

## Risk factors for relinquishment of cats to an animal shelter

Gary J. Patronek, VMD, PhD; Lawrence T. Glickman, VMD, DrPH; Alan M. Beck, ScD;  
George P. McCabe, PhD; Carol Ecker, DVM

**Objective**—To identify feline and household characteristics associated with relinquishment of a pet cat to an animal shelter.

**Design**—Case-control study.

**Sample Population**—Households that relinquished cats for adoption (case households) and a random sample of current cat-owning households in the same community (control households).

**Results**—Potentially modifiable risk factors with the highest population attributable risk for relinquishment were owners having specific expectations about the cat's role in the household, allowing the cat outdoors, owning a sexually intact cat, never having read a book about cat behavior, cats having daily or weekly inappropriate elimination, and inappropriate care expectations. Frequency of inappropriate elimination and aggression toward people were not associated with declaw status, but these behaviors were more common among sexually intact cats, compared with sterilized cats. Owners of cats in case households were more likely than owners in control households to cite cost of sterilization as a reason a cat was sexually intact. Cats found as strays and cats acquired with minimal planning were at decreased risk of relinquishment.

**Clinical Implications**—The identified risk factors can be modified by cat owners and veterinarians to decrease the estimated 4 million cats euthanatized annually in animal shelters. Owner education programs are needed as well as increased awareness on the part of cat owners and veterinarians of the importance of resolving feline inappropriate elimination problems. (*J Am Vet Med Assoc* 1996;209:582-588)

Euthanasia of healthy, but unwanted, pets by animal shelters is believed to be the leading cause of death for cats.<sup>1</sup> It is estimated that approximately 4 million cats are euthanatized annually in animal shelters.<sup>2</sup> However, unlike other common life-threatening diseases, risk factors for relinquishment of pet cats to an animal shelter have not been studied. Anecdotal reports and results of surveys suggest that the cost, source, and sterilization status of the cat, income and other household demographic factors, owners' attach-

ment to the cat, owners' expectations of the cat's role in the household, owners' understanding of typical feline behavior, frequency of behavioral problems, and access to counseling regarding feline behavior are associated with relinquishment to a shelter.<sup>1,3-9</sup> The purpose of the study reported here was to further examine the role of these and other potential risk factors for relinquishment of cats to an animal shelter.

### Material and Methods

**Case and control households**—Characteristics of the study site and the methods for case and control selection have been previously described.<sup>10</sup> A case household was defined as one in which an owner had relinquished a pet cat to the Humane Society of St Joseph County for adoption between June 1, 1994, and Mar 1, 1995; barn and feral cats were excluded. Households that relinquished only litters of kittens also were excluded, because relinquishment of kittens is typical and does not necessarily represent a failure of the human-animal bond, as would relinquishment of a cat acquired with the intention of keeping it as a pet. We attempted to contact all eligible case households by telephone. A structured interview<sup>a</sup> was conducted by a trained interviewer with an adult household member who could provide information about pet cat ownership and care.

Control households were obtained by use of a random-digit dial (RDD) telephone survey in which current dog- and cat-owning households in the study area were contacted. The final survey was administered by Chilton Research Services Inc, King of Prussia, Pa, from Dec 7 to 14, 1994. Interviews were conducted with any adult in the household who could provide information about the cat, veterinary care, and human-pet interaction. If more than 1 cat was currently owned, 1 cat was randomly selected as the reference.

**Data analysis**—Statistical methods used in this study have been previously described.<sup>10</sup> Briefly, descriptive statistics were generated by use of a personal computer program.<sup>b</sup> The  $\chi^2$  test was used to evaluate bivariate associations between categorical variables.<sup>11</sup> The odds ratio (OR) was used to measure the strength of association between risk factors and the likelihood of relinquishment of a cat to a shelter. Unconditional logistic regression was used to estimate the regression coefficients (log odds), and exponentiation of each regression coefficient was used to calculate the OR for individual risk factors.<sup>12,13</sup> Approximate 95% confidence interval (CI) was calculated, using Wolff's method.<sup>14</sup> If the expected value for any cell was  $< 5$ , exact CI were calculated, using a statistical program for epidemiologic data.<sup>c</sup> Ordinal categorical variables also were evaluated, using the  $\chi^2$  test for trend.<sup>13</sup>

The effect of combinations of risk factors was evaluated, using stratified analysis and the multiple logistic regression model.<sup>12</sup> All multivariate models were fit, using a personal computer program.<sup>b</sup> The population attributable risk (PAR), which is the proportion of cats that would not have been relinquished if the risk factors in question were completely eliminated, was calculated by use of the adjusted OR for each

From the Department of Veterinary Pathobiology and Center for Applied Ethology and Human-Animal Interaction (Patronek, Glickman, Beck), School of Veterinary Medicine, and Department of Statistics (McCabe), Purdue University, West Lafayette, IN 47907, and Clayview Animal Clinic, South Bend, IN 46637 (Ecker).

Supported in part by a fellowship in epidemiology and animal welfare from the Ralston Purina Co and funds from the Humane Society of the United States, the Byron Root trust, and the Center for Applied Ethology and Human-Animal Interaction, Purdue University.

The authors thank Sue Barton for technical assistance.

modifiable risk factor that was retained in the final multivariate logistic model.<sup>15</sup> Modifiable risk factors were considered to be those that were amenable to intervention (eg, cat being sexually intact) versus intrinsic characteristics of cats or cat owners that cannot be changed (eg, sex or time lived in current residence).

## Results

**Respondents**—The overall response rate to the RDD telephone survey has been previously described.<sup>10</sup> Of all 624 cat-owning households interviewed, 459 (73.6%) were randomly selected as controls from the RDD sample. The remaining cat-owning households from the RDD telephone survey (n = 165) were not selected, because they also owned dogs and were randomized to the control group of a separate and concurrent study of dog relinquishment.<sup>10</sup> Records were obtained for 281 eligible case households that relinquished cats to the humane society during the study period. Interviews were successfully completed with 218 (77.6%) of the case households.

Reasons for failure to interview an eligible case household included no telephone number, incorrect number, or disconnected number (29, 10.3%), refusal to participate in the interview (13, 4.6%), impaired health or mental capacity of respondent (3, 1.1%), inability to reach household (8, 2.8%), and telephone number changed to a nonpublished number (8, 2.8%). Of the 218 participating case households, 40 (18.3%) relinquished more than 1 cat. The interval from relinquishment of the cat to the shelter to interview completion ranged from 0 to 110 days (median, 8 days), and 163 of 218 (74.8%) case households were interviewed within 2 weeks of relinquishment. In the 218 case households, 154 (70.6%) of the respondents were female, 80 (36.7%) were the household members who originally most wanted to obtain the cat, and 148 (67.9%) were primary caregivers for the cat, compared with 322, 202, and 284 (70.2, 44, and 61.9%) of the respondents, respectively, from 459 control households.

**Cat- and acquisition-related risk factors**—Mean (median) ages were 2.3 years (1.5 years) and 5.3 years (4.0 years) for cats in case and control households, respectively. A cat's age was strongly associated with the risk of relinquishment. With cats  $\geq$  5 years old as the reference category, the risk was greatest for cats  $<$  6 months old (OR, 14.17; CI, 7.41 to 27.10; Table 1). More cats in case households than in control households were sexually intact (106/216, 49.1% vs 77/458, 16.8%), and this was associated with an increased risk of relinquishment (OR, 4.77; CI, 3.32 to 6.85). More owners of sexually intact cats from case households than from control households cited cost as the reason for failure to sterilize cats (41/105, 39% vs 14/74, 18.9%;  $P = 0.03$ ), and more cats that were kept indoors only than cats allowed access to the outdoors were sterilized (308/390, 79% vs 183/284, 64.4%;  $P < 0.0001$ ). A cat's sex was not significantly related to the risk of relinquishment. Of the cats in control households, 49.9% (229/459) were declawed, compared with 38.5% (84/218) of cats in case households, and being declawed was associated with a decreased risk of relin-

Table 1—Risk of relinquishment of cats to a shelter by age, source, and method of acquisition

Risk factor	No. of households (%) <sup>*</sup>		OR	95% CI
	Case	Control		
<b>Source</b>				
Private owner or breeder	124 (56.9)	219 (47.7)	1.00	NA
Pet store	16 (7.3)	24 (5.2)	1.18	0.60-2.30
Born in home	20 (9.2)	38 (8.3)	0.93	0.52-1.67
Stray	38 (17.4)	116 (25.3)	0.58	0.38-0.89
Shelter	18 (8.3)	49 (10.7)	0.65	0.36-1.16
<b>Age (yr)†</b>				
> 5	19 (8.7)	189 (41.2)	1.00	NA
> 3 to 5	28 (12.8)	65 (14.2)	4.29	2.24-8.18
0.5 to 3	123 (56.4)	168 (36.6)	7.28	4.30-12.32
< 0.5	47 (21.6)	33 (7.2)	14.17	7.41-27.10
<b>Method of acquisition‡</b>				
Purchased or adopted	46 (21.1)	116 (25.3)	1.00	NA
Received as gift	21 (9.6)	72 (15.7)	0.74	0.41-1.33
Free from previous owner	92 (42.2)	116 (25.3)	2.00	1.29-3.10

<sup>\*</sup>Percentages are based on 218 case and 459 control households.  $\chi^2_{trend} = 89.2$ ;  $P < 0.0001$ . †For cats not acquired as strays or born in the home. OR = odds ratio; CI = confidence interval; NA = not applicable.

quishment (OR, 0.63; CI, 0.45 to 0.87). More case than control households had mixed-breed cats (214/218, 98.2% vs 366/439, 83.4%), and being mixed breed was associated with an increased risk of relinquishment (OR, 10.67; CI, 3.85 to 29.61).

More case than control households acquired cats at no cost from the previous owner (92/218, 42.2% vs 116/459, 25.3%). Compared with cats acquired through purchase or adoption, cats acquired at no cost from the previous owner were at increased risk of relinquishment (OR, 2.00; CI, 1.29 to 3.10; Table 1). Fewer case than control households received cats as gifts (21/218, 9.6% vs 72/459, 15.7%;  $P = 0.03$ ), but these cats did not have a significantly different risk of relinquishment, compared with that for cats that were purchased or adopted (OR, 0.74; CI, 0.41 to 1.33). Compared with cats that were acquired from a breeder or private owner, cats found as strays were at a decreased risk of relinquishment (OR, 0.58; CI, 0.38 to 0.89). For 570 (84.2%) cats in 677 case and control households whose cost was known, 77.4% (441/570) were obtained at no cost and 93.2% (531/570) were obtained for  $\leq$  \$30. Compared with cats for which acquisition was carefully planned, cats that were unexpectedly acquired were at decreased risk of relinquishment (OR, 0.45; CI, 0.30 to 0.67). Approximately 85% (567/661) of cats from case and control households were acquired at  $<$  1 year of age.

**Postacquisition risk factors**—Cats that spent most of their time during the day confined in a basement or garage were at increased risk of relinquishment (OR, 2.72; CI, 1.21 to 6.12), compared with that for cats that spent most of their time unrestrained in some portion of the living area of the home. More case than control households allowed their cats outside (129/218, 59.2% vs 156/459, 34%), and having access to the outdoors was associated with an increased risk of relinquishment (OR, 2.82; CI, 2.02 to 3.92). Cats cared for by the entire family were at decreased risk of relinquishment, compared with cats that had a female adult as a primary caregiver (OR, 0.50; CI, 0.28 to 0.91).

Table 2—Risk of relinquishment of cats to a shelter by frequency of veterinary care

No. of veterinary visits/y	No. of households (%)*		Unadjusted		Adjusted†	
	Case	Control	OR	95% CI	OR	95% CI
≥ 2	46 (21.1)	95 (20.7)	1.00	NA	1.00	NA
1	79 (36.2)	260 (56.6)	0.63	0.41-0.97	0.71	0.43-1.17
< 1	21 (9.6)	50 (10.9)	0.87	0.47-1.61	1.27	0.60-2.65
0	67 (30.7)	45 (9.8)	3.07	1.83-5.15	1.16	0.59-2.26

†Adjusted for age, sterilization, and declaw status, duration of ownership, and outdoor access.  
See Table 1 for key.

More case households sought feline behavior advice than did control households (70/218, 32.1% vs 98/459, 21.4%;  $P = 0.003$ ), and approximately 86% (60/70 and 84/98, respectively) of the owners in each group who sought advice obtained it from a veterinarian. Compared with advice that was deemed helpful, an increased risk of relinquishment (OR, 6.84; CI, 2.24 to 20.9) was associated with advice that was not helpful, impractical, or not tried. Of 551 households that sought veterinary care, 158 (28.7%) reported that veterinarians routinely offered behavioral advice, whereas 73 (13.2%) reported that veterinarians never discussed feline behavior. Cats that never visited a veterinarian were at increased risk of relinquishment (OR, 4.13; CI, 2.71 to 6.31), compared with that for cats that had visited a veterinarian. Of 108 case and control households that never took their cat to visit a veterinarian, 37 (34.3%) had annual incomes < \$20,000, compared with 70 (14.2%) of 493 households that visited a veterinarian ( $P < 0.0001$ ). Of 112 households that never visited a veterinarian, 74 (66.1%) allowed the cat access to the outdoors, compared with 206 (37.4%) of households that visited a veterinarian ( $P < 0.0001$ ). Of 110 cats that never visited a veterinarian, 19 (17.3%) were born in the respondent's home, compared with 37 (6.7%) of cats that received veterinary care ( $P = 0.0005$ ).

A clear pattern of decreasing risk of relinquishment with increasing frequency of veterinary visits was not evident, however (Table 2). Compared with cats that visited a veterinarian  $\geq 2$  times/y, cats that never visited a veterinarian (OR, 3.07; CI, 1.83 to 5.15) were at an increased risk of relinquishment. After adjustment for sterilization and declaw status, age, outdoor access, and duration of ownership, frequency of veterinary care was not significantly associated with risk of relinquishment. The pattern of veterinary care differed for cats that were kept indoors only versus cats that were allowed outdoor access (Fig 1). Among the control households, there was a significant trend for cats that visited a veterinarian more frequently to be kept indoors ( $P < 0.0001$ ). However, no such trend was observed among the case households ( $P = 0.13$ ).

Behavioral problems were associated with an increased risk of relinquishment (Table 3). A significant trend of increasing risk of relinquishment with increasing frequency of inappropriate scratching, aggression toward people, and inappropriate elimination was evident. There was no association between the frequency of inappropriate elimination and the frequency of vet-

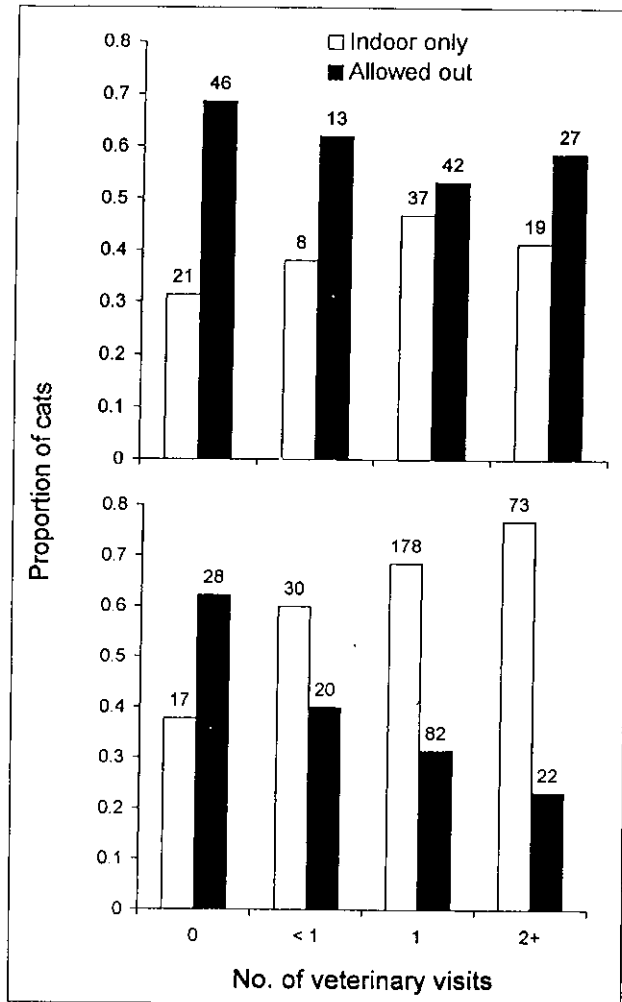


Figure 1—Average number of annual veterinary visits for indoor and outdoor cats from case (top) and control (bottom) households. Values above bars are numbers of cats.

erinary visits or indoor/outdoor status of the cat. More sexually intact cats than sterilized cats had daily or weekly aggression toward people (31/180, 17.2% vs 38/486, 7.8%;  $P = 0.001$ ) or inappropriate elimination (35/180, 19.4% vs 48/486, 9.9%;  $P = 0.001$ ). Sex and frequency of these 2 behavioral problems were not associated.

Among relinquished cats, 25 of 84 (29.8%) declawed cats had daily or weekly inappropriate elimination, compared with 36 of 134 (26.9%) nondeclawed cats ( $P = 0.64$ ), and 16 (19%) of declawed cats were aggressive toward people on a daily or weekly basis, compared with 21 (15.7%) of nondeclawed cats ( $P = 0.52$ ). Furthermore, there was no association among all cats between the frequency of any individual behavioral problem or the cumulative frequency of behavioral problems and cats being declawed.

**Owner attachment and expectations**—Status of a pet cat as a family member and displaying or carrying a picture of a pet cat were considered surrogate measures of owner-cat attachment. A picture of the cat was carried by a household member or displayed in 42.8% (92/215) of case households, compared with 75.3%

Table 3—Relationship of frequency of undesirable behavior during the previous 3 months and risk of relinquishment of cats to a shelter

Risk factor	No. of households (%)*		OR	95% CI	$\chi^2_{trend}$	P value
	Case	Control				
Inappropriate elimination						
Never	125 (57.3)	382 (83.2)	1.00	NA	86.4	< 0.0001
≤ 2 times/mo	32 (14.7)	52 (11.3)	1.88	1.16-3.05		
Weekly	24 (11.0)	18 (3.9)	4.07	2.14-7.76		
Daily	37 (17.0)	4 (0.9)	28.27	9.88-80.88		
Inappropriate scratching						
Never	123 (56.4)	283 (61.7)	1.00	NA	5.36	0.02
≤ 2 times/mo	21 (9.6)	59 (12.9)	0.82	0.48-1.41		
Weekly	21 (9.6)	48 (10.5)	1.01	0.58-1.75		
Daily	52 (23.9)	68 (14.8)	1.76	1.16-2.67		
Aggression toward people						
Never	166 (76.1)	372 (81.0)	1.00	NA	12.9	0.0003
≤ 2 times/mo	15 (6.9)	52 (11.3)	0.65	0.35-1.18		
Weekly	9 (4.1)	16 (3.5)	1.26	0.55-2.91		
Daily	28 (12.8)	16 (3.5)	3.92	2.06-7.44		

See Table 1 for key.

Table 4—Relationship of risk of relinquishment of a cat to the owner's expectations of the cat's role in the household

Expectations	No. of households (%)*		OR	95% CI
	Case	Control		
No particular role	15 (6.9)	87 (19.0)	1.00	NA
Companion to adult	64 (29.4)	110 (24.0)	3.37	1.80-6.33
Companion to child	50 (22.9)	51 (11.1)	5.69	2.90-11.14
Companion to family	67 (30.7)	161 (35.1)	2.41	1.30-4.48
Other	21 (9.6)	50 (10.9)	2.44	1.15-5.15

See Table 1 for key.

(345/458) of control households, and failure to display or carry a picture of the cat was associated with a significantly increased risk of relinquishment (OR, 4.08; CI, 2.89 to 5.76). More than 91.8% (615/670) of all households agreed that cats were family members, but only 36.7% (79/215) of case households strongly agreed, compared with 65.3% (297/455) of control households ( $P < 0.0001$ ).

Of 277 cats allowed outdoors, 128 (46.2%) were strongly considered family members, compared with 234 of 371 (63.1%) cats that were kept indoors ( $P < 0.0001$ ). Only 91 of 179 (50.8%) cats owned < 1 year were strongly considered to be family members, compared with 138 of 224 (61.6%) cats owned  $\geq 4$  years ( $P = 0.01$ ). There was no association between the frequency of veterinary visits and the proportion of households that strongly considered the cat to be a family member. More owners of sexually intact cats than owners of sterilized cats felt that the amount of work associated with cat ownership was more than expected (36/174, 20.7% vs 53/467, 11.3%;  $P = 0.002$ ). Care of the cat was more work than expected for cats with a high frequency of inappropriate scratching ( $P = 0.001$ ), aggression toward people ( $P = 0.008$ ), and inappropriate elimination ( $P = 0.003$ ). There was no association between expectation of work and the method or source of acquisition; the cat's sex, outdoor access, or declaw status; the history of prior cat ownership; or the owner ever having read a book about cat care and behavior.

The person who made the decision to acquire the

cat commonly owned a cat as a child in case and control households (152/216, 70.4% vs 335/453, 74%, respectively;  $P = 0.33$ ). However, only 60.4% (131/217) of these owners in case households versus 71.6% (328/458) of these owners in control households had owned another cat as an adult, and not having owned another cat as an adult was associated with an increased risk of relinquishment (OR, 1.65; CI, 1.18 to 2.32). Compared with having no particular expectations about the cat's role in the household, households with specific expectations were at increased risk for relinquishing the cat (Table 4). In addition, having specific expectations about the cat's role was associated with a greater degree of planning about the acquisition of the cat ( $P < 0.0001$ ).

**Household-related risk factors**—Annual household income was provided for 94.5% (206/218) of case households and 88.5% (406/459) of control households. Annual income < \$40,000 was associated with an increased risk of relinquishment, compared with that for households with annual incomes > \$75,000; households with annual incomes < \$20,000 were at the greatest risk (OR, 4.18; CI, 1.60 to 10.90; Table 5). Renting or living in an apartment or a mobile home was associated with an increased risk of relinquishment. Compared with owners who had lived in their home for  $\geq 5$  years, fewer years lived in the current residence was linearly associated with an increased risk of relinquishment ( $P < 0.0001$ ). There was a weak trend for households with children and with owners who had lower educational levels to be at increased risk of relinquishment.

**Multivariate analysis**—In order of strength of association with risk of relinquishment, the modifiable risk factors in the final model were daily or weekly inappropriate elimination (OR, 6.82; CI, 3.40 to 13.70), specific expectations about the cat's role in the household (OR, 3.45; CI, 1.56 to 7.62), inappropriate care expectations (OR, 4.36; CI, 2.20 to 8.64), allowing the cat outdoors (OR, 2.89; CI, 1.71 to 4.88), owning a sexually intact cat (OR, 2.52; CI, 1.22 to 5.20), and never having read a book about feline behavior (OR,

Table 5—Relationship of household characteristics to risk of relinquishment of cats to a shelter

Risk factor	No. of households (%)*		OR	95% CI	$\chi^2$ trend	P value
	Case	Control				
No. of children < 18 years old						
0	92 (42.2)	236 (51.4)	1.00	NA	4.09	0.04
1	43 (19.7)	87 (19.0)	1.27	0.82-1.96		
2	60 (27.5)	83 (18.1)	1.85	1.23-2.79		
3	13 (6.0)	37 (8.1)	0.90	0.46-1.77		
≥ 4	10 (4.6)	14 (3.1)	1.83	0.79-4.27		
Own home						
Yes	146 (67.0)	373 (81.3)	1.00	NA	ND	ND
No	71 (32.6)	82 (17.9)	2.21	1.53-3.20		
Residence type						
Single-family home	152 (69.7)	375 (81.7)	1.00	NA	ND	ND
Apartment	48 (22.0)	42 (9.2)	2.82	1.79-4.44		
Condominium	7 (3.2)	8 (1.7)	2.16	0.77-6.06		
Farm	2 (0.9)	20 (4.4)	0.25	0.03-1.04		
Mobile home	7 (3.2)	11 (2.4)	1.57	0.60-4.13		
Years in home						
≥ 5	75 (34.4)	262 (57.1)	1.00	NA	45.0	< 0.0001
4 to < 5	13 (6.0)	41 (8.9)	1.11	0.56-2.17		
3 to < 4	14 (6.4)	27 (5.9)	1.81	0.90-3.63		
2 to < 3	23 (10.6)	29 (6.3)	2.77	1.51-5.07		
1 to < 2	46 (21.1)	56 (12.2)	2.87	1.80-4.58		
< 1	46 (21.1)	40 (8.7)	4.02	2.45-6.59		
Annual income						
> \$75,000	6 (2.8)	28 (6.1)	1.00	NA	21.1	< 0.0001
\$50,000 to < \$75,000	26 (11.9)	75 (16.3)	1.62	0.60-4.35		
\$40,000 to < \$50,000	19 (8.7)	74 (16.1)	1.20	0.43-3.31		
\$30,000 to < \$40,000	54 (24.8)	92 (20.0)	2.74	1.07-7.04		
\$20,000 to < \$30,000	50 (22.9)	80 (17.4)	2.92	1.13-7.54		
< \$20,000	51 (23.4)	57 (12.4)	4.18	1.60-10.90		
Maximum education						
Postgraduate degree	21 (9.6)	67 (14.6)	1.00	NA	10.2	0.001
College graduate	47 (21.6)	124 (27.0)	1.21	0.67-2.19		
Some college or 2-year degree	58 (26.6)	134 (29.2)	1.38	0.77-2.46		
Vocational	20 (9.2)	16 (3.5)	4.00	1.76-9.05		
High school	66 (30.3)	99 (21.6)	2.13	1.19-3.80		
< High school	5 (2.3)	12 (2.6)	1.33	0.42-4.21		

ND = not done.  
See Table 1 for key.

1.84; CI, 1.11 to 3.02; Table 6). On the basis of the magnitude of the PAR, the most important risk factors were having specific expectations about the cat's role in the family (PAR, 67.0%), allowing the cat outdoors (PAR, 38.4%), owning a sexually intact cat (PAR, 29.4%), never having read a book about feline behavior (PAR, 26.6%), daily or weekly inappropriate elimination (PAR, 23.5%), and inappropriate care expectations (PAR, 19.8%). After adjustment for other variables, being declawed (OR, 1.89; CI, 1.00 to 3.58) and being mixed breed (OR, 5.16; CI, 1.61 to 16.5) were associated with an increased risk for relinquishment.

## Discussion

The results of this study suggested several risk factors that could potentially be modified to decrease the number of cats relinquished to shelters. Because households relinquishing litters and feral cats were excluded from the study, results could not be extrapolated to those groups.

Similar to what was found for dogs,<sup>10</sup> nearly a third of relinquishments were attributed to the cat being sexually intact. In contrast to dogs,<sup>10</sup> most cats (93%) were obtained for < \$30, so cost was not an important risk factor for relinquishment. However, the decreased risk of relinquishment for purebred cats sug-

gested that greater owner investment in the pet may be an indicator of the owner's commitment for cats as well as dogs. In comparison to what was observed for dogs,<sup>10</sup> case households were even more likely to have cited cost as the reason for failure to sterilize a sexually intact cat than control households. Because the cost of surgically sterilizing cats is typically lower than that for dogs, this result was paradoxical and may have reflected the way cats are perceived and valued by owners.

Cats that were kept indoors were less likely to be relinquished than were cats allowed outdoors, a finding consistent with households with indoor cats being more likely to strongly agree that cats were family members. Because increasing age of the cat was associated with increasing duration of ownership, youth was expected to be a cat-related risk factor for relinquishment.

Results of this study were consistent with other reports that declawed cats did not have an increased frequency of behavioral problems, such as aggression toward people or inappropriate elimination,<sup>16-18</sup> and contradicted anecdotal reports that declawed cats in shelters have a higher frequency of behavioral problems than have nondeclawed cats.<sup>19</sup> In the univariate analysis, being declawed was a protective factor for re-

Table 6—Risk of relinquishment and population attributable risk (PAR) for modifiable risk factors\* retained in the final multivariate logistic model

Risk factor	Unadjusted		Adjusted†		PAR (%)
	OR	95% CI	OR	95% CI	
Role of cat in family					
No specific role	1.00	NA	1.00	NA	67.0
Any role	3.15	1.72-5.85	3.45	1.56-7.62	
Access to the outdoors					
No	1.00	NA	1.00	NA	38.4
Yes	2.82	2.02-3.92	2.89	1.71-4.88	
Sterilization status					
Sterilized	1.00	NA	1.00	NA	29.4
Intact	4.77	3.32-6.85	2.52	1.22-5.20	
Read about feline behavior					
Ever	1.00	NA	1.00	NA	26.6
Never	2.86	2.05-3.99	1.84	1.11-3.02	
Inappropriate elimination					
Occasional or never	1.00	NA	1.00	NA	26.6
Daily or weekly	7.66	4.43-13.35	6.82	3.40-13.70	
Expectation of work					
≤ Expected	1.00	NA	1.00	NA	19.8
> Expected	4.01	2.54-6.31	4.37	2.20-8.64	

\* Factors amenable to intervention, as opposed to intrinsic characteristics of a pet cat or cat owner. † Adjusted for age, breed, declaw status of cat, method of acquisition of cat, owner attachment, and time lived in residence, in addition to the risk factors in table.  
Model deviance = 452.9; 592 df; Pearson's  $\chi^2 = 592.3$ . Hosmer-Lemeshow goodness-of-fit statistic = 7.58; 8 df;  $P = 0.47$ .

linquishment to a shelter, but after adjustment for other risk factors, it was associated with an increased risk of relinquishment. The reason for this reversal in the OR after adjustment for other variables in the multivariate model was not apparent, but it was not because of confounding by aggression (ie, aggressive cats were more likely to be declawed and more likely to be relinquished).

The relationship between frequency of veterinary care and risk of relinquishment was not as clear for cats as for dogs.<sup>10</sup> Although cats that never visited a veterinarian were at increased risk for relinquishment, there was no trend of increasing frequency of veterinary visits being associated with decreasing risk, and frequency of veterinary visits was not significant after adjustment for other risk factors in the multivariate model.

Contrary to what was observed for dogs,<sup>10</sup> an owner having read a book or other educational materials about typical feline behavior before or after acquisition of the cat protected against relinquishment. As with dogs,<sup>10</sup> inappropriate elimination was the behavioral problem associated with the highest risk of relinquishment. Because this problem may have behavioral and medical causes and may require medical and behavioral treatment, owners should be educated that they should promptly seek veterinary care for cats with this problem. To better guide veterinarians in their management of cats with behavioral problems, systematic evaluation of the efficacy of recommended treatment protocols is needed. Cats of owners that sought behavioral advice were at increased risk for relinquishment; this was likely a marker for cats with behavioral problems and may have reflected advice that was not helpful, a problem that was not adequately treated, or a problem that could not be corrected.

The risk factor with the highest PAR for relinquishment was the owner having specific expectations about the cat's role in the household (eg, companion to an adult, children, or the family). This result was unexpected, but it was consistent with other results (ie, minimal planning to acquire a cat and acquiring a cat as a stray also were associated with decreased risk of relinquishment). Cats acquired as strays may have been at decreased risk, because owners were able to evaluate the cats' personality and behavior through gradually increasing frequency of contact and care over time outside the home before deciding to make the cat a pet.

Some new cat owners may have unrealistic expectations about the characteristics of cats as pets. Although expectations about the cat's role in the household are a potentially modifiable risk factor, it probably should be addressed before acquisition of the cat for any educational intervention to be successful. Because increasing frequency of veterinary visits was not associated with a decreasing risk of relinquishment, modifying the owner's expectations about the cat after acquisition may not prevent relinquishment. However, the nature of the client's interaction with veterinarians was not evaluated in this study, and veterinarians may not have discussed characteristics of cats or cat ownership relevant to the owner's expectations about the cat's role.

The increased risk associated with cats being allowed outdoors was consistent with the results of a similar study of dogs,<sup>10</sup> such that pets that spend less time in the home were at an increased risk of relinquishment. Because this was a retrospective study, it was not possible to determine whether cats allowed outdoors were at increased risk, because this was a marker for lower initial attachment to the cat or whether allowing the cat outdoors resulted in less attachment to the cat or less socialization of the cat, thus predisposing the cat to relinquishment. However, given the increasing number of feral and stray cats or cats of equivocal ownership that are handled by shelters,<sup>20</sup> these results supported discouraging owners from allowing cats free access to the outdoors.

Given the popularity of cats as pets<sup>20</sup> and the degree to which a cat owner's unmet expectations about the cat's role in the household were associated with an increased risk of relinquishment in this study, research is needed to further characterize owner expectations and perceptions of the role of cats as household pets and to determine why owner expectations are often not met. Because most cats are not obtained from breeders or animal shelters where information about their behavior is available, veterinarians represent an important resource for counseling new or prospective cat owners. They may be able to modify owner's expectations concerning cats as pets and thus decrease relinquishment rates of cats to shelters, although the efficacy of this approach has yet to be determined.

The population to which the results of this study should be applied are owned cats. Because there is a large and yet undetermined stray and feral cat population,<sup>20</sup> the findings of this study should not be interpreted to mean that modifying risk factors for

relinquishment identified here will necessarily decrease the total number of cats handled and euthanized in shelters to the extent suggested by the PAR. The effect of modifying these risk factors for relinquishment among owned cats on the total burden of incoming cats to shelters has not been examined.

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<sup>a</sup>A copy of the interview questionnaire is available from the authors on request.

<sup>b</sup>SAS for windows, version 6.10, SAS Institute Inc, Cary, NC.

<sup>c</sup>Epi-Info, version 5, USD Inc, Stone Mountain, Ga.

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