

Paper

Assessing changes in the UK pet cat and dog populations: numbers and household ownership

J. K. Murray, T. J. Gruffydd-Jones, M. A. Roberts, W. J. Browne

The main aim of this study was to replicate methodology used to estimate the size of the UK pet cat and dog populations in 2006 and the proportion of households owning cats/dogs in 2007, to produce updated data to compare trends in ownership and population sizes. A cross-sectional study design was used to collect telephone interview data from 3155 households in the UK. 2011 UK human census data were used to predict the size of the cat and dog populations owned by households in the UK in 2011. Of the households, 23 per cent (714/3155) owned one or more cats and 30 per cent (940/3155) owned one or more dogs. There was some overlap in pet ownership with 7 per cent (210/3155) of households owning both one or more cats and one or more dogs. There was a small but significant decrease in the proportion of households that owned one or more cats in 2011 compared with 2007, with no change in the proportion owning dogs. However, overall, the total number of cats and dogs that were estimated to be owned by UK households did not change significantly between 2006 and 2011. The estimated size (and 95% CIs) of the pet cat and dog populations in the UK in 2011 was 10,114,764 cats (9,138,603–11,090,924) and 11,599,824 dogs (10,708,070–12,491,578).

Cats and dogs are the most commonly owned UK household pets (Murray and others, 2010, Westgarth and others, 2010, PDSA 2014). Recent studies have estimated that cats and dogs are owned by 24–26 per cent and 24–31 per cent of UK households, respectively (Murray and others 2010, PDSA 2014). Although the number of households in the UK is increasing (8 per cent increase between 2001 and 2011: Office for National Statistics (ONS) 2011a), anecdotal reports from animal welfare organisations suggest that finding new homes for cats and dogs has become increasingly challenging over recent years. Due to differences in study methodologies that have been used to generate estimates of the size of the UK pet cat and dog populations and potential biases arising from different sampling techniques (Downes and others 2013), comparing the size of cat and dog populations across studies cannot produce reliable indicators of changes in the population sizes, or of the proportion of households owning these pets.

The main aim of this study was thus to employ the same methodology that was used to estimate the size of the UK pet

cat and dog populations in 2006 and the proportion of households owning cats/dogs in 2007 (Murray and others 2010), to enable direct comparison with new data collected in this study that was conducted in 2011. Up-to-date UK household data based on the 2011 human census were used in this study to produce cat/dog population size estimates. It was hypothesised that between 2007 and 2011 the proportions of cat-owning and dog-owning UK households would have decreased.

Secondary aims of the study included estimating cat/dog population sizes based on the proportion of households owning cats/dogs in each of the four countries of the UK.

Materials and methods

Data collection

Using the same methodology as had been used previously by the authors to estimate the size of the UK-owned cat and dog population (Murray and others 2010), a cross-sectional study was used to obtain data relating to cats and dogs owned by households in the UK in 2011. Data were thus collected in the same year (2011) as a UK human census; however, detailed information relating to the number of occupants in households within the UK was only available two years later (ONS 2013).

A commercial company (Data Discoveries) supplied contact details for a random sample of households listed on the UK electoral roll. Data were collected between July 4, 2011, and November 20, 2011, using a telephone questionnaire that was administered by 15 trained interviewers. Households that were listed as 'ex-directory' or were registered with the Telephone Preferential Service were excluded from the sample. (The electoral roll consists of adults over the age of 18 who are eligible to vote and does not include travellers, gypsies, active serving forces members, some government personnel and non-EU citizens).

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Telephone calls were made on weekday evenings between 18:00 and 21:00 and at the weekends between 10:00 and 17:00, and a maximum of three attempts were made to contact each household. A total of 16,638 household telephone numbers were used, and contact was made with people from 10,055 households. Questionnaires were completed by 3155 householders, representing a 31.37 per cent response rate from households with which contact had been made. In order to reduce response bias resulting from households being informed that the study was about cats and dogs, the study was described as a study of UK pets and it was stressed in the introduction that the interviewers needed to speak to people who did not own pets as well as those who owned pets.

Questionnaires took approximately two to three minutes to complete by households without cats or dogs, approximately five minutes to complete by households owning only dogs and 10 minutes to complete by cat-owning households. Closed questions were predominantly used in the questionnaire, and all data used in the analyses reported in this study were collected through the use of closed questions. A copy of the questionnaire is provided in the online supplementary material.

In order to collect data that would allow us to quantify any change in the number of households within the sample that owned cats and/or dogs over recent years, and to aid comparison with our previous survey (Murray and others 2010), which had been conducted in summer–autumn 2007, all respondents were asked to report the number of cats and dogs that they owned currently, had owned 12 months previously (August 2010) and had owned four years previously (August 2007).

Estimating the size of the dog and cat populations in the UK

The number of household occupants (categorical with five categories: 1, 2, 3, 4, 5 or more) and the geographical location of the household (categorical with two categories: London, other areas of the UK) were tested for association with the probability of dog/cat ownership in this data set (data not shown) as these predictors have previously shown significant associations with dog/cat ownership (Murray and others 2010).

A commercially available statistical software package (SPSS V.19.0) was used to fit a linear statistical model to the data collected. For ease of calculating population size CIs, all five categories of household size were included in the model and no intercept was therefore included. Household location (London/outside London) was not significantly associated with cat/dog ownership within our data set so was not included as a predictor in the linear model. The predicted cat and dog numbers for each category were then multiplied by the number of households from the UK census within each category to derive estimates for the number of cats and dogs in each category, which were summed to give the overall population sizes.

The standard errors of these population estimates was calculated using the variance–covariance matrix of the parameters in the linear model.

In order to estimate the numbers of pet cats and dogs owned by householders within each of the UK countries (England, Northern Ireland, Scotland and Wales), a simpler method was

used due to the small counts within household size categories for some countries. The mean numbers of cats and dogs owned by households in each of the four UK countries were multiplied by the numbers of households within each country (ONS 2013) to estimate the owned cat and dog population sizes within these countries.

Change in cat and dog ownership

In order to facilitate evaluation of any change in the proportion of households that owned cats and dogs over recent years, respondents were asked to provide the number of cats and number of dogs owned by the household at the time of the survey (July–November 2011), 12 months previously and in August 2007. The respondents were asked to recall the number of cats/dogs owned in August 2007 in order that the proportion of cat-/dog-owning households in our previous study (Murray and others 2010) could be compared with the sample in this study. χ^2 tests were used to test for associations between cat ownership status at the time of data collection and at the two previous time points of interest (one year and four years previously). The McNemar test was used to test for differences between the proportion of respondents that reported ownership of one or more cats/dogs at the time of the survey and in August 2007.

Sample size calculations indicated that 1168 completed questionnaires were needed to provide the study with 80 per cent power to detect a difference of 5 per cent in the proportion of households that reported ownership of cats/dogs in 2007 and 2011. IBM SPSS V.21 was used for McNemar test analyses. Sample size calculations and other analyses were conducted using the Ausvet Animal Health Services Epitools website (Auset Animal Health Services 2014). Significance was set at $P < 0.05$.

Results

Questionnaires were completed by 3155 households. Of the households, 23 per cent (714/3155) owned one or more cats and 30 per cent (940/3155) owned one or more dogs. There was some overlap in pet ownerships with seven per cent (210/3155) of households owning both one or more cats and one or more dogs. Of all cat-owning households, 61.8 per cent (441/714) owned only one cat and 94.1 per cent (933/991) of cats aged six months or more were reported to have been neutered.

Number of cats and dogs owned by UK households

The proportion of households within each of the five categories of household size calculated from the 2011 census data and from the study sample were summarised, together with the mean number of cats and dogs per household reported in the study sample for each of the five categories (Table 1). The size of the household was provided by 3034 (96.2 per cent) of respondents. Survey data with missing household size data were assumed missing at random and were excluded from the calculations of number of cats/dogs owned by UK households.

Details of the models calculated for the predictor of household size on the number of cats/dogs owned by UK households are presented in Table 2.

TABLE 1: Number of households in the UK in 2011 and sampled within this study of randomly selected UK households, categorised according to the number of household occupants

Number of occupants in household	Number (%) of households in 2011 (UK census)	Number of households in study sample	Mean (sd) number of cats reported to be owned	Mean (sd) number of dogs reported to be owned
1	8,087,020 (30.6)	914 (30.1)	0.25 (0.64)	0.38 (0.90)
2	9,017,950 (34.1)	1502 (49.5)	0.40 (0.98)	0.41 (0.77)
3	4,117,000 (15.6)	396 (13.1)	0.47 (0.97)	0.52 (0.90)
4	3,406,530 (12.9)	176 (5.8)	0.48 (1.12)	0.59 (0.82)
≥5 people	1,813,620 (6.9)	46 (1.5)	0.50 (1.10)	0.35 (0.57)
Total	26,442,120	3034		

TABLE 2 : Parameters of the linear regression model fitted to data collected from randomly selected UK households in 2011 to estimate the size of the owned cat and dog populations

Household size	Cats		Dogs	
	Coefficient	se	Coefficient	se
1	0.248	0.030	0.382	0.027
2	0.403	0.023	0.414	0.021
3	0.472	0.045	0.523	0.042
4	0.477	0.068	0.585	0.062
>4	0.500	0.133	0.348	0.122

The estimated size (and 95% CIs) of the cat and dog populations in the UK in 2011 was estimated as 10,114,764 cats (9,138,603–11,090,924) and 11,599,824 dogs (10,708,070–12,491,578). The 95% CIs of the estimates of the number of owned cats and the number of owned dogs in the UK overlap, so it is not possible to conclude that there are significantly more of either species based on the telephone sample used in this study.

Using a simpler but less sophisticated method of multiplying the mean number of cats/dogs per household (0.43 dogs and 0.38 cats/household) by the number of households generated similar figures (9,730,365 cats and 11,225,745 dogs in UK households). This method was used to estimate the numbers of cats and dogs owned by households within the different countries of the UK (Table 3).

Reported changes in ownership profile

Ownership of one or more cats one year previously and four years previously was strongly associated ($P<0.001$) with the likelihood that cat ownership would be reported by householders at the time of data collection. Only 2.7 per cent (84/3124) and 9.4 per cent (293/3130) of the sample reported a change in their cat ownership status compared with the previous year and to four years previously, respectively (Tables 4 and 5). There had been a statistically significant decrease in the proportion of householders that reported owning one or more cats ($P=0.04$) between August 2007 and the time of data collection (July–November 2011) (Table 5).

The proportion of householders that retrospectively reported ownership of one or more cats in August 2007 (23.8 per cent, 746/3130, 95 per cent CI 22.3 to 25.3) was not significantly different ($P=0.12$) from the proportion of householders surveyed in 2007 (Murray and others 2010) that reported cat ownership (25.5 per cent of households, 760/2978, 95% CI 23.9 to 27.1).

Ownership of one or more dogs one year previously and four years previously was also strongly associated ($P<0.001$) with the likelihood that dog ownership would be reported by householders at the time of data collection. However, 27.6 per cent (863/3131) and 30.7 per cent (966/3141) of the sample reported a change in their dog ownership status compared with the previous year and to four years previously, respectively (Tables 6 and 7). There was no statistically significant decrease in the proportion of householders that reported owning one or more dogs

TABLE 4: The number and percentage of households reporting ownership of one or more cats at the time of data collection in 2011 and 12 months previously based on a survey of randomly selected UK households

Owned one or more cats at the time of survey (2011)	Owned one or more cats 12 months previously		Total
	Yes	No	
Yes	677 (21.7%)	33 (1.1%)	710
No	51 (1.6%)	2363 (75.6%)	2414
Total	728	2396	3124

($P=0.21$) between August 2007 and the time of data collection (July–November 2011) (Table 7).

The proportion of householders that retrospectively reported ownership of one or more dogs in August 2007 (31.0 per cent, 975/3141, 95 per cent CI 29.4 to 32.6) was not significantly different ($P=0.73$) from the proportion of householders surveyed in 2007 (Murray and others 2010) that reported dog ownership (30.6 per cent of households, 911/2974, 95 per cent CI 28.9 to 32.3).

Discussion

Identifying trends in cat/dog ownership in the UK provides useful information for the veterinary profession, pet food and veterinary pharmaceutical companies as well as for animal welfare organisations. Despite the popularity of cat and dog ownership, many UK animal welfare organisations report that they are continually full with long waiting lists (Clark and others 2012, Stavisky and others 2012). The pressure for places at rehoming centres results from factors including owner relinquishments and a shortage of available households willing to offer these unwanted pets a home.

Based on this survey of UK households, the sizes (and 95% CIs) of the pet cat and dog populations were estimated as 10,114,764 cats (9,138,603–11,090,924) and 11,599,824 dogs (10,708,070–12,491,578) in the UK in 2011. Examination of the CIs revealed no evidence of a significant difference between the numbers of pet dogs and cats owned by householders in the UK in 2011, or of significant changes in the size of either population compared with estimates published for 2006 (10,332,955 (9,395,642–11,270,269) cats and 10,522,186 (9,623,618–11,420,755) dogs) (Murray and others 2010). Although the point estimates suggested little change in the total number of pet cats, there was a suggestion of an increase in the number of pet dogs between 2006 and 2011; however, a larger sample size (with an associated smaller CI) would be needed to conclude that a statistically significant increase had occurred during this time period. In contrast to the models used to predict cat/dog ownership previously (Murray and others 2010), household location (London: yes/no) was not included in the multivariable models presented in this paper. Univariable analysis revealed no significant associations between cat/dog ownership in the current data set and household location. Inclusion of household location in the multivariable models presented (Table 2) resulted in little change to

TABLE 3: The mean, sem and estimated size of the cat and dog populations with 95% CI in England, Northern Ireland, Scotland and Wales in 2011

	England (n=2368)	Northern Ireland (n=148)	Scotland (n=355)	Wales (n=279)
Cats				
Mean	0.38	0.38	0.31	0.30
sem	0.02	0.07	0.05	0.04
Estimated population size (95% CI)	8,404,205 (7,587,250 to 9,221,160)	266,104 (165,970 to 366,238)	741,915 (519,165 to 964,664)	392,204 (286,590 to 497,817)
Dogs				
Mean	0.43	0.46	0.38	0.40
sem	0.02	0.06	0.03	0.04
Estimated population size (95% CI)	9,535,625 (8,763,776 to 10,307,475)	323,126 (244,517 to 401,736)	902,329 (739,705 to 1,064,952)	522,938 (412,527 to 633,349)

TABLE 5: The number and percentage of households reporting ownership of one or more cats at the time of data collection in 2011 and four years previously based on a survey of randomly selected UK households

Owned one or more cats at the time of the survey (2011)	Owned one or more cats in August 2007		Total
	Yes	No	
Yes	581 (18.6%)	128 (4.1%)	709
No	165 (5.3%)	2256 (72.1%)	2421
Total	746	2384	3130

the numbers of cats/dogs estimated to be kept as household pets in the UK in 2011 (data not shown). The reason for the lack of significant association between household location (London: yes/no) and cat/dog ownership is not clear; however, it was not due to relatively low numbers of London households in the current data set as there were a higher proportion of households in London in 2011 (4.2 per cent) than in our previous study (3.1 per cent). Although London households were under-represented in this study (12.4 per cent of all households within the UK were in London in 2011 (ONS 2011a)), there was a similar level of under-representation in our previous study as 12.3 per cent of households within the UK were in London in 2001 (Murray and others 2010).

Although similar methodology was used in both surveys, the potential for selection bias existed, particularly in relation to the exclusion of households without telephone landlines (Downes and others 2013). Therefore, respondents in this survey (contacted in 2011) were asked to report the numbers of cats and dogs owned in 2007 (the year that data were collected for our previous study). Comparison of the proportions of householders who reported ownership of one or more cats/dogs in 2007 was conducted between those sampled in 2011 (the current study) and those sampled in 2007 (Murray and others 2010). The results indicated that in 2007 there was no significant difference in cat/dog ownership between the two study samples. This suggested that the comparison of the total numbers of owned cats/dogs in the UK based on the two different samples of UK householders (2007 and 2011) was unlikely to be influenced by differences in the study samples.

Selection bias also had the potential to influence the accuracy of the estimated number of cats and dogs in the UK if those excluded from the sample (e.g. non-EU passport holders that were not eligible to vote) had different patterns of cat and dog ownership in comparison to those surveyed. Further research into the association between country of birth and pet ownership within the UK is needed as 2.3 million of the 63.2 million (3.6 per cent) UK residents had non-EU passports in 2011 (ONS 2011b, 2011c).

Statistical analysis of the 2011 survey data revealed a small but statistically significant decrease in the proportion of households owning cats (23.8 per cent to 22.7 per cent), but not dogs (31.0 per cent to 29.8 per cent) in 2011 compared with 2007. During this time period (2007–2011), the number of UK

TABLE 7: The number and percentage of households reporting ownership of one or more dogs at the time of data collection in 2011 and four years previously based on a survey of randomly selected UK households

Owned one or more dogs at the time of the survey (2011)	Owned one or more dogs in August 2007		Total
	Yes	No	
Yes	472 (15.0%)	463 (14.7%)	935
No	503 (16.0%)	1703 (54.2%)	2206
Total	975	2166	3141

households had increased (ONS 2011a), hence potentially explaining the lack of a significant decrease in the number of cats predicted to be owned in total by all households in the UK despite a decrease in the proportion of sampled householders that reported to own cats. Increasing the number of households that are willing and able to provide a home for a cat or dog, and in particular one from a rehoming centre, may help to reduce the number of unwanted cats and dogs and thus the burden on UK rehoming centres. Further research into factors that are associated with ownership of a cat/dog adopted from a welfare organisation is thus recommended.

The mean number of cats and dogs owned by households in England, Scotland, Wales and Northern Ireland suggested similar patterns of ownership across all four countries. All countries had higher mean numbers of dogs compared with cats, which varied from 0.38 dogs/household (Scotland) to 0.46 dogs/household (Northern Ireland) and 0.30 cats/household (Wales) to 0.38 cats/household (England and Northern Ireland). These are believed to be the first peer-reviewed estimates of the size of the owned cat and dog populations in these countries; however, direct comparison between countries and more accurate estimates would benefit from larger sample sizes of households from Northern Ireland, Scotland and Wales, which would facilitate the use of linear models using household size as a predictor. The simpler method of multiplying the mean number of cats/dogs by the number of households did not take account of the association between household size and cat/dog ownership and is therefore likely to result in an underestimation in the cat/dog population sizes for the four individual countries as households consisting of four or more people (who were more likely to own cats/dogs) were under-represented in the telephone survey (Table 1). Hence, when the total from the four countries is summed, the estimated numbers of cats/dogs in the UK are approximately 310,000–316,000 lower than the figures generated using the model including household size as a predictor. Future studies would benefit from larger sample sizes to reduce the size of the CIs and also to enable identification of trends in ownership within different UK countries and regions.

Cat/dog ownership one and four years previously was strongly associated with the likelihood of reporting cat/dog ownership at the time of data collection. This finding was not unexpected. However, a much larger proportion of households reported that they had changed their dog ownership status than the proportion reporting changed cat ownership status during the one and four year periods studied. The reasons for the observed differences could in part be due to differences in longevity reported for the two species (median of 14 years for cats and 12 years for dogs; O'Neill and others 2013, 2015). However, further investigation is warranted as changes to an owner's lifestyle (e.g. working hours, travel commitments) could also influence dog-owning decisions to a greater extent than cat-owning decisions. Recall bias could have affected the quality of retrospective cat/dog ownership data; however, it is likely that any bias would have been present to an equal extent for the two species. Thus, observed differences between pet ownership patterns in the two species are unlikely to be affected by this bias.

TABLE 6: The number and percentage of households reporting ownership of one or more dogs at the time of data collection in 2011 and 12 months previously based on a survey of randomly selected UK households

Owned one or more dogs at the time of survey (2011)	Owned one or more dogs 12 months previously		Total
	Yes	No	
Yes	507 (16.2%)	426 (13.6%)	933
No	437 (14.0%)	1761 (56.2%)	2198
Total	944	2187	3131

Conclusions

This study provides evidence for a small but significant decrease in the proportion of UK households that owned one or more cats in 2011 compared with 2007, with no change in the proportion owning dogs. The total number of cats owned by UK households had decreased slightly between 2006 and 2011, whereas the total number of dogs owned by UK households had increased; however, these differences were not statistically significant. Although cats and dogs are popular pets in the UK, statistics published by the UK's largest cat and dog rehoming organisations suggest that more needs to be done to increase the number of households willing to adopt cats/dogs and/or decrease the number entering these organisations.

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