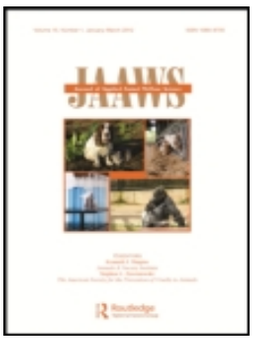

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Cross-Sectional Study of Characteristics of Owners and Nonowners Surrendering Cats to Four Australian Animal Shelters

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ABSTRACT

Unwanted cats surrendered to nonhuman animal shelters are generally categorized as either "owned" or "stray." This classification is misleading because "stray" cats may include many "semiowned" cats, for which people provide care but who are not perceived as being owned. This differentiation is important because effective strategies designed to reduce cat admissions to, and euthanasia rates in, shelters rely on accurate information about cat populations contributing to shelter intake; cat semiowners will likely respond to different strategies than people with no relationship with the cats they surrender. People surrendering cats to four Australian animal shelters were surveyed to identify factors associated with perception of ownership. Many self-classified nonowners had fed the cats they surrendered, often for a considerable period of time. The factor most strongly associated with ownership perception was an increasing association time with the cat. These findings confirm that enduring relationships between surrenderers and cats, consistent with cat semiownership, are common for cats surrendered to Australian animal shelters. This finding should be taken into account when planning education messages and cat population management strategies aimed at reducing cat admissions.

KEYWORDS

Animal shelter; cat; cat semiownership; shelter medicine; animal welfare

A substantial unwanted cat problem exists in Australia and around the world (Alberthsen et al., 2013; Clark, Gruffydd-Jones, & Murray, 2012; Marston & Bennett, 2009). In 2012 to 2013, almost 50,000 cats entered the nonhuman animal shelters of Australia's largest sheltering organization, the Royal Society for the Prevention of Cruelty to Animals (RSPCA), and 40% were euthanized (RSPCA Australia, 2013). Unwanted cats are also surrendered to other welfare organizations, municipal pounds, and veterinary clinics (Coe et al., 2014). The management of unwanted cats, particularly the large-scale euthanasia of often healthy cats, raises ethical issues (Baran et al., 2009; Rogelberg et al., 2007; Rohlf & Bennett, 2005) and poses a considerable financial burden on the community (Alberthsen et al., 2013; Australian Companion Animal Council, 2010). There are welfare concerns for cats in animal shelters and for the shelter workers who care for them. Most shelter workers have chosen to work with nonhuman animals because of their love for animals (Rohlf & Bennett, 2005), and they form attachments with the animals

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for whom they care (Arluke, 1991; Baran et al., 2009). Hence, the large number of cats euthanized can have serious negative psychological impacts on shelter workers.

The majority of cats (84%) admitted to Australian RSPCA animal shelters in Queensland are surrendered by the general public (Alberthsen et al., 2013), with approximately 44% presented as "owned" and 54% presented as "strays." Currently, cats entering animal shelters are usually subjectively classified as owned or stray. There is no generally recognized classification system for cat subpopulations (Levy & Crawford, 2004; Robertson, 2007; Slater, 2004), although many different definitions exist in the literature, including those for owned cats (Moodie, 1995; Webb, 2008), semiowned cats (Haspel & Calhoon, 1990; Toukhsati, Bennett, & Coleman, 2007), community cats (Levy, 2011), lost/stray cats (Alberthsen et al., 2013; Centonze & Levy, 2002; Webb, 2008), homeless cats (Zasloff & Hart, 1998), unowned free-roaming cats (Centonze & Levy, 2002; Levy, Woods, Turick, & Etheridge, 2003; Zasloff & Hart, 1998), colony cats (Marston & Bennett, 2009), and feral cats (Centonze & Levy, 2002; Webb, 2008). Considerable overlap exists between these definitions; for example, semiowned and unowned free-roaming cats may also be considered strays. Semiowned cats—those cats for whom people provide some care but who are not perceived as being owned—are thought to constitute a large proportion of shelter admissions (Denny & Dickman, 2010; Marston & Bennett, 2009; Toukhsati et al., 2007).

Shelter-recorded data on ownership status may be inaccurate because some people present cats who they own to animal shelters as unowned (to avoid a surrender fee or a negative judgment for surrendering their own cat), and some animal shelters categorize cats as owned solely if the person surrendering the cat has had some contact with the cat for a specified minimum time period (RSPCA staff, personal communications, November 2013).

The human–cat relationship is complex and takes many forms, and the categorization of cats into owned and unowned or stray cats is an oversimplification of a relationship that is likely to be a continuum (Webb, 2008). The spectrum of cat–human relationships in the context of surrendered cats ranges from the display of all cat ownership behaviors by people who identify themselves as caregivers (owners) to those who neither perceive themselves to be owners of the cat nor display caretaking behaviors toward the cat. Between these extremes, human–cat relationships vary from those who perceive themselves as owners but display few caretaking behaviors toward the cats (Marston & Bennett, 2009) to those who do not consider themselves to be the owners of the cats but who do display caretaking behaviors toward them (semiowners, Toukhsati et al., 2007; Toukhsati, Phillips, Podberscek, & Coleman, 2012; or cat colony caretakers, Zasloff & Hart, 1998).

While some authors have explored relationships between people and cats they care for but do not perceive ownership of (Centonze & Levy, 2002; Zasloff & Hart, 1998), determinants of perceived ownership among surrenderers of cats have not been previously investigated. Gaining an understanding of the relationships that underpin perceptions of ownership among surrenderers will facilitate better classification of cats entering animal shelters and will enable animal shelters to identify the contribution of cat semiowners to their shelter intake. If cat semiowners are making a considerable contribution, the effectiveness of future approaches to reduce the number of unwanted cats may be improved by targeting semiowners with specific education messages and management strategies.

Recruitment of people for studies of this kind is commonly problematic, as people may be unwilling to discuss surrendering an animal (DiGiacomo, Arluke, & Patronek, 1998; Finkler & Terkel, 2012; Segurson, Serpell, & Hart, 2005; Toukhsati et al., 2012), and there is limited availability of representative samples for this research area (Finkler & Terkel, 2012; Rohlf, Bennett, Toukhsati, & Coleman, 2010; Toukhsati et al., 2012). For ethical reasons, participation must be voluntary and people are only likely to volunteer if they have some interest in the outcome. Consequently, research findings in this area may be valid for people who are willing to answer a survey, but they may not be valid for all surrenderers.

The aims of the current study were to describe characteristics of people surrendering cats to Australian RSPCA animal shelters; to describe their demographics, attitudes toward cats, cat interaction histories, and expectations of cat ownership; and to identify determinants of perceived ownership among people surrendering cats.

Materials and methods

A cross-sectional study was conducted among people surrendering cats to four RSPCA animal shelters in three different Australian states during 2012. Participation was voluntary. The study was approved by the University of Queensland Ethics Committee (Project No. 2011001160).

Participants and procedures

A-priori statistical power calculations were performed based on numbers of respondents required to detect associations between binary demographic and attitude measures and the surrenderer's perceived ownership of the surrendered cat (owned or unowned) using the Compare 2 module (Version 2.69) of WinPepi (Version 11.11; Abramson, 2011). Statistical power was calculated for various total sample sizes, ratios of owner to nonowner respondents, and assumed proportions exposed (rather than not exposed) for a binary measure for each of the owners and nonowners. Power was calculated for two-sided, exact, mid *p* values; alpha was set at .05. These calculations showed that statistical power would be at least moderately high (greater than 75%) for detecting absolute differences in binary measure proportions of .2 or more if 200 respondents (70% presenting owned cats, 30% presenting unowned cats) were enrolled. We therefore aimed to enroll 200 respondents. These power calculations treated ownership status as the exposure variable. This was reversed for statistical analyses, but statistical power was similar when recalculated.

The recruitment period for the study was limited to 8 months from February 1, 2012, to September 30, 2012, to include both a time of year when kittens are commonly presented (late summer, i.e., February) and the period of time when kittens are less commonly presented (autumn/winter, i.e., March to August; RSPCA staff, personal communication, October 14, 2011) but avoid overloading admission staff during the busy Christmas period. The main RSPCA animal shelters located in the capital cities of the states receiving the most cats in Australia (Queensland, New South Wales, and Victoria; RSPCA Australia, 2011) were chosen to recruit participants. An additional shelter that accepted unowned cats was also chosen in Queensland because the main shelter did not accept reportedly unowned cats. (Unowned cats were only admitted by this shelter—Shelter 2—if they were injured or surrendered on a weekend, and they were ineligible for the study, as they were admitted to the hospital rather than through general admissions.) People were eligible for inclusion in the study only if they were members of the general public, older than 18 years, and surrendered one or more cats or kittens to one of the participating RSPCA animal shelters during the study period.

People were ineligible if they were shelter staff members; inspectors; animal control officers; humane officers; council workers; animal ambulance officers; people transferring cats from vet clinics, pounds, other animal shelters, or rescue groups; people surrendering cats with a request for euthanasia; people associated with a kitten who was born in the shelter; people surrendering cats who were admitted directly to shelter hospitals; or people returning cats whom they had adopted from the shelter within 1 month prior. Surrenderers were only eligible for enrollment once, and if they had already participated, additional cats surrendered by them at later dates were not enrolled.

The researchers trained senior shelter admission staff at each participating shelter in enrolling participants using a standardized recruitment methodology, which included providing details about the research aims and study design. These staff members were responsible for selecting and training other admission staff for participant recruitment. The study design called for shelter staff to approach all people surrendering one or more cats during the study period, invite them to participate, and provide them with an information sheet about the study. If the surrenderer wished to participate, they were asked to complete an enrollment form giving written consent and providing contact details. If they did not wish to participate, shelter staff were asked to simply record that they had been approached so that we could determine compliance rates. All potential participants were informed that their answers would not affect the outcome for the cats they were surrendering and that all details would remain confidential.

Unfortunately, shelter staff sometimes failed to record how many people were approached and what percentage of those approached agreed to participate. Hence, we cannot report this information. All people who provided consent were contacted by the first author within 1 week to 8 weeks after the surrender, either by telephone or email according to their preference indicated on the enrollment form. Telephone responses were entered directly into a digitized questionnaire (Qualtrics, http://www.qualtrics.com). Those who elected to participate by email were sent a URL, which linked to the online questionnaire. Reminder emails were sent at 2-week intervals until the questionnaire was completed or 8 weeks had passed from the date of surrender. If the questionnaire was not completed within 8 weeks of the date of surrender, the person was excluded from the study. When the respondent had surrendered more than one cat on the day they signed the consent form, one of the surrendered cats was chosen for inclusion in the study using random numbers generated in Microsoft Excel 2010.

Questionnaire design

A questionnaire was developed following a review of the literature, consultations with academic and industry experts, and testing for reliability and validity in a pilot study followed by revision. The questionnaire contained both forced-choice and open-ended questions in seven sections. Analyses using data from Sections 1 to 3 are reported in this article, and analyses using data from Sections 4 to 7 will be reported in subsequent publications. (These data detail the caretaking of the cat, interactions between the respondent and the cat, and the reasons for the cat's surrender.) Sections 1 to 3 included the following topics (further details are in Table 1):

1. Respondent demographics: forced-choice questions on gender, age, employment status, and postcode.
2. General attitudes to cats and experience of cat ownership: a combination of forced-choice and Likert-scale questions about the person's attitudes toward cats and experience of cat ownership.
3. Cat ownership and interaction history: a series of forced-choice questions on the participant's cat interactions and ownership history as a child, in the previous 5 years, and currently.

The respondent's ownership of the cat they surrendered was determined by their level of agreement with the statement, "I consider myself to be the owner of the cat" on a 5-point Likert scale. Because the distribution of these responses was bimodal and highly polarized, for analyses, the Likert scale was converted to a dichotomous outcome; people who strongly or somewhat agreed with the statement were considered owners, and those who did not agree (people who neither agreed nor disagreed or strongly or somewhat disagreed with the ownership statement) were considered nonowners for the purposes of this study. The term stray was avoided in the questionnaire and in this article due to the variation in the definition of this term (Alberthsen et al., 2013; Centonze & Levy, 2002; Webb, 2008) and because it might have been applied (unintentionally) in some cases to semiowned cats (Alberthsen et al., 2013; Marston & Bennett, 2009).

Data preparation and statistical analyses

Distributions of key variables were compared between telephone- and online-collected data, and as there were no major differences in distributions, it was concluded that there was no substantial effect of collection method. Hence, the two sets of respondents were pooled for analyses. Responses for adult cats and kittens were also similar, so these groups were pooled, and hereafter, adult cats and kittens are collectively referred to as cats. Participants from all shelters were pooled for analyses.

Our final study population was a subset of all eligible cats surrendered to the participating shelters. Because the sample was largely self-selected, we explored the potential for selection bias by comparing our data to data recorded in the RSPCA database for all eligible cats. Variables that were measured for both the study cats and all eligible cats surrendered to the RSPCA were summarized: socioeconomic

Table 1. Questionnaire categories and data variable details.

Categories	Variable details
Demographics	Gender, employment status, age, and postcode. The socioeconomic indexes were derived from the respondent's postcode based on the national decile for their home postcode (Index of Relative Socioeconomic Advantage or Disadvantage, Index of Education and Occupation, and Index of Economic Resources; Australian Bureau of Statistics, 2011).
General attitudes toward cats[a]	The respondent's level of agreement with statements measuring their attitudes toward cats in general: "I like cats," "Cats are good company," "Cats are independent," "Cats are low-maintenance pets," and "Cats are expensive pets." These statements were modified versions of those used in a previous study on attitudes and behaviors toward cats in the community (Toukhsati et al., 2007).
Experiences of cat ownership[a]	The respondent's level of agreement with statements about cat ownership (if they had previously owned a cat): "It (cat ownership) is more expensive than I expected before I first owned a cat," "It is more difficult to look after a cat than I expected before I first owned a cat," "It is difficult to get holiday care for a cat," and "I like(d) having a cat more than I expected before I first owned a cat."
Cat ownership history	Whether the respondent's family had owned a cat when they were a child, the number of cats owned in the previous 5 years (excluding the surrendered cat[s]), the respondent's reasons for cat ownership, the number of cats owned by the respondent at the time of the interview, the number of cats acquired passively by the respondent in the previous 5 years (including the surrendered cat[s]), and the number of cats acquired actively by the respondent in the previous 5 years (including the surrendered cat[s] for respondents surrendering owned cats). Passive acquisition was defined as the cat was found, a "stray," a gift, brought home by children, or left with them by another person. Active acquisition was defined as the cat was acquired from an animal shelter, pet shop, or through a private transaction.
Cat interaction history	The number of unowned cats living on or around the respondent's property in the previous 5 years (excluding the surrendered cat[s]), the number of unowned cats living on or around the respondent's property at the time of the interview, the number of unowned cats being fed by the respondent in the previous 5 years (excluding the surrendered cat[s] and cats being looked after for someone else), the number of unowned cats being fed by the respondent at the time of the interview, the number of separate times the respondents had surrendered a cat to a shelter or pound in the previous 5 years, and the number of unowned cats surrendered to a shelter by the respondents in the previous 5 years.
Association time	The time period for which the respondent had an association with the surrendered cat.

[a] These variables were quantified using 5-point Likert scales, from strongly disagree to strongly agree, with the middle category being "neither agree nor disagree."

indexes (scores) from postcode data, whether the cat was owned or unowned ("stray" in the RSPCA database), and adult cat or kitten categorization. However, the RSPCA categorization of a cat as owned or stray was defined as owned if the cat was presented by someone who claimed to be the owner or agent of the owner; the categorization was stray if the cat was presented by someone who did not claim to be the owner or agent of the owner (Alberthsen et al., 2013). In the study population, the cats were classified as owned or unowned based on the surrenderer's self-classification. Cats surrendered to the RSPCA were categorized as adult cat or kitten based on the cat's age, which was estimated by examination of the animal by trained staff. For the study population, the categorization was based on the surrenderer's opinion.

Associations between exposure variables (demographic and attitude measures, and cat ownership and interaction history measures) and the surrenderer's perceived ownership of the surrendered cat (owner or nonowner; the outcome variable) were assessed using logistic regression. As some combinations of outcome variable and exposure variable category had few or no respondents, exact logistic regression was used. Models were fitted utilizing the exlogistic command in Stata12 (Version 12.1 StataCorp, College Station, TX). Conditional probability tests were used for comparing levels within exposure variables and for joint-significance hypothesis tests to assess the overall significance of exposure variables with more than two levels. The p values were calculated using the mid-p rule as recommended by Agresti (2007). The time period for which the respondent had an association with

the surrendered cat was considered a priori to potentially be a major confounder of the results for other exposure variables. Therefore, associations between other exposure measures and the surrenderer's ownership status were adjusted for this duration and were fitted as a categorical variable.

The cat(s) surrendered when the respondent was recruited (the "current" surrenderer) were not included in the counts for the following variables for each respondent: number of cats owned in the previous 5 years, number of unowned cats living on the respondent's property in the previous 5 years and at the time of the interview, number of unowned cats being fed by the respondent in the previous 5 years and at the time of the interview, number of owned and unowned cats surrendered, and the number of times a cat or cats had been surrendered in the previous 5 years.

To explore the relationship between socioeconomic status and cat ownership status, we used socioeconomic indexes (Australian Bureau of Statistics, 2011). For each index, each respondent was classified based on the national decile for their home postcode, using indexes calculated with the 2011 census data. Thus, the socioeconomic indexes describe the socioeconomic status of each respondent's home area, rather than the respondent's household specifically.

We further explored interrelationships between variables utilizing multiple correspondence analyses (MCAs) and two-dimensional biplot visualization techniques (Greenacre & Blasius, 2006; B. Le Roux & Rouanet, 2010; N. J. Le Roux & Gardner, 2006; Torres-Salinas, Robinson-García, Jiménez-Contreras, Herrera, & López-Cózar, 2013; with Stata's -mca- and -biplot, alpha[0] mahalanobis- commands, respectively). Although the biplot analysis assumed all data were continuous and our data were ordinal or binary, it visually represented the relationships between variables more clearly than MCA, and hence, it is reported.

Results

During the 8-month study period, there were 2,752 eligible cats surrendered to the participating RSPCA animal shelters. In total, 197 people surrendering these cats were approached and consented to participate in the study: 56 (28%) were subsequently lost to follow-up, resulting in a final study population of 141 surrenderers who completed surveys; 128 (91%) were completed by telephone interview and 13 (9%) were completed by online questionnaire. Losses to follow-up included participants who could not be contacted due to incorrect or illegible phone numbers ($n = 48$), who failed to sign the consent form or provide contact details ($n = 3$), or who no longer wanted to participate ($n = 5$). Losses to follow-up were not replaced with additional participants to ensure we reached the desired sample size of 200 respondents because the animal shelters were unable to continue approaching people for consent; our study imposed extra work on the shelter workers, which became untenable during the busiest time of year (summer, October–February).

Not all eligible people were invited to participate. Two of the four animal shelters kept a record of the numbers of people approached. At Shelter 1, 274 people were approached, and of these people, 70 (26%) were enrolled and completed the questionnaire. During the study period, 1,508 cats were surrendered to Shelter 1. However, the number of eligible surrenderers was less than the number of surrendered cats, as some surrenderers would have surrendered more than one cat, some might have surrendered on multiple occasions during the study period, and some surrenderers might have been younger than 18 years old and hence were ineligible.

At Shelter 3, 78 people were approached, and of these, 34 (44%) were enrolled and completed the questionnaire. During the study period, 259 cats were surrendered to Shelter 3. Shelters 1 and 3 accounted for 74% (104/141) of the final study population. (Shelter 2 accounted for 8 respondents and Shelter 4 accounted for 28 respondents.) Reasons given by shelter staff at all four shelters for not approaching potentially eligible people surrendering cats were that the staff were too busy, they did not feel comfortable doing so when the surrenderer was upset or aggressive, they forgot, and they were not trained or briefed about the research and so approached no one.

Comparison of final study population to all RSPCA-eligible surrendered cats

Variables measured for both the final study population and eligible cats surrendered to the RSPCA but not sampled are summarized in Table 2. Minimal differences were found in distributions, except that proportions of cats who were adult cats (as distinct from kittens) and unowned cats (compared with owned cats) were higher in the study population. However, methods of categorization of cats as owned or unowned differed between RSPCA-eligible cats and the final study population cats, and so did the methods of categorization of cats as cat or kitten.

Respondents' demographics

Of 141 surrenderers, 41 (29%) considered themselves to be the owners of the cats they surrendered and 100 (71%) did not consider themselves as owning the cats (nonowners; Table 3). Levels of agreement with the statement, "I consider myself to be the owner of the cat" were bimodal and highly polarized, with 93% (131/141) of surrenderers reporting either strong agreement (39/141) or strong disagreement (92/141). However, there was a spectrum of responses to this question, with 2% of surrenderers (3/141) reporting that they somewhat disagreed, 2% of surrenderers (3/141) reporting that they neither agreed nor disagreed, and 1% of surrenderers (2/141) reporting that they somewhat agreed with the statement.

Most surrenderers were female (65%; 91/141), and there was no significant difference between the sexes in proportions perceiving themselves to be owners. The overrepresentation of women compared with population data (50.6%, Australian Bureau of Statistics, 2011) is consistent with other research in the area of companion animal guardianship and the human–animal bond (Gunaseelan, Coleman, & Toukhsati, 2013; Rohlf et al., 2010; Toukhsati et al., 2007). Half of surrenderers (71/141) were employed full-time. Odds of the surrenderers perceiving themselves as the owners did not differ significantly by occupation status or by any of the indexes of socioeconomic status. Older surrenderers (56 years or older) were less likely to identify themselves as the owners of the surrendered cats compared with younger surrenderers (aged 18–55 years).

Attitudes toward cats

Most surrenderers had a positive attitude toward cats (87%; 122/141), as indicated by agreement with the statement, "I like cats" (Table 4). Odds of the surrenders perceiving themselves as the owners did not differ significantly by attitudes except for agreement with the statement, "Cats are good company."

Table 2. Socioeconomic indicators, ownership statuses, and cat types for all eligible cats surrendered to study RSPCA shelters during the study period and for the final study population.

Variable	Measure	Eligible cats (n = 2,752)	Final study population (n = 141)
Index of Relative Socioeconomic Advantage or Disadvantage score[a]	Median	962	986
	25%–75% percentile	912–1,034	906–1,036
Index of Education and Occupation score[a]	Median	969	962
	25%–75% percentile	938–1,044	939–1,042
Index of Economic Resources score[a]	Median	974	979
	25%–75% percentile	922–1,024	926–1,034
Ownership status[b]	Percentage who were owned	40%	17%
Adult cat or kitten surrendered[c]	Percentage who were adult cats	42%	80%

Note. RSPCA = Royal Society for the Prevention of Cruelty to Animals.
[a] Indexes calculated by the Australian Bureau of Statistics using the 2011 census data for the respondent's home postcode area. A lower number indicates that an area is relatively disadvantaged compared with an area with a higher number.
[b] Methods of categorization of cats as owned or unowned differed between all eligible cats and those used in the final study population.
[c] Methods of categorization of each cat as an adult cat or kitten differed between all eligible cats and those used in the final study population.

Table 3. Demographics of respondents and assessment as determinants of respondents' perceived ownership of cats surrendered.

Variable	Owners *n* (%)	Nonowners *n* (%)	Adjusted odds ratio[a]	95% confidence interval[b]	*p* value[c]
Respondent's sex					**.38**
Male (ref. cat.)[d]	*11 (28)*	*37 (37)*			
Female	29 (73)	62 (62)	1.53	0.6, 4.4	.38
Employment Status					**.54**
Employed (ref. cat.)[e]	*23 (56)*	*64 (65)*[f]			
Homemaker, student, or retired	16 (39)	25 (25)	1.0	0.4, 2.7	.90
Other	2 (5)	10 (1)	0.3	0.03, 2.2	.30
Index of Relative Socioeconomic Advantage and Disadvantage[g]					**.29**
1–3 (ref. cat.)	*10 (24)*	*47 (47)*			
4–7	12 (28)	27 (27)	0.1	0.6, 7.8	.30
8–10	19 (47)	25 (25)	2.3	0.8, 7.2	.12
Index of Education and Occupation[g]					**.53**
1–3 (ref. cat.)	*7 (17)*	*27 (27)*			
4–7	*20 (48)*	*50 (50)*	1.9	0.6, 6.8	.31
8–10	14 (34)	22 (22)	1.6	0.4, 5.9	.43
Index of Economic Resources[g]					**.29**
1–3 (ref. cat.)	*13 (31)*	*54 (54)*			
4–7	*12 (29)*	*25 (25)*	1.9	0.6, 6.80	.30
8–10	16 (40)	20 (20)	2.4	0.7, 7.2	.13
Age group of respondent					**.02**
18–35 years (ref. cat.)	*22 (54)*	*34 (34)*			
36–55 years	13 (32)	45 (45)	0.5	0.2, 1.5	.20
56 years and older	6 (14)	20 (20)	0.2	0.03, 0.6	< .01

[a] The odds ratio refers to the odds of the surrenderer saying they were the owner of the surrendered cat. For example, for the variable "age group of respondent," using data for surrenderers who said they were the owner of the surrendered cat pooled with data for surrenderers who said they were not the owner, surrenderers in the group aged 56 years or older had 0.2 times the odds of saying they were the owner of the surrendered cat compared with surrenderers aged 18 to 35 years old. The odds ratios were adjusted for length of time the respondent had been associated with the surrendered cat.

[b] 95% confidence intervals for the odds ratio.

[c] Bold values are overall *p* values for the variable; nonbolded values are *p* values for the specific level, relative to the reference group.

[d] *Ref. cat.* = the reference category for the analysis for each variable.

[e] "Employed" included the following categories: employed full-time, employed part-time, casual worker, and self-employed.

[f] Note that total number of respondents may differ between variables due to not all respondents answering each question, and within variables, percentages may not always add up to 100% due to rounding.

[g] National deciles of indexes calculated by the Australian Bureau of Statistics using the 2011 census data for the respondent's home postcode area. A lower number indicates that an area is relatively disadvantaged compared with an area with a higher number.

Surrenderers who agreed that cats were good company were more likely to perceive themselves as owners than nonowners.

Respondents' experiences with previous cat ownership relative to their expectations of cat ownership

Most surrenderers who had owned a cat in the past (101/141) did not think that, relative to what they had expected, a cat was more expensive to own (79%; 80/101) or more difficult to look after (82%; 83/101) or that finding holiday care for their cat was difficult (74%; 70/95). The majority of respondents who surrendered an owned cat (55%; 21/38) and respondents who surrendered an unowned cat (60%; 37/62) liked owning a cat more than they had expected. Odds of the surrenderer perceiving themselves as the owner of the surrendered cat did not differ significantly by respondents' previous experiences with cat ownership relative to their expectations of cat ownership.

Recent cat ownership was common: 66% of surrenderers who surrendered an owned cat and 53% of surrenderers who surrendered an unowned cat had owned a cat—other than the cat(s) they surrendered—in the previous 5 years. Surrenderers who had previously owned a cat reported

Table 4. Respondents' attitudes toward cats and assessment as determinants of respondents' perceived ownership of the cats surrendered.

Variable	Owners *n* (%)	Nonowners *n* (%)	Adjusted odds ratio[a]	95% Confidence Interval[b]	*p* value[c]
Agreement with:					
I like cats					**.30**
Did not agree[e] (ref. cat.)[d]	*2 (5)*	*17 (17)*			
Somewhat agree	9 (22)	27 (27)	2.5	0.4, 26.1	.28
Strongly agree	30 (73)	56 (56)	3.7	0.6, 33.2	.28
Cats are good company					**.04**
Did not agree (ref. cat.)	*1 (2)[f]*	*11 (11)*			
Somewhat agree	10 (24)	35 (35)	7.8	0.6, 275.7	.08
Strongly agree	30 (73)	54 (54)	13.7	1.2, 455.8	.03
Cats are independent					**.72**
Did not agree (ref. cat.)	*6 (15)*	*33 (33)*			
Somewhat agree	11 (27)	49 (49)	1.1	0.2, 5.6	.85
Strongly agree	26 (63)	35 (35)	1.5	0.3, 7.4	.60
Cats are low-maintenance pets					**.62**
Did not agree (ref. cat.)	*10 (24)*	*30 (3)*			
Somewhat agree	18 (44)	47 (47)	1.7	0.6, 5.8	.33
Strongly agree	13 (32)	22 (22)	1.3	0.4, 4.6	.64
Cats are expensive pets					**.63**
Did not agree (ref. cat.)	*28 (69)*	*81 (81)*			
Somewhat agree	5 (12)	15 (15)	1.1	0.3, 4.1	.87
Strongly agree	2 (5)	4 (4)	2.8	0.2, 38.1	.34

[a] The odds ratio refers to the odds of the surrenderer saying they were the owner of the surrendered cat. For example, for the variable "Cats are good company," using data for surrenderers who said they were the owner of the surrendered cat pooled with data for surrenderers who said they were not the owner, surrenderers who strongly agreed that cats are good company had 13.7 times higher odds of saying they were the owner of the surrendered cat and surrenderers who somewhat agreed had 7.8 times higher odds of saying they were the owner of the surrendered cat compared with surrenderers who did not agree with this statement. The odds ratios were adjusted for length of time the respondent had been associated with the surrendered cat.

[b] 95% confidence intervals for the odds ratio.

[c] Bold values are overall *p* values for the variable; nonbolded values are *p* values for the specific level, relative to the reference group.

[d] Ref. cat. = the reference category for the analysis for each variable.

[e] "Did not agree" included strongly disagree, somewhat disagree, and neither agree nor disagree.

[f] Note that total number of respondents may differ between variables due to not all respondents answering each question, and within variables, percentages may not always add up to 100% due to rounding.

companionship, liking cats, and compassion for the cat needing a home as their primary reasons for owning a cat (Table 5). Surrenderers who had owned one or more cats (not including the cat[s] surrendered at enrollment) in the previous 5 years were more likely to identify themselves as the owners of the cats they surrendered compared with surrenderers who had owned no cats in the previous 5 years (Table 5).

At the time of the interview, the same proportion (51%) of surrenderers who surrendered an owned cat and surrenderers who surrendered an unowned cat did not own a cat, while 41% of surrenderers of owned cats and 34% of surrenderers of unowned cats owned one cat and 7% of surrenderers of owned cats and 15% of surrenderers of unowned cats owned two to four cats. Passive acquisition of previously owned cats (such as a gift or accidental finding) was common in people surrendering both owned cats (56%) and unowned cats (37%). Surrenderers who had actively acquired one or more cats in the past were more likely to identify themselves as the owners of the surrendered cats compared with surrenderers who had not.

Interactions with cats other than the cat(s) surrendered at enrollment

In the 5 years prior to the interview, 22% of owners and 24% of nonowners had had one or more unowned cats living on or around their property, not including the cat(s) they surrendered at

Table 5. Respondents' cat interactions and surrender histories and assessment as determinants of perceived ownership of the cats surrendered.

Variable	Owners *n* (%)	Nonowners *n* (%)	Adjusted odds ratio[a]	95% confidence interval[b]	*p* value[c]
Did the respondent's family own a cat when they were a child?					**.91**
Yes (ref. cat.)[d]	*26 (63)*	*65 (65)*			
No	15 (37)	35 (35)	0.9	0.3, 2.4	.91
Number of cats owned in the previous 5 years (excluding the surrendered cat[s])					**< .01**
0 (ref. cat.)	*14 (34)*	*46 (47)*			
1	21 (51)	25 (26)	4.2	1.3, 14.1	.01
≥2	6 (15)	27 (27)[e]	0.8	0.2, 3.0	.88
Reasons for cat ownership					**< .01**[f]
Companionship	17 (42)	15 (25)			
Rodent control	0	1 (2)			
Cat needed a home	6 (15)	13 (21)			
Like cats	10 (25)	25 (41)			
Cats are quiet	0	0			
Cats are easy to look after	0	0			
Other	7 (18)	7 (12)			
Number of cats owned at the time of the interview					**.06**
0 (ref. cat.)	*21 (51)*	*50 (51)*			
1	17 (41)	33 (34)	2.8	1.0, 8.8	.06
≥2	3 (7)	15 (15)	0.6	0.1, 3.0	.57
Number of cats acquired passively in the previous 5 years (including the surrendered cat[s])					**.2**
0 (ref. cat.)	*18 (44)*	*61 (63)*			
1	14 (34)	19 (20)	2.4	0.8, 7.3	.08
≥2	9 (22)	17 (17)	2.1	0.6, 8.2	.26
Number of cats acquired actively in the previous 5 years (including the surrendered cat[s] for respondents surrendering owned cats)					**< .01**
0 (ref. cat.)	*10 (24)*	*71 (72)*			
1	16 (39)	18 (18)	8.1	2.4, 30.0	<.01
≥2	15 (36)	10 (10)	9.7	2.5, 42.2	<.01
Number of unowned cats living on or around the respondent's property in the previous 5 years (excluding the surrendered cat[s])					**.5**
0 (ref. cat.)	*32 (78)*	*75 (76)*			
1	2 (5)	3 (3)	1.3	0.1, 17	.78
≥2	7 (16)	21 (21)	0.5	0.2, 1.7	.34
Number of unowned cats currently living on or around the respondent's property					**< .01**
0 (ref. cat.)	*37 (90)*	*68 (70)*			
1	1 (2)	7 (7)	0.2	0.0, 1.7	.10
≥2	3 (7)	22 (22)	0.3	0.0, 0.6	<.01
Number of unowned cats being fed by the respondent in the previous 5 years (excluding the surrendered cat[s])					**.09**
0 (ref. cat.)	*31 (76)*	*46 (46)*			
1	4 (10)	24 (24)	0.6	0.1, 2.7	.61
≥2	6 (14)	30 (30)	0.3	0.1, 0.9	.02
Number of unowned cats currently being fed by the respondent					**.39**
0 (ref. cat.)	*39 (95)*	*79 (81)*			
1	1 (2)	9 (9)	0.3	0.0, 2.1	.29
≥2	1 (2)	10 (10)	0.3	0.0, 2.8	.51
Number of separate times the respondents had surrendered a cat to a shelter or pound in the previous 5 years (including the current surrender)					
1	33 (80)	65 (65)	The surrender at enrollment was excluded for the analysis.		
2	8 (20)	14 (14)			
≥3	0	21 (21)			

(*Continued*)

Table 5 – *continued*

Variable	Owners *n* (%)	Nonowners *n* (%)	Adjusted odds ratio[a]	95% confidence interval[b]	*p* value[c]
Number of separate times the respondents had surrendered a cat to a shelter or pound in the previous 5 years (excluding the current surrender)					**< .01**
0 (ref. cat.)	*33 (80)*	*65 (65)*			
≥1	8 (20)	14 (14)	1.0	0.3, 3.3	.88
1	0	21 (21)	0.1	0.0, 0.3	<.01
Number of unowned cats surrendered to a shelter by the respondents in the previous 5 years (excluding the surrendered cat[s])					**.03**
0 (ref. cat.)	*37 (88)*	*93 (94)*			
≥1	5 (12)	6 (6)	0.4	0.1, 0.9	.03
Time period for which the respondent had an association with the surrendered cat					**< .01**
< 1 month (ref. cat.)	*3 (7)*	*64 (66)*			
1 to < 6 months	13 (32)	22 (23)	14.1[g]	4.2, 64.1	<.01
6 to < 12 months	6 (15)	6 (6)			
12 months to 3 years	3 (7)	5 (5)	72.7	17.5, 402.9	<.01
>3 years	16 (39)	0			

[a] The odds ratio refers to the odds of the surrenderer saying they were the owner of the surrendered cat. For example, for the variable "number of cats acquired intentionally in the past 5 years (including the surrendered cat[s] for respondents surrendering owned cats)," using data for surrenderers who said they were the owner of the surrendered cat pooled with data for surrenderers who said they were not the owners, surrenderers who had owned two or more cats who they had intentionally acquired had 9.7 times higher odds of saying they were the owners of the surrendered cats compared with surrenderers who did not agree with this statement. The odds ratios were adjusted for length of time the respondent had been associated with the surrendered cat.

[b] 95% confidence intervals for the odds ratio.

[c] Bolded values are overall *p* values for the variable; nonbolded values are *p* values for the specific level, relative to the reference group.

[d] Ref. cat. = the reference category for the analysis for each variable.

[e] Note that the total number of respondents may differ between variables due to not all respondents answering each question, and within variables, percentages may not always add up to 100% due to rounding.

[f] Calculated using a Pearson chi-square test.

[g] Univariate analysis.

enrollment (Table 5). At the time of the interview, 10% of owners and 30% of nonowners had at least one unowned cat living on or around their property. Surrenderers with unowned cats currently living on their property were less likely to identify themselves as the owners of the cats they surrendered than were surrenderers who had no unowned cats currently living on their property. Almost a quarter of owners (24%) and the majority (54%) of nonowners had fed at least one unowned cat in the previous 5 years, not including the cat they surrendered at enrollment. Surrenderers who had fed more than one unowned cat in the previous 5 years were less likely to identify themselves as the owners of the cats they surrendered compared with surrenderers who had not fed any unowned cats. Five percent of owners and 19% of nonowners reported that they were feeding at least one unowned cat at the time of their interview.

Previous surrender history other than the surrender at enrollment

Most owners (80%) and nonowners (65%) had only taken a cat to a shelter once (at enrollment; Table 5), but 20% of owners had surrendered a cat one other time and 35% of nonowners had surrendered a cat at least one other time. Respondents who had surrendered a cat to a shelter more than once previously in the previous 5 years were less likely to identify themselves as the owners of the surrendered cats compared with respondents who had not previously surrendered a cat to a shelter in the previous 5 years.

Time that respondent had been associated with the surrendered cat

As postulated a priori, respondents who had been associated with the surrendered cat for a longer period of time were much more likely to identify themselves as the owners of the cats (Table 5).

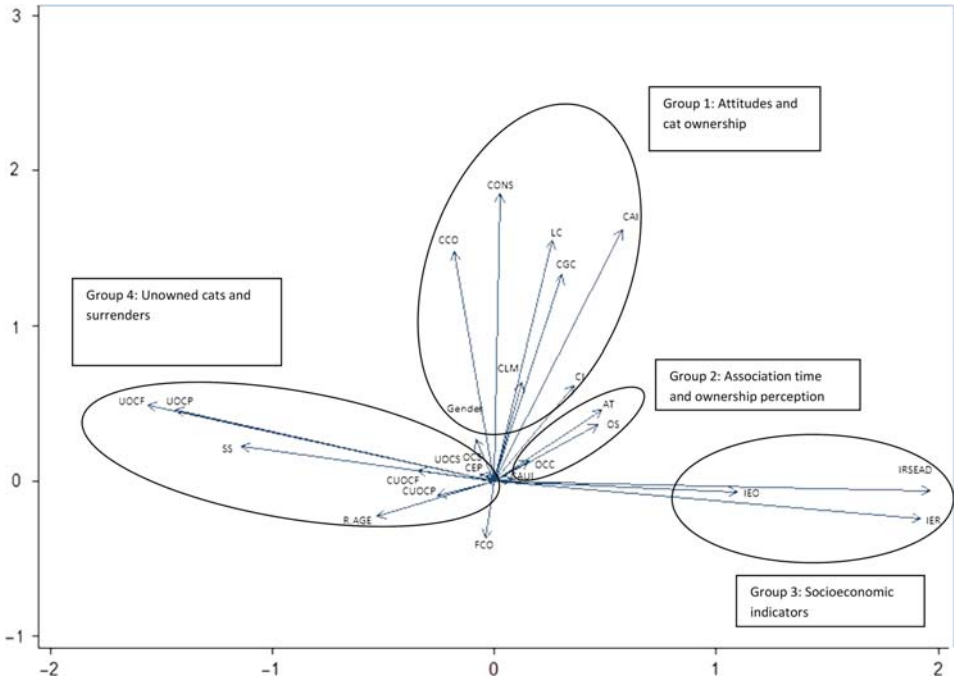

Figure 1. Biplot illustrating relationships between characteristics of cat surrenderers. The biplot shows four groups of closely positively correlated variables (indicated by vectors pointing in a similar direction). Group 1 included positive attitude variables (belief that cats are low-maintenance companion animals and are good company and the respondents indicating they like cats), intentional acquisition of cats, number of owned cats not surrendered, and gender. Group 2 included association time with the surrendered cat, the respondent's occupation, and perceived ownership of the cat. Group 3 included socioeconomic indicators and unintentional acquisition of cats. Group 4 included unowned cats fed, unowned cats on the respondent's property, and other cat surrenders to a shelter. For the biplot analysis, observations were not displayed; rather, vectors (arrows) were displayed for variables. These vectors were positioned such that the cosine of the angles between vectors approximated the correlation coefficients between the variables. Thus, variables with vectors in virtually the same direction were closely positively correlated (r was close to 1), variables with vectors at 90° were not correlated ($r = 0$), and variables with vectors nearly at 180° were closely negatively correlated (r was close to -1). The length of the vector indicates the standard deviation of the variable's data.
Note. OS = ownership status; AT = association time of respondent with cat; CAUI = cats whom the respondent has owned that they acquired unintentionally; SS = separate times the respondent has surrendered a cat to a shelter (not including the surrender at enrollment); UOCP = unowned cats on the respondent's property in the previous 5 years; CUOCP = current unowned cats on the respondent's property; CONS = cats owned by the respondent in the previous 5 years who have not been surrendered; R. AGE = respondent's age; UOCS = unowned cats surrendered by the respondent in the previous 5 years (not including the current cat); LC = agreement of the respondent with, "I like cats"; CGC = agreement of the respondent with, "Cats are good company"; CCO = current number of cats owned by the respondent; UOCF = unowned cats fed by the respondent in the previous 5 years; CAI = cats whom the respondent has owned and they acquired intentionally; IRSEAD = Index of Relative Socioeconomic Advantage and Disadvantage; IER = Index of Economic Resources; IEO = Index of Education and Occupation; OCS = owned cats surrendered by the respondent in the previous 5 years (not including the current cat); CUOCF = current unowned cats fed by the respondent; gender = respondent's gender; OCC = respondent's occupation (employed full-time, employed part-time, casual worker, self-employed, homemaker, student, retired, other); CLM = respondent's agreement with, "Cats are low-maintenance pets"; CEP = respondent's agreement with, "Cats are expensive pets"; CI = respondent's agreement with, "Cats are independent"; FCO = respondent's family owned a cat when they were a child.

Relationships between variables

The biplot illustrating relationships between characteristics of cat surrenderers (Figure 1) explained 32% of the data variation. The biplot revealed that in addition to perceived ownership of the surrendered cat, socioeconomic indicators and attitudes toward cats may be secondary factors influencing variance in our data. There were four groups of closely positively correlated variables (indicated by vectors pointing in a similar direction).

Group 1 consisted of positive attitude variables (belief that cats are low-maintenance companion animals and are good company and the respondents indicating they like cats), intentional acquisition of

cats, number of owned cats not surrendered, and gender. Group 2 included association time with the surrendered cat, the respondent's occupation, and perceived ownership of the cat. Group 3 included socioeconomic indicators and unintentional acquisition of cats. Group 4 included unowned cats fed, unowned cats on the respondent's property, and other cat surrenders to a shelter. The positioning of the vectors for Group 3 (socioeconomic indicators) and Group 4 (variables measuring the number of unowned cats fed, unowned cats on the respondent's property, and the number of separate times the respondent had surrendered a cat) pointing in almost opposite directions in the biplot indicates a strong negative correlation between these two groups of variables.

Discussion

To formulate effective intervention strategies to decrease the number of cats surrendered to animal shelters, it is important to understand the people who are surrendering them and thereby contributing substantially to shelter intake. Our study documented attitudes to cats, cat interaction history, and prior experiences of cat ownership in people surrendering cats, and it explored whether these factors were associated with the surrenderer's perceived ownership of the surrendered cat.

Feeding unowned cats was common in our study respondents: 54% of nonowners and 24% of owners had fed one or more unowned cats (not including the one surrendered) in the previous 5 years. Semiownership has been described as "the intentional provision of food or other benevolent actions that contribute to the health and fitness of a cat, but that do not constitute 'ownership' as far as the person undertaking such actions is concerned" (Toukhsati et al., 2007, p. 131). Hence, in this study, a semiowner was defined as a person who fed a cat who they identified as unowned. The semiownership behavior by both owners and nonowners documented in our study is an important finding that highlights the extent of cat semiownership among surrenderers.

Reports from Australia, Thailand, and the United States indicate that most semiowned cats are not sterilized (Haspel & Calhoon, 1990; Toukhsati et al., 2007, 2012), although such information is limited. As feeding may enhance a cat's reproductive capacity, this behavior can lead to a perpetuation of the problem of unowned cats. Studies in Australia (Toukhsati et al., 2007), Ireland (Downes, Canty, & More, 2009), Italy (Slater et al., 2008), and the United States (Haspel & Calhoon, 1990; Levy et al., 2003) have also shown that cat semiownership in the community is relatively common (10%–20%), but comparisons of the differing incidences of semiownership are not meaningful because of differences in study populations and questionnaire designs. We surveyed only people who surrendered cats to a shelter, and cat semiownership incidence may differ between this population and those studied in other studies where study populations were recruited from the general public by other methods.

In our study, the most powerful determinant of people identifying themselves as owners was association time. Increasing association time plausibly results in growing attachment to the cat and/or a greater understanding of what it means to be a cat owner, resulting in increased recognition of ownership. Some animal shelters use association time with the surrendered cat as a surrogate measure of ownership, and they only categorize cats as stray (unowned) if the person surrendering the cat says they have been associated with the cat for less than approximately 1 month (RSPCA staff, personal communication, November 2013). Our results suggest that this reclassification may be warranted: Considering association time can help overcome the problem of misrepresentation of ownership, whether intentional (to avoid anticipated judgment and the surrender fee) or unintentional.

Thirty-three percent of the 100 cats presented in our study as being unowned had been associated with their surrenderer for more than 1 month. In some shelters, they would be classified as owned and in others as stray, when in fact, the term "semiowned" may be the most appropriate classification. Although this may seem like a trivial issue of terminology, if shelter admission data are used to inform the design of strategies to address unwanted cats in the shelter's local area, this potentially misleading categorization of cats could hamper efforts to design effective population-level intervention strategies. The proportion of cats from different sources (e.g., owner-relinquished vs. other sources such relinquished strays) varies between different locations (Coe et al., 2014). Plausibly, the extent of cat

semiownership also varies between locations. It is critical to collect accurate information on the cats contributing to the shelter's intake, as strategies must address owned, semiowned, and genuinely unowned cat populations differently.

In particular, the identification of cat semiownership in a community has implications for managing the problem of unwanted cats, as cat semiowners will require different management strategies than those aimed at people who perceive themselves as cat owners. Many strategies, such as mandatory sterilization and identification legislation, will not be suitable for people who do not perceive ownership of the cat. Semiowners, however, may be amenable to intervention through the provision of options to prevent the birth of unwanted kittens or education and advice about the impact of their behaviors. Knowing more about the relationship of surrenderers to surrendered cats would allow for the assessment of the extent of semiowner contribution to shelter intake.

Knowledge about the extent of semiownership in the shelter's community allows the shelter to determine if it is a significant local problem needing to be managed at a population level. If a problem is identified, it will inform the implementation of strategies in the community, which focus on education of cat semiowners, encouragement to take ownership of semiowned cats, the provision of sterilization options for semiowned cats, and incentives to have semiowned cats sterilized. A multifaceted campaign including these strategies could result in fewer semiowned cats, fewer unwanted kittens, and ultimately, fewer cats and kittens surrendered to the shelter. The outcomes of such a campaign would need to be assessed and monitored; the information gathered from the shelter about semiowned cats and cat semiowners could act as a baseline to which postcampaign data could be compared.

Animal shelters could utilize a standard set of questions as part of the admission procedure to determine if people are semiowners, owners, or nonowners of the surrendered cats. The results of this study suggest that answers to the following four questions would be informative in differentiating semiowners, owners, and nonowners:

1. How long had the surrenderer been associated with the cat?
2. Did the surrenderer feed the cat and for how long?
3. Did the surrenderer have other unowned cats living on their property?
4. Was the surrenderer feeding other unowned cats?

If the shelter knew that there were other semiowned cats associated with the surrenderer, it would provide an important opportunity for direct intervention through education and potentially the provision of options to prevent the birth of unwanted kittens from these semiowned cats.

Almost all people who identified themselves as owners in our study had positive attitudes toward cats, and most had owned at least one cat other than the cat(s) surrendered in the previous 5 years and had acquired at least one cat intentionally. After surrendering a cat or cats to the RSPCA, many owner-surrenderers still owned at least one cat and 21% had surrendered a cat more than once previously. This finding suggests that the decision to surrender cat(s) was made individually for each cat and so may be complex and include differing attachment to specific cats and/or individual cat factors. This finding concurs with previous research that has demonstrated that "cat factors" (such as behavior problems) as well as "human factors" (such as accommodation or health) are often the reasons for surrender (DiGiacomo et al., 1998; Salman et al., 1998).

Nonowners in our study also generally had positive and benevolent attitudes toward cats and were more likely than owners to have fed unowned cats in the previous 5 years, to have unowned cats currently living on their property, and to have surrendered a cat to a shelter more than once previously. Nonowners in our study, therefore, are likely to be supporting and contributing to unowned cats both in the community and surrendered to animal shelters, as has been reported by others (Marston & Bennett, 2009; Toukhsati et al., 2007). Agreement with the statement, "I like cats" polarized our respondents into two distinct groups of people: people who liked cats and presumably wanted to help them and people who did not like cats and were willing to express their negative feelings. The latter formed a much smaller group than the former (11 respondents, all nonowners, compared with 122).

Positive, benevolent attitudes toward unowned cats found in our study and other studies (Centonze & Levy, 2002; Hsu, Severinghaus, & Serpell, 2003; Lloyd & Hernandez, 2012; Zasloff & Hart, 1998) suggest that nonlethal management strategies for unowned cats are likely to be more accepted and supported by the community, which may contribute to their success. Thus, strategies aimed at controlling the cat population (e.g., sterilization; adoption; and trap, neuter, and return programs) rather than eradication might be more successful in areas where members of the community are already caring for cats.

In the population studied, people aged 56 years or older were more likely to identify themselves as nonowners compared with their younger counterparts. Possible reasons include generational differences in psychological constructs of ownership and unwillingness to take responsibility for an animal because of advancing age or financial or health circumstances. In addition, older people may have more time to take a cat to a shelter rather than ignoring him or her, they may have more free time to take care of an unowned cat, and they may spend more time at home, leading to a greater awareness of the presence of unowned cats. Increased awareness may result in increased perception of nuisance or increased awareness of cat sickness or injury, leading to surrender for removal of the nuisance or for compassionate reasons.

The use of exploratory statistical techniques, mapping the variables using MCA and biplot, revealed the likelihood of relationships between variables studied (most notably socioeconomic indicators and interactions with unowned cats) that are not related to the ownership status of the cat but are worthy of pursuit in their own right. In particular, our results suggest an association between lower socioeconomic status and having unowned cats on one's property, feeding unowned cats, and surrendering multiple times. This finding supports previous research that showed proportionally higher intake into animal shelters from areas of relative socioeconomic disadvantage (Rinzin et al., 2008) and suggests that the provision of low-cost or free sterilization services in areas of socioeconomic disadvantage may help reduce shelter admissions. In addition, educational and social marketing strategies aimed at encouraging sterilization and other responsible cat caretaking behaviors could be targeted at postcodes of socioeconomic disadvantage.

Limitations

Recruitment of participants for this study proved to be very difficult, and there were problems with potential selection bias introduced by shelter staff only inviting a small proportion of cat surrenderers to participate and a low participation rate, which resulted in a relatively small sample size. Although a low participation rate could be anticipated for such a study and does not necessarily imply bias, the specific population studied only included people who were willing to complete a survey, and these people may not be representative of all cat surrenderers. Increasing the participation rate and sample size by offering incentives or other means of coercion might have increased response but also increased bias. Other researchers in this field have reported similar problems (Rohlf et al., 2010; Toukhsati et al., 2012).

In this study, the scale of differences in determinants of ownership perception was very large, and a larger sample size, although desirable, was not necessary to demonstrate statistical significance. However, with the small sample size, it is possible some important associations have not been detected. As we tried to avoid overloading shelter staff during their busiest times of the year, we were unable to collect data for a full 12 months. This inability to collect data might have introduced some selection bias if the surrenderers during these times differed from those during the data collection period, but it is not known how they might have differed and the effect this might have had on our findings.

Bias might have been introduced because of the following three nonrandom situations: (a) Shelter staff approached some but not all eligible surrenderers, (b) not all surrenderers approached agreed to participate, and (c) some surrenderers who agreed to participate were subsequently lost to follow-up. To assess potential bias in the sample, equivalent data were compared between eligible cats surrendered to the RSPCA but not sampled and the final study population. The study population showed a higher proportion of cats than kittens and a higher proportion of owners than nonowners compared with RSPCA admissions data. These differences are understandable given that cat age in the

study population was based on the surrenderer's opinion, whereas the RSPCA database reflects an age estimated by trained staff's examination of the animal. To a layperson, a kitten older than 4 months may look like a cat, whereas many shelter staff would not classify an animal as a cat until he or she reached approximately 6 months old (RSPCA staff, personal communication, April 11, 2014).

Similarly, ownership status in the study data was based on the surrenderer's opinion, whereas in the RSPCA's database, surrenderers are sometimes (but inconsistently) classified as owners if they have been associated with the cat for a specific period of time, irrespective of the surrenderer's opinion. Owners might have been less likely to consent to participate than nonowners, as they might have been distressed by the surrender of a cat they considered their own. It is also possible that shelter staff did not approach as many owners as nonowners to ask them to participate in the study if more owners were distressed at the time of surrender.

Although caution must be applied to generalizing this study's results to all surrenderers, the findings of this study indicate potentially important avenues for further investigation with larger and more representative samples. Given the difficulties inherent in obtaining such samples (Finkler & Terkel, 2012; Rohlf et al., 2010; Toukhsati et al., 2012), evidence to inform improved understanding of the cat populations entering animal shelters could be gained through shelters collecting more specific information as part of the obligatory admission paperwork. Toward this end, this study has revealed key questions that would facilitate unbiased large-scale data collection for shelter use and for future research in this field.

Conclusions

Length of association was the strongest factor differentiating owners from nonowners in this study, with a longer association time increasing the chances of a surrendered cat being identified as owned. The odds of people identifying themselves as the owners of the cats they surrendered were higher in people who believe that cats are good company, who actively acquired cats previously, and who owned a cat other than the one they surrendered. The odds of people identifying themselves as nonowners of the cats they surrendered increased with increasing age of the surrenderer, number of unowned cats on their property, and number of cats surrendered.

Many people surrendering cats to animal shelters feed the cats even though they do not consider themselves the owner, and consequently, they could be considered cat semiowners. These people are likely contributing to the number of unwanted cats in the community and animal shelters beyond just the cats they surrender. Socioeconomic disadvantage is associated with having unowned cats on one's property, feeding unowned cats, and surrendering multiple times, suggesting that targeting areas of relative socioeconomic disadvantage and providing them with low-cost sterilization options and strategies aimed at decreasing semiownership behaviors may reduce shelter intake.

Although the potential for sample bias and the small sample size mean caution must be applied when generalizing these results, the findings highlight the need for welfare organizations to collect information that will allow them to determine the extent of semiownership among people surrendering cats to their organizations. This information will be invaluable for local targeting of shelter and community strategies aimed at reducing the number of unwanted cats.

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