparents.

Results—Of 804 questionnaires that were completed, 421 (52%) were completed by parents and 598 (74%) were completed by women. There was a general lack of knowledge regarding dog behavior and safety practices for dog-child interactions. Women were more knowledgeable than men, regardless of parental status. Mothers were more knowledgeable than fathers and female nonparents regarding interactions with young children and had greater awareness than female nonparents and males (regardless of parental status) regarding interactions with infants and toddlers.

Conclusions and Clinical Relevance—Results suggested that dog owners frequently had only limited knowledge of dog behavior and often were unaware of factors that increased the risk of dog bites to children. The veterinary examination presents an important opportunity for education of dog owners regarding dog behavior, including body language, social signals, resource-guarding, and self-defense, and the risks of dog bites to infants and young children. (*J Am Vet Med Assoc* 2008;233:1412–1419)

Children are the most common victims of reported dog bites to people,¹ although the actual incidence of child-directed dog aggression is probably higher than that suggested by the number of reported bites.² Unfortunately, successful prevention of dog aggression toward children is difficult for a number of reasons. Most important, canine body language is often misunderstood by adults as well as children, and what appears to be affection may instead be a subtle threat.³ Most children who have been bitten by a dog were bitten by the family pet or another dog known to the child or family,⁴ and most bites involving young children have occurred in the home.⁵ Prevention programs have emphasized the importance of teaching children how to behave in the presence of dogs,^{6,a} but prevention of bites relies even more on parental supervision and, most important, parental awareness of the risks. Unfortunately, the mere presence of an adult does not guarantee adequate supervision and may not be sufficient for prevention of dog bites.^{5,7} Further compounding the problem is the finding in a survey⁸ of parents, nearly

all of whom were mothers, that parental knowledge of dog-associated risks to children may be lacking. For example, more than half the respondents indicated that they believed that an unsupervised, 4-year-old child would be safe with the parents' own dog. However, the investigators did not elaborate on their findings.

Although parents and guardians are ultimately responsible for protecting their children from dog bites, at least some of the responsibility for preventing dog bites to children rests with dog owners.⁹ However, it is not known how knowledgeable dog owners are about factors associated with dog aggression toward children or whether knowledge varies with gender or parental status of the dog owner. Therefore, the purpose of the study reported here was to assess the effects of gender and parental status of dogs owners on knowledge of and attitudes toward factors associated with dog aggression toward children. We hypothesized that, even among dog owners, knowledge of factors associated with dog aggression toward children would be lacking, but that parents and women would have greater awareness, compared with nonparents and men.

Materials and Methods

A questionnaire^b designed to measure general knowledge of and attitudes toward factors and practices associated with dog aggression toward children was dis-

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tributed to all dog owners arriving for an appointment at a university-based veterinary referral hospital from January through April 2007. Owners were given the questionnaire when they registered with the admission desk and were asked to review and complete it while waiting for their appointment. A cover page introduced the survey and indicated that the survey was intended as an attempt to learn about the attitudes of dog owners toward dog aggression with regard to children. Respondents were told the survey would be anonymous and were given the option to decline to participate. Completed surveys were placed in a designated box in the waiting room. Each survey was assigned a unique number solely for the purpose of monitoring the return rate. Each owner was asked to complete the survey only once. The survey was approved for exemption by the

university's institutional review board for research on human subjects.

Standard methods¹⁰ were used to develop the survey. The main part of the survey consisted of 37 statements, with respondents asked to indicate whether they strongly disagreed with, disagreed with, were neutral toward, agreed with, or strongly agreed with each statement. There were also 2 open-ended questions regarding safety measures respondents might take or might advise others to take with regard to interactions between dogs and children and a section in which respondents were allowed to provide unstructured comments. Additional questions solicited information on age, gender, and parental status of the respondents. It was anticipated that it would take approximately 10 minutes to complete the questionnaire. The initial questionnaire was pilot tested by distributing it to 20 dog-owning members of

Table 1—Responses of dog owners (n = 804) to 27 survey statements related to knowledge about dog behavior in situations that posed a risk of dog bites.

Statements	No. (%) of owners		
	Unsafe response	Neutral response	Safe response
General knowledge			
When a dog rolls onto its back, the dog is asking for a belly rub and it is safe to give the dog one.	336 (43)	250 (32)	198 (25)
Proper socialization of a puppy to young children will be sufficient to prevent future bites directed at children.	275 (35)	165 (21)	346 (44)
Even if a dog has already bitten someone, training can cure aggressive behavior.	259 (33)	282 (36)	242 (31)
Most bitten children are bitten by unfamiliar dogs (dogs they have never met).	143 (18)	257 (33)	388 (49)
If a dog is wagging its tail when encountering an unfamiliar child, it is safe for the child to pet the dog.	142 (18)	236 (30)	408 (52)
Dogs that are properly trained simply do not bite people, regardless of the provocation.	90 (11)	122 (16)	575 (73)
Small pet dogs (< 15 lb) are capable of killing an infant	58 (7)	121 (15)	613 (77)
Large pet dogs (> 70 lb) are capable of killing an infant.	25 (3)	80 (10)	686 (87)
Large dogs are more likely to bite children than smaller dogs are.	674 (86)	102 (13)	8 (1)
Interactions between dogs and children			
I think it is safe for young children to kiss and hug their own dogs.	648 (82)	106 (13)	41 (5)
I would never leave my dog unsupervised with a child younger than 10 years old.	282 (36)	90 (11)	418 (53)
I think it would be safe to leave a 4-year-old child alone, unsupervised, with my own dog (in same room).	261 (33)	84 (11)	443 (56)
Dogs should never, under any circumstances, be left alone with 4-year-old children.	237 (30)	161 (20)	394 (50)
If a dog growls when its food is approached, but has not bitten in the past, I would feel comfortable allowing a child in the same room with the dog while the dog eats.	135 (17)	69 (9)	594 (74)
I think it would be safe to leave a 4-year-old child alone, unsupervised, with someone else's dog (in same room).	32 (4)	74 (9)	684 (87)
Interactions between dogs and infants or toddlers			
I think it would be safe to leave a sleeping infant unsupervised with my own dog in the same room.	343 (43)	95 (12)	355 (45)
It is unsafe to leave even a trusted family dog alone with an infant.	220 (28)	134 (17)	435 (55)
Dogs should never be left alone with infants.	186 (24)	154 (20)	446 (57)
I would allow a toddler to climb onto my dog.	130 (17)	41 (5)	616 (78)
I think it would be safe to leave a sleeping infant unsupervised with someone else's dog in the same room.	51 (6)	49 (6)	691 (87)
Interactions between dogs and unfamiliar children in public areas			
I would feel comfortable taking my dog on a leash to a public place, such as a large pet store, where children might be present.	694 (88)	27 (3)	71 (9)
If an unfamiliar child wants to pet my dog during a walk, I allow it.	519 (65)	96 (12)	182 (23)
I would feel comfortable taking my dog to a crowded child's sports event, such as a soccer game.	514 (65)	65 (8)	216 (27)
I would allow my dog to mingle freely (off-leash) during a dinner party or picnic where unfamiliar people, including children, are present.	428 (54)	46 (6)	322 (40)
If a young child wanted to pet my dog and my dog moved away, I would hold my dog still and tell the child when it was okay to pet my dog.	358 (45)	60 (8)	376 (47)
If I arrived at a dog park and saw young children running there, I would still allow my dog to be off-leash.	321 (46)	61 (8)	321 (46)
Young children should not be permitted in dog parks or other public areas where dogs are off-leash.	222 (28)	158 (20)	412 (52)
For each statement, respondents were asked to indicate whether they strongly disagreed with, disagreed with, were neutral toward, agreed with, or strongly agreed with the statement. Responses were characterized as disagreed (ie, strongly disagreed or disagreed), neutral, or agreed (ie, agreed or strongly agreed), and classified as safe, neutral, or unsafe on the basis of likelihood that the particular situation or action could lead to a dog bite, as determined on the basis of general knowledge of canine behavior. Not all owners responded to all statements.			

the hospital faculty and staff, and minor changes were made as necessary to decrease ambiguity.

Twenty-seven of the 37 statements on the questionnaire were related to knowledge about dog behavior in situations that posed a risk of dog bites. Nine of these

statements were related to general knowledge of dog behavior, 6 to interactions between dogs and children, 5 to interactions between dogs and infants or toddlers, and 7 to interactions between dogs and unfamiliar children in public areas. The remaining 10 statements solicited

Table 2—Responses of dog owners (n = 804) to 10 survey statements soliciting respondents' opinions regarding dog aggression directed at children.

Statements	No. (%) of owners		
	Disagreed	Neutral	Agreed
In my opinion, dogs should tolerate being petted by unfamiliar children.	245 (31)	126 (16)	414 (53)
If I had a dog that growled at my own young children, I would give the dog away to a childless family.	326 (41)	221 (28)	242 (31)
Dog aggression towards children is most often caused by the dog's need to dominate (control and be higher in rank than) the child.	274 (35)	281 (36)	229 (29)
Dog aggression towards children is most often caused by the dog's fear of the child.	174 (22)	266 (34)	339 (44)
Most bitten children provoke dog bites because of their (the children's) behavior.	256 (35)	237 (32)	239 (33)
Whether an adult dog bites is mostly determined by its genetic makeup, regardless of training.	513 (65)	192 (24)	82 (10)
Whether an adult dog bites is mostly determined by its training, and training a dog can prevent biting, regardless of genetic makeup.	326 (41)	204 (26)	257 (33)
I believe that aggression towards owners of any age is most often due to a dog's protection of its food or other resources.	298 (38)	34 (30)	252 (32)
I believe that dog aggression towards owners of any age is most often due to the dog's fear or self-defense.	150 (19)	216 (28)	414 (53)
When I am in a public place with my dog, I think it is easy to instruct other people (of any age) about safety around my dog.	129 (16)	68 (9)	601 (75)

For each statement, respondents were asked to indicate whether they strongly disagreed with, disagreed with, were neutral toward, agreed with, or strongly agreed with the statement. Responses were characterized as disagreed (ie, strongly disagreed or disagreed), neutral, or agreed (ie, agreed or strongly agreed). Not all owners responded to all statements.

Table 3—Comparison of responses for parents versus nonparents to a survey regarding knowledge of and attitudes toward factors associated with dog aggression toward children.

Statement	No. of parents (%)			No. of nonparents (%)			P value
	Agreed	Neutral	Disagreed	Agreed	Neutral	Disagreed	
General knowledge							
Proper socialization of a puppy is sufficient to prevent bites to children.	122 (30)	76 (19)	211 (52)	153 (41)	89 (24)	135 (36)	< 0.001
Even if a dog has bitten someone, training can cure aggressive behavior.	119 (29)	143 (35)	146 (36)	140 (37)	139 (37)	96 (26)	0.005
It is safe for an unfamiliar child to pet a dog if the dog is wagging its tail.	80 (20)	107 (26)	223 (54)	62 (16)	128 (34)	186 (49)	0.049
Interactions with children							
It is safe to leave a 4-year-old child alone, unsupervised, with someone else's dog.	10 (2)	29 (7)	375 (91)	22 (6)	45 (12)	309 (82)	0.002
It is safe to leave a 4-year-old child alone, unsupervised, with my own dog.	139 (34)	34 (8)	241 (58)	122 (33)	51 (14)	201 (54)	0.047
Interactions with infants and toddlers							
It is unsafe to leave even a trusted family dog alone with an infant.	246 (60)	69 (17)	98 (24)	187 (50)	66 (18)	123 (33)	0.010
Dogs should never be left alone with infants.	254 (62)	79 (19)	77 (19)	192 (51)	75 (20)	108 (29)	0.002
It is safe to leave a sleeping infant unsupervised with someone else's dog.	23 (6)	15 (4)	377 (91)	28 (7)	34 (9)	314 (84)	0.003
Opinions							
I would give away my dog if it growled at my children.	151 (37)	114 (28)	147 (36)	91 (24)	107 (28)	179 (47)	< 0.001
Dog aggression to children is most often caused by dog's fear.	158 (39)	159 (39)	90 (22)	181 (49)	107 (29)	84 (23)	0.006
Most bitten children provoke dog bites because of their own behavior.	132 (32)	138 (34)	140 (34)	162 (43)	100 (27)	114 (30)	0.006
Training a dog can prevent biting, regardless of its genetic makeup.	111 (27)	114 (28)	184 (45)	146 (39)	91 (24)	141 (37)	0.003

Only those statements for which responses for parents were significantly different from responses for nonparents are shown. See Tables 1 and 2 for key.

respondents' opinions regarding dog aggression directed at children.

Statistical analysis—For purposes of analysis, responses to each of the 37 survey statements were characterized as disagreed (ie, strongly disagreed or disagreed), neutral, or agreed (ie, agreed or strongly agreed), and summary statistics were calculated. For the 27 survey statements involving general knowledge about dog behavior related to aggression, potential responses were classified as safe, neutral, or unsafe on the basis of likelihood that the particular situation or action could lead to a dog bite.

For each statement, the χ^2 test was used to determine whether responses were associated with parental status (ie, parent vs nonparent) or gender (ie, male vs female). Two-way ANOVA was used to determine whether total scores for responses to the 9 statements on general knowledge, the 5 statements on interactions with children, or the 7 statements on interactions with unfamiliar children in public areas were associated with parental status, gender, or the interaction between parental status and gender. For these analyses, responses were converted to scores ranging from 1 to 5, with a lower score indicating greater knowledge or safer practice.

All analyses were performed with standard software.^c Values of $P < 0.05$ were considered significant.

Results

Of 1,225 questionnaires that were distributed, 861 (70%) were filled out and returned to office staff or the

collection box (1 was returned by mail). Of these, however, 57 were excluded because the client refused to participate ($n = 40$), the client had previously completed the survey (4), or information regarding age, gender, or parental status of the respondent or responses to greater than a third of the statements were missing (13). The remaining 804 questionnaires were included in the study.

Of the 804 clients who responded to the questionnaire, 421 (52%) were parents and 598 (74%) were female. Two hundred thirty-one (29%) respondents currently had at least 1 child < 18 years old living at home. Respondents ranged in age from 18 to 79 years (mean \pm SD, 46 ± 13 years).

Knowledge of and attitudes toward factors associated with dog aggression toward children—Responses to the 37 statements involving dog behavior and aggression toward children indicated that most respondents lacked knowledge in these areas (Table 1). For example, 35% of all respondents agreed with the statement, "proper socialization of a puppy to young children will be sufficient to prevent future bites directed at children," and 33% agreed with the statement, "even if a dog has already bitten someone, training can cure aggressive behavior," representing responses classified as unsafe. Similarly, 43% of respondents agreed with the statement, "when a dog rolls onto its back, the dog is asking for a belly rub and it is safe to give the dog one," again representing an unsafe response.

Table 4—Comparison of responses for women versus men to a survey regarding knowledge of and attitudes toward factors associated with dog aggression toward children.

Statement	No. (%) of women			No. (%) of men			P value
	Agreed	Neutral	Disagreed	Agreed	Neutral	Disagreed	
General knowledge							
It is safe to give a belly rub to a dog that rolls onto its back.	245 (42)	173 (30)	163 (28)	91 (45)	77 (38)	35 (17)	0.006
Proper socialization of a puppy is sufficient to prevent bites to children.	185 (32)	122 (21)	274 (47)	90 (44)	43 (21)	72 (35)	0.003
Even if a dog has bitten someone, training can cure aggressive behavior.	173 (30)	218 (38)	189 (33)	86 (42)	64 (32)	53 (26)	0.005
Most bitten children are bitten by unfamiliar dogs.	96 (16)	173 (30)	314 (54)	47 (23)	84 (41)	74 (36)	< 0.001
It is safe for an unfamiliar child to pet a dog if the dog is wagging its tail.	95 (16)	171 (29)	316 (54)	47 (23)	65 (32)	92 (45)	0.040
Dogs that are properly trained do not bite people, regardless of provocation.	59 (10)	85 (15)	439 (75)	31 (15)	37 (18)	136 (67)	0.045
Interactions with children							
It is safe to leave a 4-year-old child alone, unsupervised, with my own dog.	184 (32)	55 (9)	345 (59)	77 (38)	29 (14)	98 (48)	0.020
Dogs should never be left alone with 4-year-old children.	306 (52)	122 (21)	159 (27)	88 (43)	39 (19)	78 (38)	0.010
Interactions with unfamiliar children							
I feel comfortable taking my dog on leash to public areas where children may be present.	513 (87)	15 (3)	59 (10)	181 (88)	12 (6)	12 (6)	0.020
Opinions							
Dogs should tolerate being petted by unfamiliar children.	302 (52)	84 (14)	197 (34)	112 (55)	42 (21)	48 (24)	0.010
Training a dog can prevent biting, regardless of its genetic makeup.	181 (31)	145 (25)	256 (44)	76 (37)	59 (29)	70 (34)	0.048

Only those statements for which responses for women were significantly different from responses for men are shown. See Tables 1 and 2 for key.

Twenty-eight percent of respondents disagreed with the statement, “it is unsafe to leave even a trusted family dog alone with an infant,” and 24% disagreed with the statement, “dogs should never be left alone with infants,” representing unsafe responses (Table 1). However, most owners seemed to distinguish their own dogs from others’ dogs, in that 43% agreed with the statement, “I think it would be safe to leave a sleeping infant unsupervised with my own dog in the same room” (ie, provided an unsafe response), but only 6% agreed with the statement, “I think it would be safe to leave a sleeping infant unsupervised with someone else’s dog in the same room.” Eighty-two percent of respondents agreed with the statement (ie, provided an unsafe response), “I think it is safe for young children to kiss and hug their own dogs.” Seventeen percent of respondents agreed with the statement, “if a dog growls when its food is approached but has not bitten in the past, I would feel comfortable allowing a child in the same room with the dog while the dog eats.”

Unsafe responses to statements concerning interactions between dogs and unfamiliar children in public areas were common (Table 1). For example, 54% of respondents agreed with the statement, “I would allow my dog to mingle freely off-leash during a dinner party or picnic where unfamiliar people, including children, are present.” Similarly, despite the fact that running children or the poorly controlled social atmosphere in dog parks may stimulate chasing by dogs, 28% of respondents disagreed with the statement, “young children should not be permitted in dog parks or other public areas where dogs are off-leash.”

In regard to the 10 statements soliciting respondents’ opinions about dog aggression directed at children, 53% of respondents agreed with the statement, “in my opinion, dogs should tolerate being petted by unfamiliar children” (Table 2). Seventy-five percent of respondents agreed with the statement, “when I am in a public place with my dog, I think it is easy to instruct other people about safety around my dog,” but 16% disagreed.

Parental status—For 12 of the 37 statements, responses from parents were significantly different from responses from nonparents (Table 3). For example, parents were more likely than nonparents to disagree with the following statements: “proper socialization of a puppy to young children will be sufficient to prevent future bites directed at children” ($P < 0.001$), “even if a dog has already bitten someone, training can cure aggressive behavior” ($P = 0.005$), and “if a dog is wagging its tail when encountering an unfamiliar child, it is safe for the child to pet the dog” ($P = 0.049$). Parents were less likely to agree that training can prevent future biting, regardless of genetic makeup ($P = 0.003$), and that most children who were bitten had provoked the bite because of their behavior ($P = 0.006$).

Gender—For 11 of the 37 statements, responses from women were significantly different from responses from men (Table 4). For example, women were more likely than men to disagree with the following statements: “proper socialization of a puppy to young children will be sufficient to prevent future bites directed at children” ($P = 0.003$), “most bitten children are bitten by unfamiliar dogs” ($P < 0.001$), “even if a dog has already bitten someone, training can cure aggressive behavior” ($P = 0.005$), “dogs that are

properly trained simply do not bite people, regardless of the provocation” ($P = 0.045$), “if a dog is wagging its tail when encountering an unfamiliar child, it is safe for the child to pet the dog” ($P = 0.04$), and “when a dog rolls onto its back, the dog is asking for a belly rub and it is safe to give the dog one” ($P = 0.006$). Although men and women did not differ with regard to their responses to statements concerning interactions with infants and toddlers, they did differ in their responses to statements concerning leaving 4-year-old children alone with dogs.

Interaction between parental status and gender—Analysis of the interaction between parental status and gender revealed that women were more knowledgeable than men (ie, had lower total scores), regardless of parental status, about dog behavior ($P < 0.001$; Figure 1).

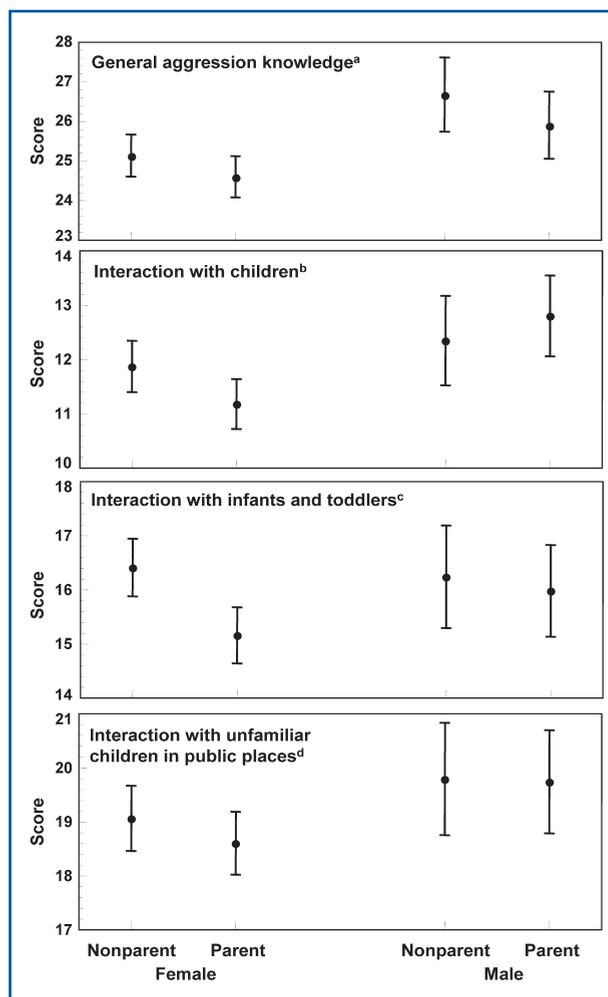


Figure 1—Interaction between parental status and gender in responses to statements related to knowledge about dog behavior in situations that posed a risk of dog bites. Lower scores indicate greater knowledge. ^aScores for females were significantly ($P < 0.001$) lower than scores for males. ^bScores for female parents were significantly ($P = 0.04$) lower than scores for female nonparents, and scores for female parents were significantly ($P < 0.001$) lower than scores for male parents, but scores for male parents were not significantly ($P = 0.4$) different from scores for male nonparents. ^cScores for female parents were significantly ($P = 0.001$) lower than scores for female nonparents, but scores for male parents were not significantly ($P = 0.7$) different from scores for male nonparents. ^dScores for female parents were significantly ($P < 0.05$) lower than scores for male parents, but scores for female nonparents were not significantly ($P = 0.2$) different from scores for male nonparents.

Mothers were more knowledgeable than fathers ($P < 0.001$) and female nonparents ($P = 0.04$) with regard to interactions between dogs and young children. For interactions between dogs and infants or toddlers, mothers were also more knowledgeable than female nonparents ($P = 0.001$) and men, regardless of parental status ($P = 0.001$). Finally, mothers were more knowledgeable than fathers ($P < 0.05$) regarding interactions between dogs and unfamiliar children in public places.

Discussion

Results of the present study suggested that dog owners in general often lacked knowledge or awareness of factors associated with dog aggression toward children. Although the risk of dog bites associated with some of the statements in the present survey was ambiguous, all situations could potentially have led to dog bites. Dog owners who were parents or female were more likely than owners who were nonparents or male to be knowledgeable about certain aspects of dog behavior and interactions with children.

Experts agree that any dog is capable of biting, including those with no history of biting¹¹ and those whose aggressive behavior has been treated,¹² regardless of whether the dog has received obedience training¹¹ or been socialized to children. Although 33% of respondents in the present study indicated that they thought training can cure aggressive behavior, parents and women were each more likely to disagree that socialization will prevent future bites or that training can cure aggressive behavior.

Dog bites are typically thought to be a result of deliberate efforts to tease or hurt the animal.¹³ However, even affectionate or neutral interactions by children, such as postural changes, eye contact, and petting, can be provocative for some dogs.¹¹ Younger children are most frequently bitten in the face, head, and neck when bitten by dogs they know; in unknown or misunderstood circumstances; or when attempting to cuddle with a dog.¹⁴ In general, although the reasons for biting may be difficult to confirm, dogs bite as a result of fear; resource, food, or territory guarding; illness; or pain. In the present study, 33% of respondents disagreed with the statement that most children who are bitten had provoked the bite as a result of their behavior. Furthermore, 82% of respondents indicated that they thought it was safe for young children to kiss and hug their own dogs, presumably on the basis of the incorrect assumption that a dog will not bite if hugged by a family member. The mistaken belief that some dogs will not bite, or that certain interactions between dogs and children are inherently safe, can lead to decreased caution and dog bites to children even if an adult is present.⁵

Another common misconception among dog owners is that dogs are driven to assert social dominance over people of any age, including children, and will be aggressive when their social rank is threatened. This paradigm has largely been abandoned by veterinary behaviorists,¹² but is reinforced by the popular media¹⁵ and continues to be a part of the public perception of dog behavior. In the present study, 29% of respondents agreed that dog aggression toward children was most

often caused by dominance, although 44% agreed that dog aggression was most often caused by the dog's fear of the child, which is more likely to be accurate.¹¹ The mistaken idea that dominance is the underlying cause of aggression has important consequences because owners who attempt to gain "dominance" over already anxious dogs may worsen the dogs' tendency to bite.

In our experience, the body language of dogs is often misunderstood, and results of the present study support this impression. Rather than signaling friendliness, for example, a wagging tail may simply be indicating a neutral willingness to interact or may be a signal of defensiveness and impending aggression.¹⁶ In the present study, parents were more likely than nonparents and women were more likely than men to be aware of this. Women in particular may be more sensitive to nonverbal social signaling, as they also were more likely than men to understand that it may be unsafe to pet a dog that has rolled onto its back. Depending on the social context, such posturing might indicate that the dog is soliciting attention, but it may also signal fear and a desire to disengage. Overall, 45% of respondents indicated that they would restrain their dog if it moved away from an unfamiliar child attempting to pet it. However, in the authors' experience, such a situation may lead to defensive aggression by the restrained dog. Even the unambiguous threat of growling was apparently underestimated, in that 17% of respondents in the present study indicated they would feel comfortable allowing a child in the same room during feeding time with a dog that growls when its food is approached, assuming that the dog had not bitten anyone in the past. Clearly, it would be unsafe to allow a child near a growling dog while it is eating, even if it does not have a history of biting anyone. Various studies^{5,7,11} have reported that 40% to 85% of dog bites involved dogs that did not have any history of biting people. In the authors' experience, human-directed canine aggression is most often motivated by resource-guarding or fear. In contrast, only 53% and 32% of respondents in the present study, respectively, agreed that aggression was most often due to protection of food or other resources or that aggression was most often due to fear or self defense.

Infants and younger children are more likely than older children to be victims of severe or fatal dog attacks.¹⁷ In a study¹⁸ of dog-child communication, children between 2 and 5 years old took the initiative in interacting with body contact with a pet dog, and younger children tended to be more aggressive in their interactions. Thus, it is not surprising that younger children are more frequently bitten on the face, head, or neck, by the family dog, and in their own homes.¹⁹ Whereas young children may elicit aggression from dogs motivated by fear, pain, or resource-guarding, neonatal infants are more often victims of apparently predatory attacks.²⁰ However, there appeared to be a lack of awareness of this risk among dog owners in the present study, in that 24% of respondents disagreed with the statement "dogs should never be left alone with infants." In addition, 43% indicated that they thought a sleeping infant would be safe when unsupervised with the respondent's own dog. However, fatal attacks of infants are most often inflicted by pet dogs in the infant's home,^{17,20} and

infants are no less vulnerable when asleep than when awake.²¹ Any dog of any size is capable of killing an infant, and basic caution must include never leaving an infant alone with a dog. In the present study, dog owners who were parents were more cautious than non-parents regarding infant safety, both in relation to their own dogs and in relation to dogs owned by others.

The many dog owners in the present study who indicated that they were comfortable taking their dogs to public areas, dinner parties, parks, and other public locations may be making unsafe assumptions about interactions between dogs and unfamiliar children. Pet stores, for example, include blind corners, proximity to chew toys and foods, and the social tension associated with the presence of many unknown dogs and humans. Public parks and other areas shared by running children and off-lead dogs are potentially quite unsafe for children.¹⁴ Some dogs, particularly fearful ones, are apprehensive when approached or petted by unfamiliar children. Again, because fear signals may be misinterpreted or disregarded, the risk of biting can be intensified as the interaction continues, especially if the owner forces the dog to stand still for the child. Fifty-three percent of respondents agreed that dogs should tolerate being petted by unfamiliar children, and 45% stated that they would hold their dog still for an unfamiliar child to pet the dog if the dog attempted to move away. Such efforts may backfire and result in biting by the reluctant or fearful dog. However, it can be difficult for dog owners to convey their concerns to anyone showing interest in their dogs, and 16% of respondents indicated that they do not find it easy to instruct others about safety around their dogs. Thus, a perhaps important consideration for parents whose children are interested in petting an unfamiliar dog is whether the owner's permission to pet the dog is reliable. Women in the present study were less likely than men to indicate that dogs should tolerate being petted by unfamiliar children, perhaps because women are more sensitive to social fear or discomfort in dogs or to the risks posed by interactions of such dogs with unfamiliar children. Similarly, women were less likely than men to feel comfortable taking their dogs to public places where children might be present.

Children may be at risk of bites by unfamiliar dogs in public areas where dogs are off-lead. In the present study, 41% of respondents indicated that if they saw running children when they arrived at a dog park, they would still allow their dog off-lead. It is important to note that running can trigger chasing and biting, particularly where a group of dogs might facilitate each other's aggressive or predatory behavior. This was not well recognized by respondents, however, in that only 28% agreed that young children should not be permitted in public areas where dogs are off-leash.

Although there was a general lack of awareness among dog owners regarding risks to children, women and parents in the present study were generally more aware than their counterparts of such risks. The differences between the present study and a previous study⁸ involving parents who brought their children to a pediatrician's office may be attributable to the larger number of respondents in the present survey or to demographic

differences between parents in the previous study, only 55% of whom were dog owners, and dog owners in the present study.

Several limitations of the present study may have skewed our results. First, the survey targeted a convenience sample of dog owners who had brought their dogs to a referral hospital. Thus, respondents may have been more affluent and educated and, therefore, more aware of dog behavior and risks than the general population. As a result, our findings may underestimate the percentage of dog owners in the general population who lack knowledge regarding factors associated with dog aggression. In addition, by its nature, the survey may have attracted respondents who had strong opinions and who, therefore, may not reflect the general population's perspective. Third, findings were limited because respondents were not individually interviewed.

All respondents in the present study were dog owners who had brought their dogs to a hospital for veterinary care. The veterinary consultation presents a unique opportunity to identify potential problems and to discuss general issues of health and behavior. First and foremost, any history of overt aggression to people would be an indication for intervention or referral to a behavioral specialist. Second, even in the absence of a history of overt aggression, a history of fearful reactions to social or environmental stimuli or separation from the owner might suggest a predisposition to anxiety- or fear-related biting in threatening situations and should be addressed by the veterinarian or veterinary behaviorist.¹¹ Third, because behavior is a reflection of physical as well as emotional health, veterinarians can assess whether orthopedic, dermatologic, or other diseases are contributing to irritable behavior. The presence of pain alone is sufficient reason to separate a dog from young children, who may unintentionally trigger biting.¹¹ Finally, even if problems are not currently evident, veterinarians can assist owners in preventing problems by providing information on dog behavior, including resource-guarding, territorial aggression, pain- and fear-related aggression, and predatory behavior toward infants. Thus, veterinarians play an important role in reducing the risks of aggression toward children.

Dog bites to children are common and lead to physical as well as emotional trauma to the victim.²² There may be increased risk for children when the dog is owned by a person who is not a parent or who is male. However, regardless of parental status or gender of the dog owner, knowledge of dog behavior was limited among dog owners in the present study. Future prospective studies of the circumstances of dog bites to children might provide more information about the consequences of such lack of knowledge. Education of the adult dog-owning public regarding dog behavior, including body language and social signals, motivations for resource-guarding and self-defense, and risks posed to infants and younger children, should be pursued. Ultimately, the safety of children relies almost entirely upon the perception and understanding of the adults around them.

a. De Keuster T, De Butcher R. The blue dog—how does the programme work in practice? (oral presentation). 31st World Small

- Anim Assoc Cong, 12th Eur Cong Fed Eur Companion Anim Vet Assoc, and 14th Czech Small Anim Vet Assoc Cong 2006.
- Copies of the survey are available on request.
 - SAS statistical software, version 9.1, SAS Institute Inc, Cary, NC.

References

- Ozanne-Smith J, Ashby K, Stathakis VZ. Dog bite and injury prevention—analysis, critical review, and research agenda. *Inj Prev* 2001;7:321–326.
- Beck AM, Jones BA. Unreported dog bites in children. *Public Health Rep* 1985;100:315–321.
- Mertens PA. Canine aggression. In: Horwitz D, Mills D, Heath S, eds. *BSAVA manual of canine and feline behavioural medicine*. Gloucester, England: British Small Animal Veterinary Association, 2002:195–215.
- Brogan TV, Bratton SL, Dowd MD, et al. Severe dog bites in children. *Pediatrics* 1995;96:947–950.
- Chun YT, Berkelhamer JE, Herold TE. Dog bites in children less than 4 years old. *Pediatrics* 1982;69:119–120.
- Chapman S, Cornwall J, Righetti J, et al. Preventing dog bites in children: randomised controlled trial of an education program. *BMJ* 2000;320:1512–1513.
- Wright JC. Severe attacks by dogs: characteristics of the dogs, the victims, and the attack settings. *Public Health Rep* 1985;100:55–61.
- Villar RG, Connick M, Barton LL, et al. Parent and pediatrician knowledge, attitudes, and practices regarding pet-associated hazards. *Arch Pediatr Adolesc Med* 1998;152:1035–1037.
- Cornwell JM. Dog bite prevention: responsible pet ownership and animal safety. *J Am Vet Med Assoc* 1997;210:1147–1148.
- Dillman DA. *Mail and Internet surveys: the tailored design method 2007 update with new internet, visual, and mixed-mode guide*. 2nd ed. New York: John Wiley & Sons Inc, 2007;32–148.
- Reisner IR, Shofer FS, Nance ML. Behavioral assessment of child-directed canine aggression. *Inj Prev* 2007;13:348–351.
- Reisner IR. Differential diagnosis and management of human-directed aggression in dogs. *Vet Clin North Am Small Anim Pract* 2003;33:303–320.
- Rohrich RJ, Reagan BJ. Man's best friend revisited: who's watching the children? (edit) *Plast Reconstr Surg* 1999;103:2067–2068.
- Kahn A, Bauche P, Lamoureux J, et al. Child victims of dog bites treated in emergency departments: a prospective survey. *Eur J Pediatr* 2003;162:254–258.
- Millan C. Understanding aggression. Available at: www.cesarmillaninc.com/tips/issues_understand_aggression.php. Accessed Dec 13, 2007.
- Bradshaw JWS, Nott HMR. Social and communication behaviour of companion dogs. In: Serpell J, ed. *The domestic dog: its evolution, behaviour and interactions with people*. Cambridge, England: Cambridge University Press, 1995:115–130.
- Chu AY, Ripple MG, Allan CH, et al. Fatal dog maulings associated with infant swings. *J Forensic Sci* 2006;51:403–406.
- Filiatre JC, Millot JL, Montagner H. New data on communication behaviour between the young child and his pet dog. *Behav Processes* 1986;12:33–44.
- Bernardo LM, Gardner MJ, Rosenfield RL, et al. A comparison of dog bite injuries in younger and older children treated in a pediatric emergency department. *Pediatr Emerg Care* 2002;18:247–249.
- Sacks JJ, Sattin RW, Bonzo SE. Dog bite-related fatalities from 1979 through 1988. *JAMA* 1989;262:1489–1492.
- Sacks JJ, Lockwood R, Hornreich J, et al. Fatal dog attacks, 1989–1994. *Pediatrics* 1996;97:891–895.
- De Keuster T, Lamoureux J, Kahn A. Epidemiology of dog bites: a Belgian experience of canine behaviour and public health concerns. *Vet J* 2006;172:482–487.



Selected abstract for JAVMA readers from the American Journal of Veterinary Research

In vitro mechanical evaluation of medial plating for pantarsal arthrodesis in dogs
Reunan P. Guillou et al

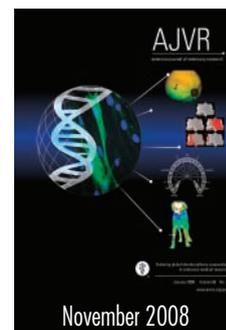
Objective—To compare the bending properties of pantarsal arthrodesis constructs involving either a commercially available medial arthrodesis plate (MAP1) or a specially designed second-generation plate (MAP2) implanted in cadaveric canine limbs and evaluate the effect of calcaneotibial screw (CTS) augmentation on the structural properties of both constructs.

Sample Population—5 pairs of canine hind limbs.

Procedures—Within pairs, specimens were stabilized with an MAP1 or MAP2 and loaded to 80% of body weight, with and without CTS augmentation. Compliance, angular deformation (AD), and plate strains were compared.

Results—Construct compliance and AD did not differ between plates. Maximum plate strain was lower in the MAP2 than in the MAP1 (difference of approx 30%). Augmentation with a CTS reduced compliance, AD, and strains in MAP1 constructs but had no effect on those variables in MAP2 constructs.

Conclusions and Clinical Relevance—Because of lower peak strains, the MAP2 may be less susceptible to failure than the MAP1. Furthermore, CTS augmentation was unnecessary with MAP2s, which could minimize intra- and postoperative morbidity. Compared with what is known for other dorsal plates, MAP2 constructs were associated with approximately 35% less AD. As a result of improved local stability, one might anticipate earlier fusion of the talocrural joint with an MAP2. In addition, plate peak strain was approximately 3.5 times lower in MAP2s than in dorsal plate constructs, which should result in greater fatigue resistance. The use of MAP2s may be a better alternative to both MAP1s and dorsal plates and could contribute to lower patient morbidity. (*Am J Vet Res* 2008;69:1406–1412)



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