6-12-2014

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Recommended Citation
O'Neill, D. G., Church, D. B., McGreevy, P. D., Thomson, P. C., & Brodbelt, D. C. (2015). Longevity and mortality of cats attending primary care veterinary practices in England. Journal of feline medicine and surgery, 17(2), 125-133. https://doi.org/10.1177/1098612X14536176

Longevity and mortality of cats attending primary-care veterinary practices in England

Original Article

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Abstract

Enhanced knowledge on longevity and mortality in cats should support improved breeding, husbandry, clinical care and disease prevention strategies. The VetCompass research database of primary-care veterinary practice data offers an extensive resource of clinical health information on companion animals in the UK. This study aimed to characterise longevity and mortality in cats and to identify important demographic risk factors for compromised longevity. Crossbred cats were hypothesised to live longer than purebred cats.

Descriptive statistics were used to characterise the deceased cats. Multivariable linear regression methods investigated risk factor association with longevity in cats that died at or after 5 years of age.

From 118,016 cats attending 90 practices in England, 4,009 cats with confirmed deaths were randomly selected for detailed study. Demographic characterisation showed that 3,660 (91.7%) were crossbred, 2,009 (50.7%) were female and 2,599 (64.8%) were neutered. The most frequently attributed causes of mortality in cats of all ages were trauma (12.2%), renal disorder (12.1%), non-specific illness (11.2%), neoplasia (10.8%) and mass lesion disorders (10.2%). Overall, the median longevity was 14.0 years (IQR 9.0-17.0; range 0.0-26.7). Crossbred cats had a higher median longevity than purebred cats (median (IQR) 14.0 years (9.1-17.0) versus 12.5 years (6.1-16.4), $P < 0.001$) but individual purebred cat breeds varied substantially in longevity. In cats dying at or after 5 years (n = 3,360), being crossbred, lower bodyweight, neutered and non-insured were associated with increased longevity. This study described longevity in cats and identified important causes of mortality and breed-related associations with compromised longevity.

Key words

feline, longevity, electronic patient record, mortality, cat, breed, demography, purebred, crossbred, veterinary

Introduction

Improved understanding of longevity and mortality in pet cats will support enhanced breeding, husbandry and clinical strategies that advance the health and welfare of owned cats (1-3). There are an estimated 8.5 to 10.3 million owned cats in the UK, with 19.0-25.5% of households owning a cat (4, 5), suggesting substantial population impacts from even moderate welfare gains. Recently, health issues associated with purebred dog breeding have been highlighted (6-8). However, breed-related disorder predispositions also affect cats (9-11) and warrant exploration of effects on longevity and mortality (12, 13).

Hybrid vigour describes superior viability, production and fecundity of crossbred progeny compared with their purebred parents and is an accepted phenomenon in production species (Dechow et al., 2007; Nicholas, 2010). A recent report that hybrid vigour may influence longevity in dogs (14) indicates that cats may similarly be affected.

Despite being stated to have a long lifespan (15), few peer-reviewed reports have described population longevity values and mortality in domestic cats (2). Analysis of veterinary clinical records from 460,000 cats in the US identified an average longevity of 12.1 years and that neutering was associated with extended longevity (16). Analyses of Swedish pet insurance records relating to 49,450 cats identified mortality variation between breeds but not between the sexes (17). However, differing population and study design characteristics thwart subsequent attempts at generalisation to support disorder prioritisation and strategies to minimise disorder impacts (2).

Epidemiological analysis of electronic patient records (EPRs) collected from a large sample of primary-care veterinary practices into a single national surveillance system has been recommended to investigate companion animal health (6, 18). Veterinary EPRs provide longitudinal collection of clinical data that are contemporaneously recorded by veterinary health professionals and cover all presented patients and disorders (18). The VetCompass (http://www.rvc.ac.uk/VetCompass/) database of merged primary-care practice EPRs holds an extensive resource of clinical health information on companion animals in the UK (19) and has been interrogated to report on longevity and mortality in dogs (14) .

Using the VetCompass database, this study aimed to estimate longevity, report common causes of mortality and identify demographic risk factors for compromised longevity in cats in England. Longevity in crossbred cats was hypothesised to exceed purebred cats.

Materials and methods

The VetCompass project collects de-identified EPR data from primary-care veterinary practices in the UK for companion animal health surveillance (20). The current study included all cats with data uploaded to VetCompass from September 01, 2009 to December 20, 2012. Practice selection required willingness to participate and use of an appropriately configured practice management system (PMS). Clinicians selected summary diagnosis terms at episodes of clinical care from an embedded VeNom Code list (21). Clinical data extraction from PMSs used integrated clinical queries (22) before uploading to a secure structured query language (SQL) database. Data-fields collected included demographic (species, breed, date of birth, sex, neuter status, insurance status, weight and deceased status) and clinical information (free-form text clinical notes, summary diagnosis terms, treatment and deceased status with relevant dates). Sample size calculation estimated that a cross-sectional study design with 314 purebred cats and 2,826 crossbred cats would have 80% power to detect a one-year longevity difference between purebred and crossbred cats (at $\alpha = 0.05$), assuming that overall longevity was normally distributed with standard deviation of 6 years and that 10% of cats were purebreds (24). Ethical approval of the project was granted by the RVC Ethics and Welfare Committee (URN 2010 1076).

A random sample of potential deaths was selected from the ‘deceased status' field for detailed study (25). True death cases were identified from the clinical notes and the cause of mortality was extracted from the clinical note and VeNom diagnosis data relating to the death event. If a cause of mortality was not explicitly stated at the time of death, then no defined cause of mortality was included. The causes of mortality were grouped into appropriate pathophysiologic or organ-system categories. The mechanism of death (assisted [euthanasia] or non-assisted) (26) and mode of body disposal was noted. The age at death relied on the date of birth values recorded in the PMS; no age at death was included for cats without birth date information. Cats with recognized breed names were grouped as ‘purebred’ while cats described as mixed-breed, breed-specified crosses or domestic cats were grouped as ‘crossbred’ (11). The neuter and insurance statuses at death were used. Neuter and sex status were combined to create a sex/neuter variable with four categories: female entire, female neutered, male entire and male neutered. The maximum bodyweights recorded after 6 months of age were categorised into six groups (0.0-2.9 kg, 3.0-3.9 kg, 4.0-4.9 kg, 5.0-5.9 kg, 6.0 kg and above, no weight recorded).

Following data checking and cleaning in Excel (Microsoft Office Excel 2007, Microsoft Corp.), statistical analyses used Stata Version 11.2 (Stata Corporation). Overall and breed-specific (for breeds with 10 or more cats in the study) longevities were reported using median, interquartile range (IQR) and range. Median overall longevity values for purebred and crossbred cats were compared using the Mann-Whitney U test. The proportion of cats that were euthanased was compared between purebred and crossbred cats using the chi-squared test. Causes of mortality were separately tabulated for cats of all ages, cats dying before 5 years of age and cats dying at or after 5 years. General linear regression modelling was used to evaluate associations between risk factors (purebred/crossbred, sex/neuter, weight category, microchip and insured) and longevity in cats dying at or after 5 years of age. The 5 year cut-off was chosen because the longevity data after this age approximated the normal distribution that is a required assumption for linear regression modelling (27). Univariable risk factors liberally associated with longevity (*P* < 0.2) were evaluated using multivariable models developed using backwards stepwise elimination. The final model was evaluated using the clinic attended as a random effect and for pairwise interaction effects (28). The predictivity of the final non-random effect model was evaluated using the adjusted r^2 value. Model diagnostics included visual inspection of residual and residual-versus-fitted plots to assess normality and homoscedasticity, respectively (28). Statistical significance was set at $P < 0.05$.

Results

From 118,016 cats attending 90 practices in central and south-east England with 12,012 potential death cases, a study sample of 4,009 cats with confirmed deaths attending 87 practices was randomly selected. Data completeness varied between the variables: sex 98.9%, neutered 100.0%, breed 99.9%, date of birth 99.3%, insured 100.0%, microchipped 100.0%, weight 45.4%, cause of mortality 82.3%, mode of death 95.1% and mode of body disposal 84.2%. Demographic characterisation of deceased cats with information available indicated that 3,660 (91.7%) were crossbred, 2,009 (50.7%) were female, 2,599 (64.8%) were neutered, 543 (13.5%) were insured and 238 (5.9%) were microchipped. Adult bodyweights were distributed as follows: <3.0 kg (440 cats, 24.2%), 3.0-3.9 kg (612, 33.6%), 4.0-4.9 kg, (461, 25.3%), 5.0-5.9 kg (208, 11.4%), ≥ 6.0 kg, (98, 5.4%). The median (IQR) bodyweight was 3.7 (3.0-4.6) kg. Euthanasia accounted for 3,265 (85.7%) deaths overall with a greater proportion of crossbred cats (3,006, 86.0%) being euthanased compared with purebred cats (254, 81.9%) (P = 0.050). Overall, 2,522 (74.7%) cats were cremated.

Median overall longevity was 14.0 years (IQR 9.0-17.0; range 0.0-26.7) and was bimodally distributed, peaking at years 1 and 16 (Fig. 1). The median longevity of crossbred cats (14.0 years, IQR 9.1-17.0; range 0.0-26.7) was greater than purebred cats (12.5 years; IQR 6.1-16.4; range 0.0-22.0) ($P < 0.001$). Female cats (15.0 years, IQR 11.0-17.4) had a higher median longevity than male cats (13.0 years, IQR 7.6-16.0) ($P < 0.001$). Neutered cats (15.0 years, IQR 11.8-17.0) had a higher median longevity than non-neutered cats (11.0 years, IQR 2.13-16.0) ($P < 0.001$). The longest-lived breeds were the Birman ($n = 12$; median 16.1 years; IQR 8.1-16.9) and Burmese ($n = 31$; 14.3 years; IQR 10.0-17.0). The shortest-lived breeds were the Bengal ($n = 15$; 7.3 years; IQR 2.2-11.5) and Abyssinian ($n = 11$; 10.0 years; IQR 1.1-18.1) (Table 1).

A cause of mortality was specified for 3,309 (82.5%) cats. In cats of all ages with a cause of mortality specified, the most frequently attributed causes were trauma ($n = 405$; 12.2%), renal disorder ($n = 399$; 12.1%), non-specific illness ($n = 370$; 11.2%), neoplasia ($n = 356$; 10.8%) and mass lesion disorders ($n = 336$; 10.2%) (Table 2). Mass lesions described mass-associated disorders that did not have a more precise aetiological diagnosis. Of the 405 cats that died from trauma, 243 (60.0%) were ascribed to road traffic accidents (RTA). Younger and older cats differed markedly in cause of mortality.

For cats dying before 5 years of age (*n* = 516), the most frequent causes were trauma (*n* = 244; 47.3%), viral infectious disorders (*n* = 34; 6.6%) and respiratory disorders (*n* = 23; 4.5%). For cats dying at or after 5 years of age (*n* = 2,793), the most frequent causes were renal disorder (*n* = 379; 13.6%), non-specific illness (*n* = 352; 12.6%), neoplasia (*n* = 343; 12.3%) and mass lesion disorder (*n* = 324; 11.6%) (Table 3).

For cats dying at or after 5 years (*n* = 3,360), all risk factors evaluated using univariable linear regression modelling were associated with longevity. Multivariable modelling identified being crossbred, lower bodyweight, neutered and non-insured as associated with increased longevity. After accounting for the effects of the other risk factors, the mean additional longevity for crossbred cats was 0.6 years (95% confidence interval (CI): 0.2 to 1.1, $P = 0.008$) compared with purebred cats. Compared with entire female cats, neutered female cats had 0.6 years (95% CI: 0.1 to 1.0, $P = 0.007$) greater longevity and entire male cats had 1.8 years (95% CI: -1.3 to -2.3, $P < 0.001$) shorter longevity. Increasing bodyweight was associated with decreasing longevity ($P < 0.001$). The longevity of insured cats was 1.1 years (95% CI: -0.7 to -1.5, $P < 0.001$) shorter than non-insured cats (Table 4).

Adjusting for clustering within veterinary clinics did not materially affect the results. No significant interactions or major departures from normality or homoscedasticity were identified. A relatively low adjusted r^2 value (0.085) suggested that the final model accounted for 8.5% of data variation.

Discussion

This study of over 4,000 cats attending primary-care veterinary practices aimed to report longevity and mortality values that would generalise well to the overall owned cat population in England and further aimed to explore longevity variation between purebred and crossbred cats. The novel information derived from the study would support evidence-based approaches to advance feline breeding, husbandry and medicine (1-3).

The non-normal and bimodal distribution of longevity in the current study (Figure 1) suggested the median as a more appropriate statistic for longevity than the mean because extreme values from non-normally distributed distributions exert disproportionate effects on the mean (27). Few published studies have reported the longevity of domestic cats. A report based on clinical records from 800 Banfield Pet Hospitals in the US suggested an 'average' longevity of 12.1 years for cats but did not specify whether this was a median or a mean value (16). Improved nutrition, health care and management are stated to have increased life expectancy in domestic cats but specific supporting data are limited (2, 15, 17).

The current study identified a bimodal longevity distribution peaking in years 1 and 16 that suggested the existence of two distinct sub-populations of cats: those with a propensity for earlier death and cats that survive to an older age (Fig. 1). Longevity is similarly bimodal in dogs (14), indicating that mortality studies should be separated for each longevity group. Of deaths before 5 years of age, almost half (47.3%) resulted from trauma, with the majority resulting from RTA. This compares with just 5.8% of trauma-related deaths in cats dying at or after 5 years of age. The preponderance for RTA-related deaths among younger cats concurs with a UK practice-based study that reported reducing RTA death rates as cats aged (29). A Swedish study of insured cats that died before 12 years of age also identified RTA as important to cat mortality, with an age-standardised mortality rate (ASMR) of 411 per 10,000 cat-years at risk (17). Differing international attitudes to outdoor access for owned cats may affect trauma- and RTA-related mortality: over 90% of UK cats have daily outdoor access (30) compared with 80% in Australia (3) and 50-60% in the US (31).

The most common causes of mortality at or after 5 years identified in the current study were renal disorder (13.6%), non-specific illness (12.6%), neoplastic disorder (12.3%) and mass lesion disorder (11.6%). The clinical importance of renal disease in older cats is supported by previous reports showing that 15-30% of cats over 15 years old were azotaemic (32). Kidney-and-ureter disorders were the most common cause of mortality in insured cats dying before 12 years of age in Sweden (ASMR: 713 per 10,000 cat-years at risk) (17). The frequent identification of physical and biochemical abnormalities in apparently healthy older cats (33, 34) emphasises the value of clinical vigilance and routine health checks to optimise the detection and management of renal disease, especially in older cats (35-37). Although 12% of deaths in the current study were from neoplasia, an equivalent number of deaths were also ascribed to non-specific masses. Although mass lesions could include cysts, inflammation and infection (38), it is possible that many may have been undiagnosed neoplastic disorders, suggesting that neoplasia could account for up to a quarter of deaths in older cats. Neoplastic disorders were reported to have an ASMR of 528 per 10,000 cat-years at risk in insured cats in Sweden but the study was limited by including only cats that died before 12 years of age (17). Although malignant neoplasia is often life-limiting, routine veterinary evaluation of older cats for neoplastic disorders has been recommended because earlier diagnosis may enable interventions that increase longevity and improve palliative care as well as the provision of more-informed choices for owners (34).

The current study results supported the hypothesis that longevity in crossbred cats exceeds purebred cats. Direct comparison of median overall longevity values showed that crossbred cats outlived purebred cats by 1.5 years (crossbred cats: 14.0 years compared with purebred cats: 12.5 years). Within those cats dying at or after 5 years of age, after accounting for bodyweight, sex, neutering and insurance status, crossbred cats outlived purebred cats by 0.6 years. In support, an Australian survey on currently-living pet cats reported a significantly higher median age for crossbreds (7.0 years) compared with purebreds (5.5 years) (3).

Cats have been kept as pets by humans for 10,000 years (39) but it is during the past 150 years that cats have especially been selectively bred for show and novelty (12). Purebred cats comprised 8.3% of the population in the current study. Although the proportion of UK owned cats that are purebred is currently around 10% (40), this value is predicted to rise, bringing an expansion in both the recognition and impact of breed-related anomalies and genetic disorders (41, 42). The substantial longevity deficit identified for purebred cats in the current study warrants further investigation to better understand and manage the mechanisms involved. It may be that purebred cats express more recessive disorders because of greater homozygosity for deleterious genes, i.e. inbreeding depression (43) but other genetic and non-genetic differences may additionally contribute. It is also worth noting that, although purebred status was significantly associated with a reduced longevity, only 8.5% of longevity variation was explained by the final model used in the current study. This implies substantial roles in feline longevity for factors not included in the current study such as diet (44), vaccination (45), outdoor access (31) and obesity (46).

Despite the superior longevity identified in crossbreds, it is notable that longevity varied widely between pure cat breeds, suggesting the importance of improved understanding of associations between breed and longevity. The Birman, Burmese, Siamese and Persian lived as long as or longer than crossbreeds whereas the Bengal, Abyssinian, Ragdoll, Maine Coon and British Shorthair breeds showed reduced longevity. A

Swedish insurance study similarly identified equivalent or greater age-based survival for Birman, Norwegian, Persian and Siamese cats compared with domestic cats (2). Longevity variation between breeds may partially be explained by differing breed bodyweights; lighter breeds have greater longevity than heavier breeds (47). Differing breed predispositions to specific diseases may also contribute to longevity variation (9). Larger breed-specific studies would enable greater longevity precision and reporting of within-breed risk factors for compromised longevity. Such studies are especially important for less popular breeds where smaller gene pools for breeding may increase predispositions for inherited disease (10).

It is worth noting that both overall and breed-specific longevity is influenced by the right of owners to opt for termination of life for their cats. In the current study, more than 85% of deaths involved euthanasia, with statistically different proportions of crossbred and purebred cats being euthanased (86.0% vs. 81.9% respectively). Euthanasia decision-making is complex and emotionally intense both for owners (48) and veterinarians (49). Greater understanding of the human factors involved in pet euthanasia decisions may ameliorate the psychological burden on owners and veterinarians as well as improving the quality of the decisions made.

Maximum bodyweight values recorded after 6 months of age were negatively associated with longevity in the current study. In cats that died at 5 years of age or older, cats weighing less than 3 kg lived 1.7 years longer on average than cats weighing between 4 and 5 kg. A negative association between bodyweight and longevity has previously been reported in dogs (14) and was hypothesised to result from genetic and pathological effects induced by artificial selection for extremes of size and growth (50-53). The bodyweight associations with longevity identified in the current study may have been partially confounded by breed and obesity effects that could be explored in future studies (46).

Although the study indicated an association between insurance and reduced longevity, the direction of any causality requires careful consideration. Insured animals may revert to being non-insured as they age because of increasing insurance costs or exclusions (54, 55). The current study used insurance values at death and thus the negative association identified may have resulted from increasing insurance policy cancellation with advancing age.

Neutering was associated with 0.6 years greater longevity in females and 1.7 years greater longevity in males. Neutering offers health benefits including reduced risk of asthma, gingivitis and hyperactivity in both sexes and decreased abscesses, aggression toward veterinarians, undesirable sexual behaviours and urine spraying in males (56, 57). However, the current neutering results should be interpreted cautiously because the neuter status at death was used and was modelled as time-independent (i.e. a single value applies throughout life) because of the nature of the available data. Cats aged less than five months tend to be entire whereas a consistent proportion of older cats tend to be neutered (58) suggesting that neutering ideally should be modelled as a time-dependent variable (van Hagen et al., 2005). With ongoing VetCompass data accrual, future studies will increasingly use time-dependent modelling.

This study had some limitations. Many of the study cats were privately-owned and therefore the results may not reflect longevity in unowned or feral cats. Data on some cats that died and were buried at home or that went missing may not have been included. Exclusion of records with unconfirmed cause of mortality in this study could have resulted in under-estimation of deaths caused by RTA (59) or animal attacks (60). The veterinary practices included in the study had progressive attitudes to data sharing and were situated mainly in central and south-east England, and thus may not be representative of all veterinary practices in England. The validity of the data relied heavily on owner-reported information and on the clinical acumen and note-making of attending practitioners (14).

Conclusions

Crossbred cats showed greater longevity than purebred cats on average but individual purebred cat breeds varied substantially in longevity. Increasing bodyweight in adult cats was negatively associated with longevity. The most common cause of mortality in younger cats was trauma and in older cats were renal disorders, non-specific illness, neoplasia and mass lesion disorders. The study identified important breed and phenotypic associations with longevity variation that can be used to direct breeding and research strategies. Increased awareness of the common causes of mortality within sub-demographics of cats should promote improved management and diagnostic methods that will improve feline welfare.

Acknowledgments

Support by the Royal Society for the Prevention of Cruelty to Animals (RSPCA) for this study is gratefully acknowledged. We thank Peter Dron (RVC) for VetCompass database development and Noel Kennedy (RVC) for software and programming development. We are especially grateful to the Medivet Veterinary Partnership and other UK practices and clients for participating in VetCompass.

Conflict of interest statement

None of the authors of this paper has a financial or personal relationship with other people or organisations that could inappropriately influence or bias the content of the paper.

Funding

This work was supported by an RSPCA Animal Welfare Research Grant.

Abbreviations

CI, confidence interval; EPR, electronic patient record; IQR, interquartile range; RTA, road traffic accident

Table 1

Breed longevity (breeds with 10 or more study animals) for cats attending primary-care veterinary practices in England ranked by median age at death. The interquartile range (IQR), range and number of study cats are also shown (*n* = 4,009).

Breed	Median (years)	IQR	Range	No. of cats
Birman	16.1	8.1-16.9	1.0-20.7	12
Burmese	14.3	10.0-17.0	0.7-20.7	31
Siamese	14.2	10.8-19.0	0.9-21.1	31
Persian	14.1	12.0-17.0	0.0-21.2	70
Crossbred	14.0	9.2-17.0	0.0-26.7	3,621
British shorthair	11.8	5.8-16.3	0.0-21.0	69
Maine Coon	11.0	4.0-15.5	0.2-19.0	14
Ragdoll	10.1	0.9-14.8	0.1-17.9	21
Abyssinian	10.0	1.1-18.1	1.0-20.8	11
Bengal	7.3	2.2-11.5	0.6-13.7	15

Table 2

Attributed causes of mortality (top 20) specified in the clinical notes (*n* = 3,309) in cats of all ages attending primary-care veterinary practices in England. The median, interquartile range (IQR) and range for the age (years) at death are reported.

Attributed cause	Rank	No. deaths (%)	Median	IQR	Range
Trauma	1	405 (12.2)	3.0	1.1-9.0	0.0-22.0
Renal disorder	2	399 (12.1)	15.1	12.0-17.3	0.3-24.0
Non-specific illness	3	370 (11.2)	16.0	13.3-18.0	0.0-25.0
Neoplasia	4	356 (10.8)	13.6	11.3-16.0	1.2-22.1
Mass lesion disorder	5	336 (10.2)	14.2	12.0-16.5	0.9-22.1
Neurological disorder	6	231 (7.0)	15.1	13.0-18.0	0.1-25.0
Respiratory disorder	7	183 (5.5)	13.7	10.0-16.8	0.1-22.0
Cardiac disease	8	139 (4.2)	14.0	11.5-16.3	0.0-22.0
Endocrine disorder	9	124 (3.8)	16.0	12.9-17.3	0.0-24.1
Thromboembolism	10	106 (3.2)	12.0	8.1-15.0	2.0-21.3
Enteropathy	11	98 (3.0)	14.7	10.4-17.0	0.1-23.0
Hepatopathy	12	61 (1.8)	13.6	10.0-16.4	1.0-25.0
Viral disorder	13	60 (1.8)	3.8	0.6-10.4	0.1-17.0
Urinary disorder	14	57 (1.7)	7.0	3.5-13.0	0.1-20.9
Abdominal disorder	15	48 (1.5)	15.7	10.9-18.1	0.2-22.0
Oral cavity disorder	16	47 (1.4)	15.5	12.7-18.0	2.6-23.0
Behavioural disorder	17	43 (1.3)	16.0	14.0-18.6	2.0-22.0
Ocular disorder	18	37 (1.1)	16.0	9.0-18.0	0.1-23.0
Anaemia	19	36 (1.1)	10.9	2.8-15.0	0.1-17.5
Parasitic disorder	20	31 (0.9)	15.2	12.0-17.8	0.1-21.9

Table 3

Attributed causes of mortality (top 15) specified in the clinical notes in cats aged below five years (*n* = 516) and cats aged five years or above (*n* = 2,793) that attended primary-care veterinary practices in England.

Attributed cause of mortality	< 5 years		≥ 5 years	
	Rank	No. (%) deaths	Rank	No. (%) deaths
Trauma	1	244 (47.3)	6	161 (5.8)
Viral disorder	2	34 (6.6)		
Respiratory disorder	3	23 (4.5)	7	160 (5.7)
Renal disorder	4	20 (3.9)	1	379 (13.6)
Urinary disorder	5	19 (3.7)		
Non-specific illness	6	18 (3.5)	2	352 (12.6)
Congenital disorder	7	17 (3.3)		
Thromboembolism	8	14 (2.7)	10	92 (3.3)
Enteropathy	9	13 (2.5)	11	85 (3.0)
Intoxication (poisoning)	10	13 (2.5)		
Neoplasia	11	13 (2.5)	3	343 (12.3)
Mass lesion disorder	12	12 (2.3)	4	324 (11.6)
Neurological disorder	13	12 (2.3)	5	219 (7.8)
Anaemia	14	10 (1.9)		
Cardiac disease	15	10 (1.9)	8	129 (4.6)
Endocrine disorder			9	118 (4.2)
Hepatopathy			12	55 (2.0)
Abdominal disorder			14	45 (1.6)
Behavioural disorder			15	42 (1.5)
Oral cavity disorder			13	46 (1.7)

Table 4

Final multivariable linear regression results for risk factors associated with longevity (years) in cats attending primary-care veterinary practices in England that died at or after 5 years of age (*n* = 3,310). The coefficient indicates the average longevity difference in years compared with the baseline group.

Variable		Coefficient	95% Confidence interval	P-value
Purebred status				
	Crossbred	Baseline	-	-
	Purebred	-0.6	-0.2 to -1.1	0.008
Sex/neuter status				
	Female entire	Baseline	-	-
	Female neutered	0.6	0.1 to 1.0	0.007
	Male entire	-1.8	-1.3 to -2.3	<0.001
	Male neutered	0.1	-0.4 to 0.5	0.756
Bodyweight				
	< 3.0 kg	Baseline	-	-
	3.0-3.9 kg	-0.8	-0.3 to -1.3	0.001
	4.0-4.9 kg	-1.7	-1.2 to -2.2	<0.001
	5.0-5.9 kg	-2.0	-1.4 to -2.7	<0.001
	≥ 6.0 kg	-3.3	-2.5 to -4.2	<0.001
	No weight recorded	-0.4	-0.8 to 0.0	0.047
Insured status				
	Not insured	Baseline	-	-
	Insured	-1.1	-0.7 to -1.5	<0.001

Figure legends

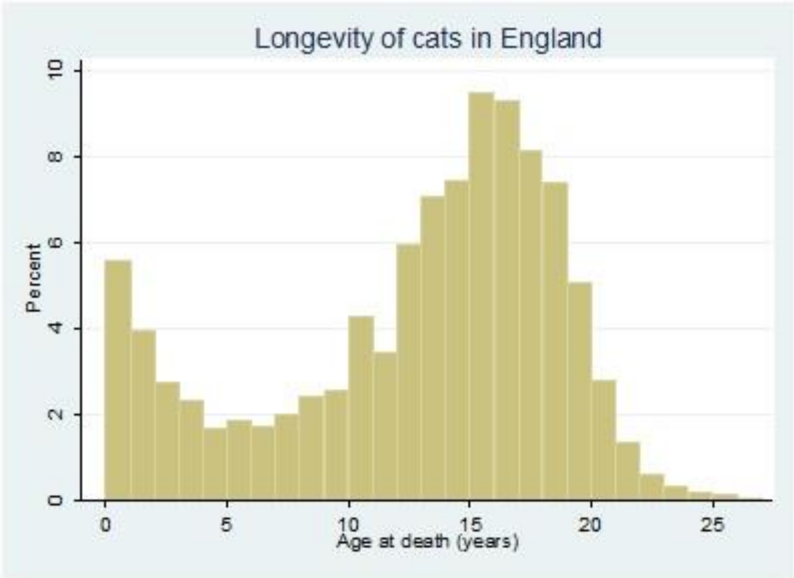

Figure 1. Distribution of ages at death in cats (*n* = 3,979) attending primary-care veterinary practices in England showing the percentage of cats that died within one-year age bands.

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