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JOURNAL TITLE: International Journal of Epidemiology

PUBLICATION DATE: 22 June 2017 (online)

PUBLISHER: Oxford University Press

DOI: 10.1093/ije/dyx066

Cohort Profile: The 'Bristol Cats Study' (BCS) – a birth cohort of kittens owned by UK households

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Why was the cohort set up?

Longitudinal health-related data among domestic cats represents an important information deficit in veterinary literature. Cats are popular household pets in the United Kingdom (UK) with approximately 23% of households in the UK owning one or more cats.(1) In 2015, the approximate cost of caring for a cat during its lifetime (median length = 14 years, interquartile range 9.0-17.0)(2) was estimated to be approximately £17,000, excluding veterinary costs associated with treating ill or injured cats.(3) Commonly diagnosed health problems affecting pet cats of all ages include periodontal disease (68% of cats of all ages)(4) and overweight/obesity (11.5-38% of cats of all ages).(5,6) Cognitive dysfunction, chronic kidney disease (CKD) and hyperthyroidism are among the most prevalent health conditions diagnosed in cats over the age of 10 years, with reported prevalences within this age group (≥10 years) of approximately 36%(7), 10%(3) and 10%(8), respectively. Amongst a large sample (n=3309) of cats attending primary care veterinary practices in England, trauma (including road traffic accidents), was the most commonly attributed (47%) recorded cause of mortality in young (<5 years) cats, and renal disorder (including CKD) was the most commonly attributed cause of mortality (14%) amongst cats aged 5 years or older within this sample.(2) Unwanted behaviours such as inappropriate elimination (toileting inside the house, but outside the litter box) and aggression towards people and/or other cats are common reasons for which owners seek help from pet behaviourists(9), or cite as reasons for relinquishment of pet cats to rehoming organisations.(10)

The 'Bristol Cats Study' (BCS) cohort was set up with the aim of collecting data prospectively from owners and veterinarians (with owner permission) that could be used to advance veterinary knowledge of these, and other, common feline disorders through examining possible links between owner- and/or veterinary-reported disorders and environmental exposures. To date, publications based on data collected from the BCS cohort include analysis of factors associated with owner reports of lower urinary tract signs (LUTS) (i.e. straining/apparent difficulty urinating, passing blood when urinating and/or vocalising (e.g. meowing) before or during urination)[11], owner-reported road traffic accidents (RTA)[12] involving their cat and overweight/obesity[13] (defined as body condition score 4 or 5 on a 5-point scale). These conditions were hypothesised to often not result in presentation of the cat to a veterinarian (LUTS and fatal RTAs) or not be recorded in the veterinary clinical notes (overweight/obesity), hence the value of the BCS owner-reported data. Examples of hypotheses that have been tested, numbers of cats with data available for analyses and statistical power calculations are summarised in Table A of the Supplementary data at IJE online. Other analyses that are underway include a nested case-control study of risk factors for gingivitis in cats aged 3-4 years and testing faecal samples for parasites.[14] Analyses of other outcome are envisaged and buccal swabs are being collected to facilitate future prevalence studies, subject to identification of variants, sufficient statistical power and funding.

The long-term aims of the BCS are to use multivariable regression models to quantify the strength of associations between environmental exposures and common disorders of cohort cats in senior (11-14 years) and geriatric (>15 years) life stages.[15] Details of hypotheses to be tested and the number of cats estimated to be available for future analyses of CKD, hyperthyroidism and cognitive dysfunction are available in Table A of the Supplementary data at *IJE online*.

Peer-reviewed veterinary research publications often report work conducted at veterinary referral centres, which can result in a 'referral bias'.[16, 17] Data collected from first opinion practices[18, 19] have other limitations, including a lack of information on

lifestyle and those intrinsic to veterinary record keeping. In addition, some animals may attend multiple veterinary practices, or move to a practice that is not participating in a particular study. Sometimes animals with a disorder might not be presented to a veterinarian,[20] whilst an estimated 13.6% of UK pet cats are not even registered with a veterinary practice.[21] Consequently, prevalence estimates reported from studies using veterinary practice/referral centre data might under-or over-estimate the prevalence of diseases if disease prevalence varies according to veterinary registration status. Prospective longitudinal studies offer a number of advantages over cross-sectional and retrospective studies. Cross-sectional studies provide results based only on a point-in-time sample of the population, whereas longitudinal studies allow critical evaluation, and following over time, of events occurring prior to the outcome under investigation. The relatively long life-span of UK pet cats dictates the need for longitudinal studies to better understand benefits of preventive medicine on health outcomes in later life.

The original study team of Jane Murray and Tim Gruffydd-Jones (both at the University of Bristol) were aware of the impact and value of the Avon Longitudinal Study of Parents and Children (ALSPAC)[22] that was being run by researchers at the University of Bristol. Following a series of meetings with one of the Directors of the ALSPAC study, and ethical approval from the University of Bristol (Reference: UIN/13/026), the Bristol Cats Study (BCS) was launched in June 2010.

The BCS has been set up and maintained with a small budget. Until December 2014, consumables for the study were funded through profits of Continuing Professional Development (CPD) courses for veterinarians run at the University of Bristol. Cats Protection (the United Kingdom (UK)'s leading feline welfare charity) has funded staff time (Jane Murray's post) since the study launch. Since December 2014, The WALTHAM Centre for Pet Nutrition (a division of Mars Petcare) has funded the study administrator post. Additional funding that has been used to support research students and staff working with BCS data, and to cover some of the consumable costs, has been obtained from the Biotechnology and Biological Sciences Research Council, British

Small Animal Veterinary Association Petsavers, The Langford Trust for Animal Health & Welfare, and Zoetis.

This report describes recruitment and the first six years of follow-up of the BCS cohort. The intention is that follow-up of the cohort will continue for the lifetime of the enrolled cats. Identifying environmental risk factors that can be monitored or avoided could lead to better management of feline health by owners, and hence improved health and welfare for cats.

Who is in the cohort?

Cat owners (themselves aged 18 years or more) could register 8-16 week-old kittens with the BCS between June 2010 and December 2013 (inclusive). During 2010, registration of pet cats was limited to owners living in the Bristol ('BS') postcode region. This geographical restriction was imposed to facilitate visits from researchers to participating households (e.g. to validate questionnaire data and/or to collect more detailed data), and to aid engagement with participating cat owners through BCS conferences/open days. At the end of 2010, only 146 cats had been recruited, so registration was extended across the UK. Advantages of recruiting over a larger area can include access to a wider range of environments (rural, suburban, urban, metropolitan), demographics, and socio-economic strata, in addition to increasing the sample size. To date, analyses[11,12,13,20,23] have not incorporated geographical restriction of cohort (pre/post 2011) as a potential explanatory variable, but future analyses can assess whether geographical restriction is a potential confounder. During 2010, recruitment was limited to just one kitten per household (requested to be the kitten with the name that was first alphabetically) to avoid having to account for clustering at the household level in analysis; however, multiple kitten registration per household was allowed from January 2011 onwards to increase the size of the cohort. Inclusion of more than one cat per owner (or household) in analyses introduces the potential of hierarchical clustering of data. Two-level random intercept models will be used to account for this clustering through assigning level 1 to cat identification and level 2 to owner identification.

Cat owners were recruited into the BCS using a variety of advertising methods. These included asking veterinarians to add BCS leaflets to kitten packs issued to owners when kittens were presented for vaccination, posters displayed in veterinary practices, pet shops and libraries, advertising through websites used by cat owners (e.g. animal welfare organisation websites), in publications aimed at veterinarians and cat owners, and via social media (Facebook and Twitter). There are no plans to continue or extend the recruitment of cats to the study.

Eligible sample

No national database or compulsory registration of pet cats exists in the UK, hence we cannot provide accurate details regarding the eligible sample. In 2011, two studies estimated that there were between 10,114,764 (95% confidence intervals 9,138,603-11,090,924)[1] and 11,916,000 pet cats owned by households in the UK.[3] Evidence of association between some household factors (e.g. presence of one or more dogs in the household, presence of children aged 11-15 years, highest level of qualification achieved by household members, and age and gender of householders) and cat ownership have been reported,[24-26] hence comparison of BCS cohort demographic data with UK census data is likely to be meaningful. A comparison of cat, owner and household demographic data obtained from the BCS cohort and from three other sources of UK pet cat demographic data is provided in Table B in the Supplementary data at *IJE* online.

Data from the BCS cohort were obtained from self-completed questionnaires (see Supplementary data; some data were missing. As self-selected participants in a feline cohort study, compared with the eligible population, the BCS cohort is hypothesised to have a higher proportion of cats that are pure bred, registered with a vet, insured, and microchipped. However, despite potential differences between the demographics of the cohort and the wider population of cats in the UK, these differences are more likely to lead to biased measures of incidence than biases in effect measures.

How often have they been followed up?

Self-completed questionnaires were completed by owners at registration, when their cats were aged 2-4 months (Questionnaire 1, (Q1)), and have subsequently been issued to owners within about two weeks of their cats reaching the following ages: 6 months (Questionnaire 2, (Q2)), 12 months (Questionnaire 3, (Q3)), 18 months (Questionnaire 4, (Q4)), 30 months (Questionnaire 5, (Q5)), 4 years (Questionnaire 6, (Q6)), and annually thereafter. By May 2016, all cats remaining in the study had reached 30 months of age.

Response rates

Final response rates presently are available for Q1-Q5 for the 2203 BCS cohort cats. The number and percentage of questionnaires (Q1-Q5) completed by owners of cohort cats, and the number of cats leaving the study between ages at which questionnaires were issued is summarised in Figure 1.

Questionnaires were completed for 87% of the cats enrolled on the study (and still participating in the study), at age six months, and for 79%, 72% and 60% of the cohort at age 12, 18, and 30 months, respectively. The proportion of cats retained at age six, 12, 18, and 30 months were 95%, 90%, 86% and 82%, respectively. Considering only owners who still had cats registered on the study, questionnaire response rates remained above 73% for the fifth questionnaire, which was completed when cats were aged 30 months. Reasons for leaving the study are discussed later, and include deceased and missing cats, and owners who withdrew from the studies for a variety of reasons.

Loss to follow up

The BCS utilises a variety of engagement strategies to maximise retention of owners in the study. Despite these strategies, some cats inevitably will be lost to the study, for example due to mortality or because they have ‘gone missing’. A summary of the reasons reported by owners or recorded by the study team for cats leaving the study to

date (27/5/16) is presented in Table 1. The most common reasons for loss to follow up include cat death from a road traffic accident (21.7%), loss of contact with the owner (20.6%), and owner electing to leave study (20.4%). Owners also reported other reasons for leaving the study, which are described in Table 1.

Multivariable logistic regression models were used to test for associations between specific owner and cat variables and cats lost to follow up, excluding deceased and missing cats, from the study between recruitment and age 18 months (Q4). Loss to follow up was more likely for cats with owners aged less than 44 years, without a degree or postgraduate qualification, with a household income of less than £30,000, and/or with children in the household at time of Q1 completion. No evidence of association was found for household tenure, source of cat, sex or breed of cat, or presence of other cats in the household and the likelihood of having dropped out of the study by 18 months.[27] This information is useful when assessing potential effects of retention bias on results obtained from the BCS data, in addition to helping to direct future retention strategies.

What has been measured?

Areas of data collection, which includes owner-completed questionnaires, data collected from veterinarians (body condition scores, oral health scores, and clinical notes) and non-invasive sampling carried out by owners is presented in Table C of the supplementary data at *IJE* online. Visits to the homes of convenience samples of BCS cat owners have been conducted to validate some owner-reported data (e.g. weight of dry food fed to cats) and oral health scores assigned by the cats' veterinarian, and to obtain more detailed data related to diets and feeding practices.

Links to electronic versions of questionnaires 1–7 (Q1–Q7) are available in the Supplementary data at *IJE* online.

Oral Health cards and Body condition score cards: Since December 2012, an annual Christmas card mailed to owners of BCS cats has included oral health and body condition score cards (available as Supplementary data at *IJE* online) along with pre-paid return envelopes. Owners are requested to take these cards with them to their cat's annual vaccination and health check for completion by their veterinarian and return by the owner.

On 27th May 2016, one or more sets of veterinary-completed oral health and body condition score cards had been returned by the owners of 864 cats. Two sets of cards had been received for 470 cats, three sets received for 181 cats and four sets received for 29 cats. However, in some instances there were missing data on one of the cards returned, for example if the veterinarian had been unable to examine the mouth of the cat.

Table D in the supplementary data at *IJE* online provides details of the broad areas of data collected by owner-completed questionnaires within the BCS to date and outlines feline samples submitted by owners and data collected from veterinarians of study cats that have been, or are being, collected for cats registered with the BCS.

Key findings and publications

Key findings of the study to date include identifying a strong association between intended and actual age of neutering, and prevalences of obesity and lower urinary tract signs (LUTS) within the cohort. Despite four months being the recommended age in the UK for neutering pet cats[28, 29] (to reduce the risk of unplanned pregnancies), only 14.1% of the cohort were neutered at (or before) four months of age, whereas at 12.5-13 months of age, 73.5% were reported to have been neutered at (or before) six months of age.[21] If owners of cats enrolled on the BCS are more likely than cat owners that are not enrolled on the BCS to be engaged with the veterinary profession (Table B, supplementary data at *IJE online*), then these results provide strong evidence that there is scope to increase awareness within pet owners and the veterinary profession regarding the recommended age of neutering.

Seven per cent of owners reported their cats to be overweight or obese (defined as a body condition score of 4 or 5 on a five-point scale) at around one year of age. The two factors found to be independently associated with an increased risk of feline obesity at age 12.5-13 months of age were cats with restricted or no outdoor access, and cats fed dry food as the only or major (>50%) type of food in their diet.[13] Obesity is a serious health problem in pets just as it is in humans. Results from studies suggest that obese cats are 3.9 times more likely to develop diabetes mellitus, 2.3 times more likely to develop non-allergic skin conditions, and 4.9 times more likely to develop lameness compared with optimal weight cats.[30] Although being overweight also may have detrimental effects on health in itself, it leads to obesity in a substantial number of cases: in a follow up study of a feline obesity prevalence study by Scarlett *et. al*.[31] 42% of initially overweight cats had gained weight 4 years later, whilst just 30% had lost weight and 28% remained overweight.[32] Findings from the BCS cohort may be used by owners to help reduce the likelihood of cats becoming overweight or obese.

The most recent publication investigated owner-reported LUTS in cats, defined as cats whose owners had seen the cat urinating and reported one or more of the following signs: straining/apparent difficulty urinating, passing blood when urinating and/or vocalising (e.g. meowing) before or during urination. An increased risk at 18 months of age was associated with cats with an indoor-only lifestyle, and for cats that had received a change in diet between the ages of 12 and 18 months.[11] The prevalence of owner-reported LUTS in our cohort was higher than previously reported in studies of cats attending veterinary hospitals[17,33] and the novel risk factor of change in diet suggests that further investigation into the effects of diet (and possibly other) changes on prevalence of LUTS is warranted.[17, 33]

Four publications based on data collected from the cohort have been published by February 2017; details of these publications are available on the Bristol Cats Study website.[34]

What are the main strengths and weaknesses?

The main strengths of the BCS cohort are the large sample size and high retention of owners in the study over time. For instance, 72% of cats initially enrolled in the study had their 18 month (approximately 548 days) questionnaires completed by their owners (Figure 1). In comparison, researchers working on a longitudinal study of Labrador Retriever dogs in the UK[35] reported that only 39-45% of owners were actively involved in the study when dogs were aged 400 days or more. The collection of detailed household, diet and management data enables variables associated with these factors to be included in risk factor analyses, in contrast to studies based solely on data obtained from veterinary records. Owner-reported observation of clinical signs enables investigation of problems that are either not presented to veterinarians for investigation, or only presented once the clinical signs become more chronic or more serious in nature; hence data from this study can be used to identify factors with the potential to provide early intervention of problems.

The main weaknesses of the study are that despite the size of the initial cohort, there is not enough statistical power to investigate outcomes and/or exposures with a low prevalence. Owner-reported data relating to clinical signs also must be interpreted with caution, as there is potential for reporting bias. Because of this, owner reports are compared with clinical data collected from veterinary practices to assess for bias whenever possible.

Can I get hold of the data? Where can I find out more?

Although the data are not available via open access or via a formal application process, researchers wishing to collaborate and initiate research based on the Bristol Cats Study data are invited to contact Jane Murray (Jane.Murray@bristol.ac.uk) to discuss research ideas and access to data.

Profile in a nutshell

- The Bristol Cats Study (BCS) is the first study of a birth cohort of kittens in the world.
- 2203 pet kittens (aged 8-16 weeks) living in the UK were recruited via their owners to the BCS between June 2010 and December 2013.
- Owners complete questionnaires when their cats are aged 2-4 months, 6 months, 12 months, 18 months, 2.5 years, 4 years and annually thereafter. Questionnaire data include cat and owner demographic information, household data, management data, cat behaviour, clinical signs of disease, body condition scores, veterinary treatment and preventive care.
- Additional data collected from owners responding to requests for further data/samples includes:
    - Non-invasive samples (buccal swabs, faecal samples and hair).
    - Body condition scores and oral health scores assigned annually by the veterinarians of study cats and submitted via owners.
    - Clinical notes from veterinary practices of study cats.
- In May 2016, 1701 cats and 1356 owners were still registered on the BCS, representing 77.2% of the original cohort of 2203 cats.
- Collaborations with researchers from other institutions within and outside the UK are ongoing and further collaborations are welcomed.

ACKNOWLEDGEMENTS: Andy Ness is thanked for his advice and guidance prior to the launch of the Bristol Cats Study. We thank owners of cohort cats for their participation in the study and for their commitment to providing data. Emma Gale and Jane Murray are funded by WALTHAM® and Cats Protection, respectively. The following are thanked for their help with study administration: Victoria Crossley, Freya Gruffydd-Jones, Cheryl Heath, Sarah Hobbs, Jo Hockenhull, Rachel Kinsman, Louise Longstaff, Lauren Molyneaux, Megana Nedungadi, Hannah Robbins, Claire Roberts, Vanessa Taylor, Elodie Tinland, Louise Trott-Grant, Louise Whatford, Amber Whitmarsh, Jessica Wilson and Melanie Wilson. Laura Corbin is thanked for her helpful comments during preparation of the manuscript.

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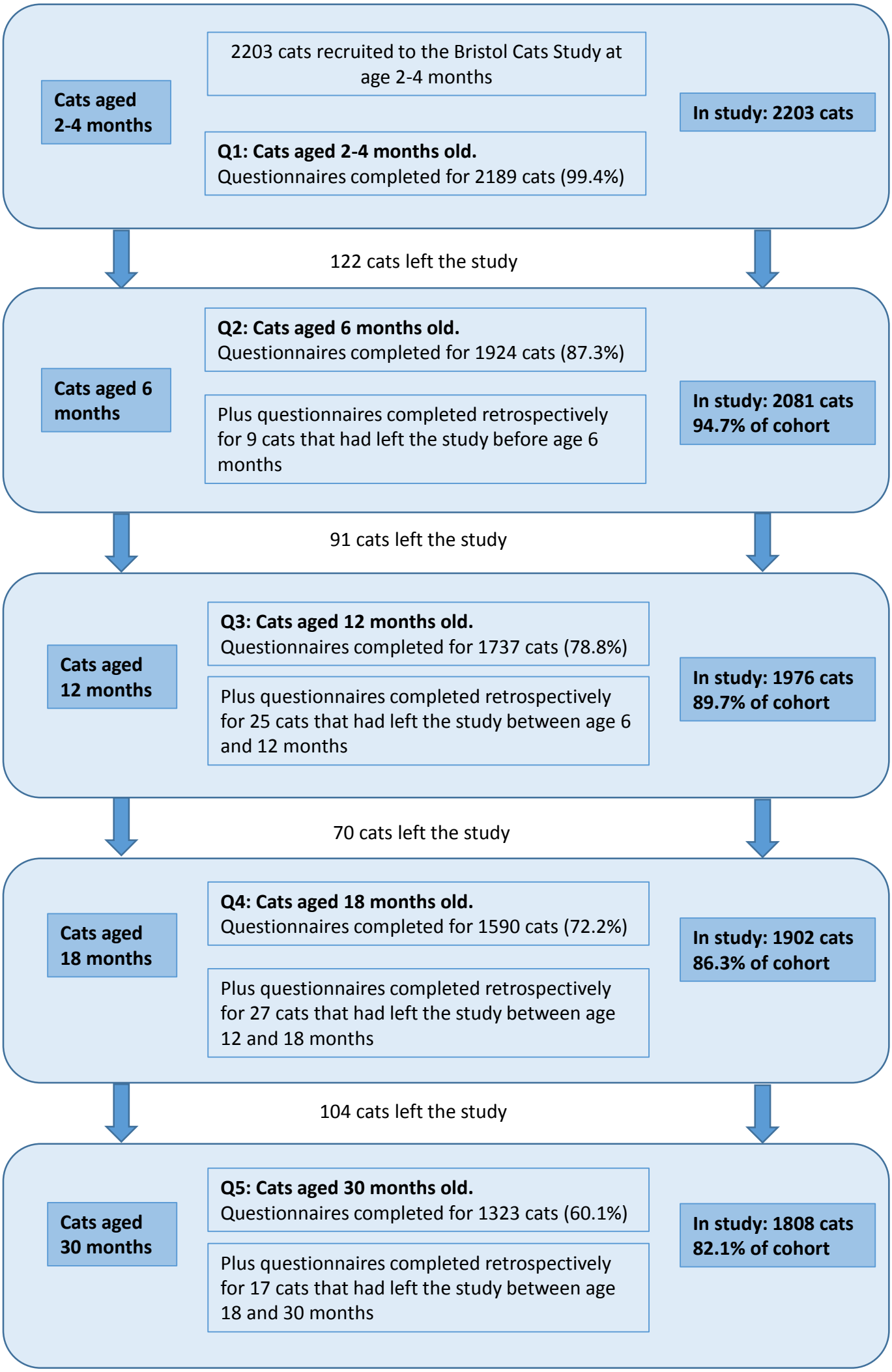
Table 1. Reasons for cats having left the Bristol Cats Study

Reason for leaving the Bristol Cats Study	Number of cats (27/5/16)
Road traffic accident (RTA)	107
Cat missing	38
Feline infectious peritonitis (FIP)	9
Died (other reason or non-specified)	58
Rehomed / fostered on / returned to breeder	57
Owner elected to leave study	101
Lost contact with owner	105
Other	0
Reason unknown / not given	19
Total	**494**
Number in cohort	**2203**
Percentage of cohort	**22.4%**

Figure 1. Numbers of questionnaires completed from the first five questionnaires that were issued to owners of cats registered on the Bristol Cats Study (BCS) when their cat(s) reached specific ages (questionnaires 1-5 (Q1-5)). The numbers of cats leaving the study at each time point are also provided.



Outcome and actual[a]/ estimated[b] prevalence (%)	Examples of exposures hypothesised to be associated with an increased odds of outcome	Actual[a]/ expected[b] frequency of exposure in controls in univariable analysis	Number of cats with data for the outcome variable available for univariable analysis[c]	Actual[a]/ expected[b] number of cats available for multivariable analysis, after the removal of cats with missing data for variables of interest after the univariable analysis	Minimum odds ratio to be detected with 80% power and 95% level of confidence[d]
Published analyses					
Cat not neutered by 6.5 months of age (23%)[1]	At age 2-4 months, owner stated no intention to neuter by 6 months of age	23%	679	543 (80.0% of 679) (127 cases and 416 controls)	2.0
Cat overweight or obese by 12.5 months of age (7%)[2]	'Dry' food only diet	21%	966	768 (79.5% of 966) (52 cases and 716 controls)	2.4
Cat has owner-reported lower urinary tract signs at 18 months of age (4%)[3]	Indoor only lifestyle at 18 months	19%	1030	829 (80.5% of 1030) (33 cases and 796 controls)	2.9
Cat has been involved in a road traffic accident by 12.5 months of age (4%)[4]	Black coat colour	14%	1181	770 (65.2% of 1181) (26 cases and 744 controls)	2.7
Analyses in progress					
Cat has gingivitis at age 3-4 years (13%)	No opportunity to hunt 'Wet' food constitutes at least 50% of diet	19% 49%	317	187 (59.0% of 317 cats) (83 cases and 104 controls)	2.7 2.5
Potential future analyses					
Cat has signs of chronic kidney disease aged 11-14 years (>11%)[e]	Moderate/severe dental disease Frequent/annual vaccination history	25-50% exposure amongst controls	991[f]	545[g] (60 cases and 485 controls)	2.3
Cat has signs of cognitive	Environmental enrichment (e.g.	25-50% exposure	991[f]	545[g] (152 cases	1.9

dysfunction aged 11-14 years (28%)[h]	playing with toys, company and interaction with people, food-hunting games) Diet (e.g. enriched with antioxidants, feeding diets formulated for senior cats) Exposure to brominated flame retardants, (in particular polybrominated diphenyl ethers) (e.g. in new furniture) No/little exposure to early-life stressors including:agonistic interactions with other household cats and spending time in a rehoming organisation	amongst controls		393 controls)	
Cat has signs of hyperthyroidism aged 11-14 years (>9%)[i]	Diet • Sea food flavoured cat food • Tinned cat food (bisphenol: used to coat inside of the tins) Exposure to brominated flame retardants, (in particular polybrominated diphenyl ethers) (e.g. in new furniture)	25-50% exposure amongst controls	991[f]	545[g] (49 cases and 496 controls)	2.4

[1] Welsh, C. P., Gruffydd-Jones, T.J. and Murray, J.K. (2013) The neuter status of cats at four and six months of age is strongly associated with the owners' intended age of neutering. Vet. Rec., 172(22) 578.

[2] Rowe E, Browne W, Casey R, Gruffydd-Jones T, Murray J. (2015) Risk factors identified for owner-reported feline obesity at around one year of age: dry diet and indoor lifestyle. *Prev. Vet. Med*., **121**, 273-281.

[3] Longstaff, L., Gruffydd-Jones, T.J., Buffington, C.A. T., Casey, R.A. and Murray, J.K. (2016) Owner-reported lower urinary tract signs in a cohort of young cats. J. Feline Med. Surg., 1-10. DOI: 10.1177/1098612X16643123 10.1016/j.prevetmed.2015.07.011. [Epub ahead of print]

[4] Wilson, J., Gruffydd-Jones, T.J. and Murray, J.K. (*in press*) Risk factors for road traffic accidents in cats up to age 12 months that were registered between 2010-2013 with the UK pet cat cohort ('Bristol Cats'). *Veterinary Record.*

[a] Actual: based on Bristol Cats dataset available for analysis (published or analysis in progress)

[b] Expected: estimated based on peer-reviewed research (planned analyses)

[c] Some published analyses[1,2] have been based on data available at the time of analysis, rather than on the entire cohort. Not all cats have had data available for the outcome variable (e.g. if the owner had not cat seen the cat urinating[3], resulting in a reduced dataset.

[d] Power calculations were carried out prior to analyses; however, post-hoc calculations are presented in this table for published/ongoing analyses using Sampsize http://sampsize.sourceforge.net/iface/s3.html#cc [Accessed December 12, 2016].

[e] Finch, N.C., Syme, H.M. and Elliott, J. (2016) Risk factors for development of chronic kidney disease in cats. *J Vet Intern Med*, **30**, 602-610.

[f] Allowing for loss to follow up (at a rate of 85 cats/year based on 2014-2016 data). Currently 1671 cats (aged 3-6 years) remain in the study (14/11/16). In 8 years' time, the cohort will be aged 11-14 years. Estimate 680 more cats will have left the study (85x8=680), thus 991 cats will remain in the study.

[g] Based on the assumption that 55% of cats remaining in the study will have no missing data for the outcome variable or explanatory variables included in the multivariable analysis.

[h] Gunn-Moore, D., Moffat, K., Christie, L.A. and Head, E. (2007) Cognitive dysfunction and the neurobiology of ageing in cats. *Journal of Small Animal Practice*, **48**, 546-553.

[i] Stephens, M.J., O'Neill, D.G., Church, D.B., McGreevy, P.D., Thomson, P.C. and Brodbelt, D.C. (2014) Feline hyperthyroidism reported in primary-care veterinary practices in England: prevalcne, associated factors and spatial distribution. *Veterinary Record*, doi: 10.1136/vr.102431

Table B. Cat, owner and household demographic data from the BCS cohort (N=2203) and from three other data sources of cat and cat owner demographic information.

	2007 study of cat-owning households in the UK[1]	PDSA Pet Animal Welfare report [1] (n=5317)	Cats visiting English veterinary practices[4]	BCS data (cohort recruited 2010-2013)
	Number (%) of cats	% of cats	Number (%) of cats	Number (%) of cats
Breed				
Mixed breed	682 (92.4)	No data available	126723 (89.0)	1636 (77.1)
Persian	22 (3.0)		1942 (1.4)	12 (0.6)
Siamese	7 (0.9)		1318 (0.9)	40 (1.9)
British shorthair	5 (0.7)		3380 (2.4)	118 (5.6)
Burmese	3 (0.4)		1321 (0.9)	26 (1.2)
Oriental	3 (0.4)			13 (0.6)
Abyssinian	2 (0.3)			1 (<0.1)
Bengal	2 (0.3)		1466 (1.0)	36 (1.7)
Norwegian Forest	2 (0.3)			15 (0.7)
Maine Coon	0 (0.0)			71 (3.3)
Ragdoll	1 (0.1)		1215 (0.9)	42 (2.0)
Birman	0 (0.0)		834 (0.6)	16 (0.8)
Other pure breeds	9 (1.2)		4160 (2.9)	97 (4.6)
Number of cats in household				
One	350 (49.5)	56%	No data available	466 (21.5)
Two or more	357 (50.5)	44%		1702 (78.4)
Gender of cat				
Male	359 (50.1)	No data available	39273 (48.6)	1131 (52.2)
Female	357 (49.9)		41557 (51.4)	1034 (47.8)
Household income				
<£10,000 per annum	60 (14.4)	No data available	No data available	180 (8.9)
≥£10,000 per annum	357 (85.6)			1834 (91.1)

Highest level of qualifications				
GCSE's/ O' levels or less	260 (42.2)	No data available	No data available	274 (13.2)
A' levels or higher	356 (57.8)			1805 (86.8)
				Data in rows below extracted from Q4 (18 months)
Cat registered with a vet				
No	84 (13.6)	16%	0%	12 (0.8)
Yes	532 (86.4)	84%	100%	1567 (99.2)
Cat insured				
No	No data available	No data available	63383 (70.5)	671 (43.5)
Yes			26585 (29.5)	870 (56.5)
Cat microchipped				
No	No data available	38%	No data available	154 (9.9)
Yes		62%		1405 (90.1)
Cat neutered				
No	69 (6.4)[b]	8%	2750 (3.4)	76 (4.8)
Yes	1010 (93.6)[b]	92%	78080 (96.6)	1498 (95.2)

[a] Only percentages are available from the PDSA PAW report

[b] Cats aged 12 months or more

Table C. Data collected by questionnaires completed by owners of cats registered with the Bristol Cats Study, from registration to June 2016. (Cats age 2-4 months to six years).

	Approximate age of cat	**Data collected**
Owner-completed questionnaires	2-4 months	Baseline cat/owner demographics
		Management of cat (indoor/outdoor access, diet)
		Veterinary care (preventative and for medical problems)
		Behaviour problems
	6 months	Changes in household
		Changes in management of cat (indoor/outdoor access, diet, plans to breed or neuter)
		Neighborhood and local traffic conditions
		Veterinary care (preventative and for medical problems)
		Changes in behaviour
		Owner satisfaction with; presence of symptoms of allergy
	12, 18 & 30 months	Changes in household
		Changes in management of cat (indoor/outdoor access, diet, plans to breed or neuter)
		Veterinary care (preventative and for medical problems, body condition score)
		Changes in behaviour
	4 years	Changes in household
		Changes in management of cat (indoor/outdoor access, diet)
		Veterinary care (preventative and for medical problems, body condition score)
		Changes in behaviour

		What is normal for your cat at the moment?
		Baseline mobility data
	5 years	Changes in household
		Changes in management of cat (indoor/outdoor access, diet)
		Veterinary care (preventative and for medical problems, body condition score)
		Changes in behaviour
		What is normal for your cat at the moment?
	6 years	Changes in household
		Changes in management of cat (indoor/outdoor access, diet)
		Veterinary care (preventative and for medical problems, body condition score)
		Changes in behaviour
		What is normal for your cat at the moment?
		Excessive grooming behaviours, scratching, signs and areas of skin irritation

Table D. Samples submitted for cats registered with the Bristol Cats Study, from registration to June 2016. (Cats age 2-4 months to six years).

	Approximate age of cat	**Data collected**
Oral health scores assigned by veterinarians	Annually from December 2012.	
Body condition scores assigned by veterinarians	Annually from December 2012.	
		Owner-collected samples
Buccal swabs	2011 and 2012	Samples received from 551 cats
	Summer 2016	Samples requested from owners from whom samples from their cats had not yet been collected
Faecal samples	6 and 30 months	One or two samples collected from 832 cats
Hair (collected by brushing)	Summer 2016	Samples requested
Clinical notes from veterinarians	Between September 2015 and September 2016	855 sets of clinical notes received to date (27/5/16) from vets whose owners had given signed consent for their cats' records to be accessed (n=1159).
	Annually	Requests to vets for the last 12 months of clinical notes for study cats with permission to access their veterinary records
Ongoing	Correspondence with owners via email and telephone is used to update records, for example with reports of mortality.	