



Puppy acquisition: factors associated with acquiring a puppy under eight weeks of age and without viewing the mother

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Abstract

Background Puppy acquisition decisions may impact upon the health and behaviour of these dogs in later life. It is widely recommended by welfare organisations and veterinary bodies that puppies should not leave maternal care until at least eight weeks (56 days) of age, and that when acquiring a puppy it should be viewed with its mother.

Methods Owner-reported prospective data were used to explore risk factors for puppy acquisition age, and whether the mother was viewed during acquisition, within a cohort of dog owners participating in an ongoing longitudinal project.

Results A quarter (461/1844) of puppies were acquired under eight weeks of age and 8.1 per cent were obtained without viewing the mother (n=149). Only 1.6 per cent of puppies were obtained under eight weeks of age and without the mother being seen (n=30). Multivariable logistic regression analysis revealed that owners who intended their puppy to be a working dog, visited their puppy prior to acquisition, and/or obtained a puppy of unknown breed composition had increased odds of acquiring a puppy under eight weeks of age. The odds also increased as the number of dogs in the household increased but decreased as annual income rose. Owners who visited their puppy prior to acquisition, obtained a Kennel Club registered puppy, viewed the puppy's father, and/or collected their puppy from the breeder's home had decreased odds of acquiring a puppy without viewing the mother.

Conclusion Targeting interventions towards identified owners who are more likely to acquire a puppy against current recommendations could help reduce these types of acquisitions.

Introduction

Dogs are popular pets in the UK and it has been estimated that approximately 24–30 per cent of UK households own at least one dog.^{1–4} Many owners obtain their dogs as puppies, yet limited research exists on factors influencing how puppies are acquired and where from.

In the UK many welfare organisations and veterinary bodies recommend that puppies should not leave maternal care until at least eight weeks (56 days) of age, and that when acquiring a puppy it should be viewed with its mother,^{5–7} despite an absence of scientific literature providing an evidence-base for the specific age recommendations that are in place. In the UK, there are legal restrictions on the sale of puppies under eight weeks of age, and in England the current legislation, The Animal Welfare (Licensing of Activities Involving Animals) (England) Regulations 2018, states that a puppy under eight weeks of age may only be shown to a prospective owner if it is with its biological mother.⁸

Despite these recommendations and legal restrictions, there is some evidence that puppies are acquired under eight weeks of age and/or without the mother being seen. One UK study investigating dog acquisition behaviour sampled owners of the top 10

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most commonly registered Kennel Club pedigree breeds (of 2014).⁹ The study did not specifically look at puppy acquisition behaviour and included adult dogs and dogs rehomed from welfare organisations (which are commonly over eight weeks of age when rehomed). However, they reported 1.7 per cent (24/1427) of owners acquired their dog under eight weeks of age, and the median acquisition age was 2.25 months. They reported 47.1 per cent of owners saw their dog's mother, 44.3 per cent saw both parents and 6.8 per cent saw neither.

A review of behavioural cases by the Association of Pet Behaviour Counsellors reported that of 749 canine cases for which data were collated, 143 puppies were obtained under eight weeks of age, 189 were obtained at eight weeks of age, and 46 puppies were obtained between eight and 12 weeks of age.¹⁰ Another UK retrospective study, investigating associations between viewing the parents of a puppy and the development of behavioural problems later in life, reported that 80 per cent of 265 owners saw at least one of the puppy's parents during acquisition, most commonly only the mother and rarely only the father.¹¹ Owners who viewed only one of their puppy's parents had two and a half times increased odds of being referred to an animal behaviourist for a behavioural problem than owners who saw both parents, and owners who saw neither parent had nearly four times increased odds of being referred.

Although there has been limited investigation into factors associated with the acquisition of puppies under eight weeks of age and/or without viewing the mother, literature exists that considers how early life experiences (such as maternal care, genetics, environment, attachment and socialisation) can impact on physiological and behavioural development.¹²⁻¹⁵ Two examples of studies which have assessed the impacts of early separation from maternal care are, first, Slabbert and Rasa who reported puppies separated from maternal care at six weeks (but not their littermates) showed greater weight loss, distress, disease susceptibility and mortality up to six months of age compared with puppies that had remained in maternal care until 12 weeks of age.¹⁶ Secondly, Pierantoni and colleagues reported that 70 puppies separated from maternal care between 30 and 40 days were significantly more likely to display destructive behaviour, excessive barking, fearfulness on walks, noise reactivity, possessiveness towards food and toys, and attention-seeking compared with 70 puppies that remained in maternal care until two months (60 days) of age.¹⁷

Other retrospective studies have assessed the impacts of delayed separation from maternal care. For example, Appleby and colleagues reported increases in aggression to unfamiliar people outside the home in dogs that were obtained after eight weeks.¹⁸ Likewise, Jokinen and colleagues investigated how homing age

influenced the prevalence of aggressive and avoidance-related behaviours in a sample of 3689 adult dogs (aged one year or more).¹⁹ They reported homing age was significantly associated with avoiding, growling and snapping at unfamiliar people when away from the home environment and when unfamiliar people visited the home. They reported a higher prevalence of avoidance and aggressive behaviour towards unfamiliar people in puppies homed after eight weeks of age compared with those homed at six to eight weeks of age.

Viewing a puppy with its mother gives prospective owners the opportunity to evaluate (subject to their own experience/knowledge) factors such as the level of maternal care, the general condition and temperament of the mother, and interactions between the mother and puppies. This is particularly important given that studies suggest that characteristics such as fearfulness and anxiety are heritable,²⁰⁻²² and that offspring of prenatally stressed mothers of a variety of species tend to be more emotionally responsive and take longer to recover from stressful situations.²³ If prospective owners can observe and correctly identify undesirable traits in the mother, it may help them to make informed decisions about whether a puppy may be suitable for their circumstances.

The overall aim of the study was to provide better understanding about factors associated with acquisition of puppies under eight weeks of age and without viewing the puppy's mother. This information could lead to the development of intervention strategies aimed at decreasing these types of purchases. To that end, this study used data collected prospectively to carry out the following:

1. Report the number of puppies within a cohort of dogs that were acquired (a) under eight weeks (56 days) of age, (b) without seeing the mother, and (c) under eight weeks of age and without seeing the mother.
2. Investigate factors associated with the acquisition of puppies under eight weeks of age.
3. Investigate factors associated with the acquisition of puppies without viewing the mother.

Materials and methods

Study design

The data used were collected as part of 'Generation Pup', a longitudinal study of canine health, behaviour and welfare. The only inclusion criteria for 'Generation Pup' were as follows: participants must be resident in the UK or the Republic of Ireland (ROI), be at least 16 years of age, and own a puppy (any breed or cross-breed) under 16 weeks of age at the time of registration. Analysis of data from the 'Generation Pup' study will enable investigation of risk factors for a variety of outcomes from data collected prospectively from owners and veterinarians (with owner permission). 'Generation Pup' plans to recruit 10,000 puppies, so the data used in this study were extracted whilst recruitment was still ongoing.

A total of 2392 puppies were recruited to 'Generation Pup' between May 2016 and February 2019 (inclusive). Study advertising occurred through a variety of methods to maximise diversity among the owners in the cohort. Recruitment methods included advertising through veterinary practices, social media, dog breeders, puppy training classes, and publications (eg, Veterinary Record and Dogs Trust's WAG magazine).

Data collection

This analysis used data obtained from the first three mandatory self-administered questionnaires that were issued to owners between May 2016 and February 2019 upon registration to the project. The first two questionnaires could be completed before or after puppy acquisition. The third questionnaire became available to the owner upon completion of the first two questionnaires and could only be completed when the puppy joined the household. Thus, puppy age when the third questionnaire was completed varied from birth to 16 weeks of age.

Most owners completed the questionnaires online, although postal paper copies were available. The questionnaires mainly consisted of closed questions with multiple choice answers and took approximately 10–30 min to complete. Free-text responses were recoded where necessary. Data from respondents were anonymised prior to analysis. The study was approved by the University of Bristol Animal Welfare Ethical Research Board (UIN/18/052), the Clinical Research Ethical Review Board at the Royal Veterinary College (URN 2017 1658-3), the Social Science Ethical Review Board at the Royal Veterinary College (URN SR2017-1116), and Dogs Trust Ethical Review Board (ERB009).

Outcome variables

For the analysis of factors associated with acquisition of puppies under eight weeks, there were two categories: puppies that were acquired prior to eight weeks (<56 days) of age and puppies whose owners acquired them aged eight weeks or older (≥56 days). Age when acquired was determined using the dates the owner reported as the puppy's date of birth (DOB) and the date the puppy joined the household. These questions were asked in the third questionnaire (which could be completed from birth to 16 weeks of age) to minimise recall bias. Owners were asked if each date was exact or estimated. Where the owner reported either date as an estimation, these puppies were excluded from the dataset used for this analysis.

For the analysis of factors associated with acquisition without viewing the mother, there were two categories: puppies whose owners reported having seen the mother during the acquisition process and puppies whose owners did not. Where the owner reported they did not know if they had seen the mother, these puppies were excluded from the dataset used for this analysis.

Potential explanatory variables

The variables assessed for association with each of the two outcome variables are listed in [table 1](#). To increase the statistical power of the analysis, particularly when variables had categories that contained few data points, univariable analysis was used to rationalise merging categories that had similar associations with the outcome under investigation, and where combining categories was deemed to be logical.

Study size

The study size was determined by the number of puppies whose owners had completed questionnaires 1–3 (inclusive). If an owner had registered more than one puppy, only one of their puppies was randomly selected for inclusion in this analysis. This was to remove any effects of clustering at the level of the household. Homebred puppies were excluded from the analysis. Puppies acquired from welfare organisations and puppies trained for assistance work were also excluded as the acquisition process is often different for these puppies. For example, puppies may end up in welfare organisations due to situations such as puppies being abandoned without their mother, or the mother dying.

The study had 80 per cent power to detect an odds ratio (OR) of at least 2, based on a 95 per cent confidence interval (CI) and assuming 30 per cent of puppies were exposed to the risk factors under investigation and using a control/case ratio of 3:1 (Sampsize.sourceforge.net).

Descriptive statistics

The number of puppies acquired (a) under eight weeks of age, (b) without seeing the mother, and (c) under eight weeks of age and without seeing the mother were summarised.

Statistical analysis

To test for associations between potential explanatory variables and the two outcome variables, univariable and multivariable logistic regression models were used. Variables with a P value less than 0.2 in the univariable analysis were included in the building of a multivariable model using the backward elimination technique. To allow comparison of models during the multivariable analysis, puppies with missing data for any of the variables eligible for inclusion were excluded from the dataset.

For the analysis of risk factors associated with the acquisition of puppies without viewing the mother, the variable 'annual household income' had data missing for 302 owners. Although this variable had a P value less than 0.2 in the univariable analysis, it was the first variable to be eliminated during the multivariable model-building process. For this reason, the modelling progress was restarted with the variable 'annual

Table 1 Variables assessed as potential risk factors for acquisition of 1) a puppy under eight weeks of age, and 2) without viewing the puppy's mother within the 'Generation Pup' cohort

Variable	Description	Categories
Owner gender	Gender of owner	Male
		Female
Owner age	Age of owner	Continuous*
Previous dog ownership experience	Owner's previous experience owning a dog(s)	Previous dog ownership experience as an adult †
		First dog/first since childhood
Number of adults in household	Number of adults in household	Continuous
Number of children in household	Number of children in household	Continuous
Highest level of education in household	Highest level of education achieved by a member of the household	A Levels/GCSE/O Levels/vocational qualifications/no formal qualifications
		Postgraduate degree/undergraduate degree/higher qualification (for example HND)
Annual household income	Annual income of household	Continuous*
Number of other dogs in household	Number of dogs in household	Continuous
Sex of puppy	Sex of puppy	Male
		Female
Purity of breed	The purity of puppy's breed	Pure breed/mix of two specific breeds
		Unknown breed composition‡
Puppy is Kennel Club registered	Registered with Kennel Club	Yes, registered
		No
Source of puppy	Where the puppy was obtained from	Kennel Club/professional breeder
		Hobby breeder
Number of times owner met puppy before joining the household	How many times did the owner meet the puppy before the puppy joined the household	First met puppy when acquired
		At least once before acquisition
How the puppy was brought to the household	Whether the puppy was delivered to the household or collected from another location	Delivered to household/collected from a location other than breeder's home
		Collected from breeder's home
Mother was seen	Whether the mother was seen by the owner at some point during the acquisition process	Mother was seen
		Mother was not seen
Acquired under eight weeks of age	Whether the puppy was acquired under eight weeks of age	Yes, acquired under eight weeks of age
		No
Father was seen	Whether the father was seen by the owner at some point during the acquisition process	Father was seen
		Father was not seen
Owner intended puppy to be a family pet	Owner stated they intended for the puppy to be a family pet	No
		Yes
Owner intended puppy to be a working dog§	Owner stated they intended for the puppy to be a working dog	No
		Yes

*Owners were asked to select an age and income bracket. For age, these brackets were: '16–24 years', '25–34 years', '35–44 years', '45–54 years', '55–64 years', '65 years and older' and 'Prefer not to state'. For income, these brackets were: 'Less than £15,000', '£15,000–less than £25,000', '£25,000–less than £35,000', '£35,000–less than £45,000', '£45,000–less than £55,000', '£55,000 or more', 'I don't know', 'Prefer not to state'. For the analysis these two variables were treated as continuous variables by using the middle value of the brackets and an upper age of 70 and income of £75,000.

†The category 'Previous dog ownership experience as an adult' was created by combining the following responses: 'I have always owned a dog/s since having a family dog/s as a child', 'I have almost always had a dog/s – but with breaks for other life circumstances', 'I have had other dogs during my adult life'.

‡The category 'Unknown breed composition' was created by combining the following responses: 'A mixed breed without known parentage, but of a particular "type" (eg, Collie type or Collie cross)' and 'A mixture of different/unknown breeds ("heinz 57")'.

§This category includes owners who intended to train their dogs to be sheep, cattle, gun, police/military, pest control, water rescue, search and rescue, and guard dogs.

household income' excluded to maximise the size of the dataset. The variable 'annual household income' was included in the analysis of risk factors associated with the acquisition of puppies under eight weeks of age.

For the final model, variables with a P value less than 0.05 were retained, and biologically plausible interactions were tested for. The Hosmer and Lemeshow test was used to examine the fit of the model to the dataset. The statistical package IBM SPSS Statistics v25 was used for all data analysis.

Results

Puppy acquisition within the cohort

The number of puppies recruited to 'Generation Pup' at the time of this analysis was 2392. There were 70 owners who had more than one dog registered to the study: 65

of these had two dogs registered and five had three dogs registered. One dog was randomly selected for each of these owners and was included in the analysis. The remaining puppies (n=75) belonging to these owners were excluded. Of the remaining 2317 puppies, 86 (3.7 per cent) were homebred, 49 (2.1 per cent) were acquired with the intention of being assistance dogs and 68 puppies (2.9 per cent) were obtained from welfare organisations. These puppies were excluded along with 270 puppies whose owners had been unable to report an accurate age at acquisition. (Of these 270 puppies, 100 of these puppies were acquired under eight weeks of age if their estimations were correct.) Thus, there were 1844 puppies eligible for inclusion in the analysis.

The median (25th–75th percentile) acquisition age was 8.3 weeks (8.0–9.1 weeks). A quarter (461/1844)

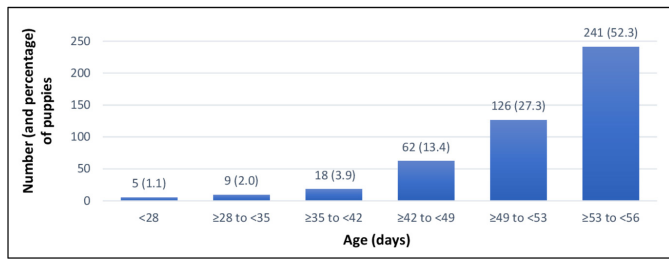


Figure 1 Number (percentage) of puppies acquired under eight weeks of age within the 'Generation Pup' cohort (n=461).

of the puppies were acquired under eight weeks of age. **Figure 1** shows the age brackets at which these 461 puppies were obtained.

Of the 1844 puppies, 8.1 per cent were acquired without the mother being seen (n=149), and only 1.6

per cent were obtained under eight weeks of age and without the mother being seen (n=30).

Univariable analysis of puppy acquisition under eight weeks of age

Table 2 summarises the univariable logistic regression results. There were 12 variables with a P value less than 0.2 identified for inclusion in the multivariable model-building process.

Multivariable analysis of puppy acquisition under eight weeks of age

Five variables were retained in the final multivariable model (**table 3**). The model indicated that as annual

Table 2 Univariable logistic regression model of odds ratios (ORs), 95 per cent confidence intervals (CIs) and P values of potential explanatory variables for acquisition of puppies under eight weeks of age within the 'Generation Pup' cohort

Variable	Categories	Acquired at least eight weeks of age, n (%)	Acquired under eight weeks of age, n (%)	OR (95% CI)	P value
Owner gender	Male	145 (79.2)	38 (20.8)	1.00	
	Female	1237 (74.5)	423 (25.5)	1.31 (0.90 to 1.90)	0.163
Owner age	Continuous*			0.96 (0.89 to 1.03)	0.238
Previous dog ownership experience	Previous dog ownership experience as adult†	946 (73.4)	343 (26.6)	1.00	
	First dog/first since childhood	436 (78.8)	117 (21.2)	0.74 (0.58 to 0.94)	0.013
Number of adults in household	Continuous			0.95 (0.84 to 1.08)	0.449
Number of children in household	Continuous			0.94 (0.82 to 1.07)	0.345
Highest level of education in household	A Levels/GCSE/O Levels/vocational qualifications/no formal qualifications	358 (72.5)	136 (27.5)	1.00	
	Postgraduate degree/undergraduate degree/higher qualification (for example HND)	1024 (75.9)	325 (24.1)	0.84 (0.66 to 1.06)	0.131
Annual household income	Continuous*			0.91 (0.85 to 0.98)	0.008
Number of other dogs in household	Continuous			1.13 (1.04 to 1.22)	0.003
Dog sex	Male	712 (75.3)	233 (24.7)	1.00	
	Female	671 (74.6)	228 (25.4)	1.04 (0.84 to 1.28)	0.727
Purity of breed	Pure breed/mix of two specific breeds	1309 (75.5)	425 (24.5)	1.00	
	Unknown breed composition‡	70 (68.0)	33 (32.0)	1.45 (0.95 to 2.23)	0.088
Puppy is Kennel Club registered	No	695 (74.2)	242 (25.8)	1.00	
	Yes, registered	645 (76.0)	204 (24.0)	1.10 (0.89 to 1.37)	0.381
Source of puppy	Kennel Club/professional breeder	633 (76.8)	191 (23.2)	1.00	
	Hobby breeder	674 (73.8)	239 (26.2)	1.18 (0.95 to 1.46)	0.148
How many times owner met puppy before joining the household	First met puppy when acquired	327 (80.5)	79 (19.5)	1.00	
	At least once before acquisition	1040 (73.6)	374 (26.4)	1.49 (1.13 to 1.96)	0.004
How the puppy was brought to the household	Delivered to household/collected from a location other than breeder's home	108 (80.0)	27 (20.0)	1.00	
	Collected from breeder's home	1246 (74.6)	424 (25.4)	1.36 (0.88 to 2.11)	0.166
Mother was seen when puppy was visited/acquired	Mother was seen	1264 (74.6)	431 (25.4)	1.00	
	Mother was not seen	119 (79.9)	30 (20.1)	0.74 (0.49 to 1.12)	0.154
Father was seen when puppy was visited/acquired	Father was seen	455 (72.3)	174 (27.7)	1.00	
	Father was not seen	928 (76.4)	287 (23.6)	0.81 (0.65 to 1.01)	0.058
Owner intended puppy to be a family pet	No	61 (69.3)	27 (30.7)	1.00	
	Yes	1322 (75.3)	434 (24.7)	0.74 (0.47 to 1.18)	0.209
Owner intended puppy to be a working dog §	No	1296 (75.8)	413 (24.2)	1.00	
	Yes	87 (64.4)	48 (35.6)	1.73 (1.20 to 2.51)	0.004

*Owners were asked to select an age and income bracket. For age, these brackets were: '16–24 years', '25–34 years', '35–44 years', '45–54 years', '55–64 years', '65 years and older' and 'Prefer not to state'. For income, these brackets were: 'Less than £15,000', '£15,000–less than £25,000', '£25,000–less than £35,000', '£35,000–less than £45,000', '£45,000–less than £55,000', '£55,000 or more', 'I don't know', 'Prefer not to state'. For the analysis these two variables were treated as continuous variables by using the middle value of the brackets and an upper age of 70 and income of £75,000.

†The category 'Previous dog ownership experience as an adult' was created by combining the following responses: 'I have always owned a dog/s since having a family dog/s as a child', 'I have almost always had a dog/s – but with breaks for other life circumstances', 'I have had other dogs during my adult life'.

‡The category 'Unknown breed composition' was created by combining the following responses: 'A mixed breed without known parentage, but of a particular "type" (eg, Collie type or Collie cross)' and 'A mixture of different/unknown breeds ("heinz 57")'.

§This category includes owners who intended to train their dogs to be sheep, cattle, gun, police/military, pest control, water rescue, search and rescue, and guard dogs.

Table 3 Multivariable logistic regression model of odds ratios (ORs), 95 per cent confidence intervals (CIs) and P values of explanatory variables that were significantly associated with the acquisition of puppies under eight weeks of age within the 'Generation Pup' cohort

Variable	Categories	Acquired at least eight weeks of age, n (%)	Acquired under eight weeks of age, n (%)	OR (95% CI)	P value
Annual household income	Continuous*			0.91 (0.85 to 0.99)	0.018
Number of other dogs in household	Continuous			1.13 (1.03 to 1.24)	0.009
Purity of breed	Pure breed/mix of two specific breeds	1025 (75.6)	331 (24.4)	1.00	
	Unknown breed composition†	50 (64.9)	27 (35.1)	1.75 (1.07 to 2.86)	0.027
How many times owner met puppy before joining the household	First met puppy when acquired	247 (79.4)	64 (20.6)	1.00	
	At least once before acquisition	828 (73.8)	294 (26.2)	1.48 (1.08 to 2.02)	0.014
Owner intended puppy to be a working dog‡	No	1006 (75.9)	319 (24.1)	1.00	
	Yes	69 (63.9)	39 (36.1)	1.63 (1.07 to 2.49)	0.023

*Owners were asked to select an age and income bracket. For age, these brackets were: '16–24 years', '25–34 years', '35–44 years', '45–54 years', '55–64 years', '65 years and older' and 'Prefer not to state'. For income, these brackets were: 'Less than £15,000', '£15,000 - less than £25,000', '£25,000 - less than £35,000', '£35,000 - less than £45,000', '£45,000 - less than £55,000', '£55,000 or more', 'I don't know', 'Prefer not to state'. For the analysis these two variables were treated as continuous variables by using the middle value of the brackets and an upper age of 70 and income of £75,000.

†The category 'Unknown breed composition' was created by combining the following responses: 'A mixed breed without known parentage, but of a particular "type" (eg, Collie type or Collie cross)' and 'A mixture of different/unknown breeds ("heinz 57")'.

‡This category includes owners who intended to train their dogs to be sheep, cattle, gun, police/military, pest control, water rescue, search and rescue, and guard dogs.

household income increased the odds of a puppy being acquired under eight weeks of age decreased.

As the number of dogs in the household increased, the odds of being acquired under eight weeks of age increased. Owners who visited their puppy at least once before acquisition and owners who intended for their puppy to be a working dog (for example, a sheep, cattle, gun, police/military, pest control, water rescue, search and rescue, or guard dog) were more likely to obtain puppies under eight weeks of age.

Puppies were also significantly more likely to be acquired under eight weeks of age if they were of unknown breed composition compared with puppies that were pure bred puppies or a mix of two breeds.

The final multivariable logistic regression model (table 3) was found to correctly classify 75.3 per cent of cases, and the Hosmer and Lemeshow test provided evidence that the model was a reasonably good fit for the data (0.775).

Univariable analysis of puppy acquisition without viewing the mother

Table 4 summarises the univariable logistic regression analysis for factors associated with puppy acquisition without viewing the mother. There were 10 variables with a P value less than 0.2 identified for inclusion in the multivariable model-building process (after 'annual household income' was excluded as detailed in the Materials and methods section).

Multivariable analysis of puppy acquisition without viewing the mother

Four variables were retained in the final multivariable model (table 5). Owners who visited their puppy at least once prior to acquisition and owners who collected their puppy from the breeder's home were less likely to obtain a puppy without viewing the mother. Puppies that were Kennel Club registered also had decreased odds of being acquired without the mother being viewed. Owners who did not view the puppy's father had 12 times increased

odds of acquiring a puppy without viewing the mother compared with owners that viewed the father.

As the variable 'annual household income' was removed prior to the model-building process, it was forced into a reduced final model. However, no association was evident between annual income and acquisition of puppies without viewing the mother (P=0.546). Thus, annual income was not included the final multivariable model.

The final multivariable logistic regression model (table 5) was found to correctly classify 95.0 per cent of cases, and the Hosmer and Lemeshow test provided evidence that the model was a reasonably good fit for the data (0.805).

Discussion

Little research has been conducted to investigate puppy acquisition behaviour. This study utilised data from owners of puppies recruited to 'Generation Pup' (between May 2016 and February 2019) to explore acquisition age and whether the mother of the puppy was seen during the acquisition process.

Advice regarding minimum acquisition age was not being followed by a quarter of the cohort, as 461 puppies were reported to have been acquired under eight weeks of age. For this study, acquisition age was calculated using the owner-reported DOB for the puppy and the date that the puppy joined the household. Only dates reported by owners to be 'exact' were included in the analysis. Thus, acquisition age was calculated with a precision of one day. Determining an accurate acquisition age of a puppy relied on the breeder having given the owner correct information about the puppy's DOB and the owner recalling the DOB and acquisition date correctly. An attempt was made to minimise recall bias by asking the owner for the two dates in the third questionnaire which could be completed from birth to 16 weeks of age. By asking the owner for the two dates, rather than asking how old the puppy was when

Table 4 Univariable logistic regression model of odds ratios (ORs), 95 per cent confidence intervals (CIs) and P values of potential explanatory variables for acquisition of puppies without viewing the mother within the 'Generation Pup' cohort

Variable	Categories	Saw mother, n (%)	Did not see mother, n (%)	OR (95% CI)	P value
Owner gender	Male	170 (92.9)	13 (7.1)	1.00	
	Female	1524 (91.8)	136 (8.2)	1.17 (0.65 to 2.11)	0.608
Owner age	Continuous*			0.97 (0.87 to 1.10)	0.666
Previous dog ownership experience	Previous dog ownership experience as adult†	1187 (92.1)	102 (7.9)	1.00	
	First dog/first since childhood	506 (91.5)	47 (8.5)	1.08 (0.75 to 1.55)	0.673
Number of adults in household	Continuous			0.97 (0.79 to 1.19)	0.788
Number of children in household	Continuous			1.13 (0.94 to 1.36)	0.190
Highest level of education in household	A Levels/GCSE/O Levels/vocational qualifications/ no formal qualifications	446 (90.3)	48 (9.7)	1.00	
	Postgraduate degree/undergraduate degree/higher qualification (for example HND)	1248 (92.5)	101 (7.5)	0.75 (0.53 to 1.08)	0.121
Annual household income	Continuous *			0.88 (0.80 to 0.99)	0.033
Number of other dogs in household	Continuous			0.90 (0.77 to 1.06)	0.215
Dog sex	Male	872 (92.3)	73 (7.7)	1.00	
	Female	823 (91.5)	76 (8.5)	1.10 (0.79 to 1.54)	0.566
Purity of breed	Pure breed/mix of two specific breeds	1609 (92.8)	125 (7.2)	1.00	
	Unknown breed composition‡	86 (83.5)	17 (16.5)	2.54 (1.47 to 4.42)	0.001
Puppy is Kennel Club registered	No	850 (90.7)	87 (9.3)	1.00	
	Yes, registered	804 (94.7)	45 (5.3)	0.54 (0.38 to 0.79)	0.001
Source of puppy	Kennel Club/professional breeder	771 (93.6)	53 (6.4)	1.00	
	Hobby breeder	863 (94.5)	50 (5.5)	0.84 (0.57 to 1.26)	0.400
How many times owner met puppy before joining the household	First met puppy when acquired	342 (84.2)	64 (15.8)	1.00	
	At least once before acquisition	1353 (95.7)	61 (4.3)	0.24 (0.17 to 0.35)	<0.001
How the puppy was brought to the household	Delivered to household/collected from a location other than breeder's home	88 (65.2)	47 (34.8)	1.00	
	Collected from breeder's home	1607 (96.2)	63 (3.8)	0.07 (0.05 to 0.11)	<0.001
Acquired under eight weeks of age	Yes, acquired under eight weeks of age	431 (93.5)	30 (6.5)	1.00	
	No	1264 (91.4)	119 (8.6)	0.74 (0.49 to 1.12)	0.154
Father was seen when puppy was visited/acquired	Father was seen	623 (99.0)	6 (1.0)	1.00	
	Father was not seen	1072 (88.2)	143 (11.8)	13.85 (6.08 to 31.53)	<0.001
Owner intended puppy to be a family pet	No	47 (53.4)	41 (46.6)	1.00	
	Yes	1648 (93.8)	108 (6.2)	0.08 (0.05 to 0.12)	<0.001
Owner intended puppy to be a working dog§	No	1564 (91.5)	145 (8.5)	1.00	
	Yes	131 (97.0)	4 (3.0)	0.33 (0.12 to 0.90)	0.031

*Owners were asked to select an age and income bracket. For age, these brackets were: '16–24 years', '25–34 years', '35–44 years', '45–54 years', '55–64 years', '65 years and older' and 'Prefer not to state'. For income, these brackets were: 'Less than £15,000', '£15,000–less than £25,000', '£25,000–less than £35,000', '£35,000–less than £45,000', '£45,000–less than £55,000', '£55,000 or more', 'I don't know', 'Prefer not to state'. For the analysis these two variables were treated as continuous variables by using the middle value of the brackets and an upper age of 70 and income of £75,000.
 †The category 'Previous dog ownership experience as an adult' was created by combining the following responses: 'I have always owned a dog/s since having a family dog/s as a child', 'I have almost always had a dog/s – but with breaks for other life circumstances', 'I have had other dogs during my adult life'.
 ‡The category 'Unknown breed composition' was created by combining the following responses: 'A mixed breed without known parentage, but of a particular "type" (eg, Collie type or Collie cross)' and 'A mixture of different/unknown breeds ("heinz 57)".
 §This category includes owners who intended to train their dogs to be sheep, cattle, gun, police/military, pest control, water rescue, search and rescue, and guard dogs.

acquired, more accurate information was collected as owners were unable to 'round' the age to weeks.

The percentage of puppies in the 'Generation Pup' cohort that were acquired under eight weeks of age was

considerably higher than that reported by Packer and colleagues.⁹ A potential explanation for this is that the most common age for the dogs in their study was two to four years, therefore recall bias might have influenced

Table 5 Multivariable logistic regression model of odds ratios (ORs), 95 per cent confidence intervals (CIs) and P values of explanatory variables that were significantly associated with the acquisition of puppies without viewing the mother within the 'Generation Pup' cohort

Variable	Categories	Saw mother, n (%)	Did not see mother, n (%)	OR (95% CI)	P value
Puppy is Kennel Club registered	No	793 (92.2)	67 (7.8)	1.00	
	Yes, registered	765 (95.7)	34 (4.3)	0.53 (0.32 to 0.86)	0.011
How many times owner met puppy before joining the household	First met puppy when acquired	311 (85.0)	55 (15.0)	1.00	
	At least once before acquisition	1247 (96.4)	46 (3.6)	0.20 (0.12 to 0.32)	<0.001
How the puppy was brought to the household	Delivered to household/collected from a location other than breeder's home	76 (63.3)	44 (36.7)	1.00	
	Collected from breeder's home	1482 (96.3)	57 (3.7)	0.06 (0.04 to 0.10)	<0.001
Father was seen when puppy was visited/acquired	Father was seen	572 (99.0)	6 (1.0)	1.00	
	Father was not seen	986 (91.2)	95 (8.8)	12.45 (5.17 to 29.97)	<0.001

the accuracy of reported data. Also, some owners may have been aware, or become aware since acquiring their dog, of the minimum acquisition age recommendations and may have been influenced by social-desirability bias to report their dog's acquisition age as over eight weeks, or simply may have rounded the age up to eight weeks if the actual age was seven to eight weeks.

Of the puppies acquired under eight weeks of age, puppies were most commonly acquired between seven to eight weeks (≥ 49 and < 56 days) of age (figure 1), so this category was broken down into two sub-categories: up to 49 and less than 53 days; and up to 53 and less than 56 days. Despite 241 dogs being acquired between one and three days prior to the puppy turning eight weeks of age, these puppies were not excluded from the risk factor analysis due to the recommendations stating that puppies should not be acquired under eight weeks of age.

The percentage of puppies acquired without the mother being seen was 8.1 per cent (149/1844). This was considerably lower than the percentages reported by Packer and colleagues and Westgarth and colleagues.^{9 11} There are a couple of possible explanations for this. First, prospective puppy buyers may be more likely than ever before to request to view a puppy's mother (and breeders may be more likely to show the mother) due to large media campaigns such as 'Where's Mum?'.²⁴ Secondly, 'Generation Pup' participants may be more likely to follow advice on puppy acquisition than the wider puppy-acquiring population. This is suggested because the participants may have an interest in animal welfare evident from them joining a research project that aims to improve canine welfare.

A very small percentage of puppies, 1.6 per cent (30/1844) were acquired under eight weeks of age and without seeing the mother; of these, three were reported to have required hand-rearing.

Risk factor analysis of puppy acquisition under eight weeks of age

The final multivariable model identified five variables which were independently associated with the odds of a puppy being acquired under eight weeks of age (table 3).

Owners in the 'Generation Pup' cohort who visited their puppy at least once before acquisition were more likely to obtain puppies under eight weeks of age. Most owners, 77.7 per cent (1414/1820), visited their puppy at least once prior to acquisition; this is similar to the percentage (75.3 per cent) that Packer and colleagues reported.⁹ The reasons behind this association would be interesting to explore further. One potential explanation could be that owners who visited their puppy prior to acquisition felt, on seeing the puppy, it was old enough to be taken home even though it was not eight weeks of age, or simply they did not want to leave without taking the puppy with them. On a positive note, the reverse of

this finding is that owners who did not meet their puppy prior to acquisition were more likely to meet them for the first time when the puppy was over eight weeks of age.

Owners who intended for their puppy to be a working dog (for example, a sheep, cattle, gun, police/military, pest control, water rescue, search and rescue, or guard dog) were more likely to obtain puppies under eight weeks of age compared with owners who did not intend for their puppy to be a working dog. In a gun dog training guide, it states the ideal age to acquire a puppy is seven to eight weeks and emphasises the importance of viewing the mother.²⁵ Guides such as this may have shaped dog-owners' perceptions, and this finding would be interesting to explore further. It could be speculated that owners who were looking to acquire a working dog wanted to obtain a puppy under eight weeks of age so that they could begin training the puppy as early as possible.

The final multivariable model also indicated that as the number of dogs in the household increased, the odds of a puppy being acquired under eight weeks of age increased. It is speculated that owners with an existing dog(s) may have felt more able to care for a puppy under eight weeks of age due to their experiences with their other dog(s). One UK study revealed that around one fifth of prospective dog owners did not carry out research prior to acquisition, and the author suggested that some owners may consider themselves to have adequate experience and not in need of carrying out further research prior to acquisition.²⁶

Puppies were also more likely to be acquired under eight weeks of age if they were of unknown breed composition compared with puppies that were pure bred puppies or a mix of two breeds. A potential explanation for this association is that mixed breed puppies may be more likely to have been bred by a hobby breeder than a licensed breeder or be a result of an accidental mating. Hobby breeders do not need to conform to the same selling restrictions as licensed breeders.

The model indicated that as annual household income increased, the odds of a puppy being acquired under eight weeks of age decreased. This association is one that would be interesting to explore further and is difficult to speculate about.

Risk factor analysis of puppy acquisition without viewing the mother

The final multivariable model identified four variables which were independently associated with the odds of a puppy being acquired without the mother being seen (table 5).

Owners who visited their puppy at least once prior to acquisition and owners who collected their puppy from the breeder's home were less likely to acquire a puppy without viewing the mother. These associations could be expected as theoretically the owner had more

opportunities to meet the mother than owners who did not visit their puppy prior to acquisition and those who collected their puppy from a location other than the breeder's home. In a previous study, dog owners were asked to rank how important a list of attributes were when they acquired their dog. A correlation was reported between the importance of husbandry and viewing the parents of a dog. The authors suggested that prospective puppy owners who are interested in the puppy's previous husbandry will deem it important to view its parents.²⁷

Also, owners who visited their puppy at least once prior to acquisition, if adhering to purchasing recommendations and acquiring a puppy at a minimum of eight weeks of age, may well have viewed their puppy for the first time when it was a younger age and was potentially more likely to be with its mother.

It is worth considering the possibility that if a prospective owner went to view or collect a puppy from the breeder's home and the mother of the puppy was not there, they may not have obtained that puppy, thereby following purchasing recommendations. Alternatively, some prospective owners may have observed a maternal environment that was not ideal, or seen a puppy without its mother and chosen to home/'rescue' the puppy anyway. In addition, the benefit of viewing a puppy's mother may be masked where unscrupulous sellers show owners a 'stooge' mother.

The final multivariable model also identified puppies that were Kennel Club registered had decreased odds of being acquired without the mother being viewed. A potential explanation for this association is that Kennel Club registered puppies are more likely to have been bred by breeders belonging to the Kennel Club Assured Breeder Scheme and are potentially more likely to conform to guidelines/legislation.

The findings of this present study lend support to those reported by Westgarth and colleagues that when prospective owners saw at least one of the puppy's parents, it was most commonly only the mother and was rarely only the father.¹¹ Owners in the 'Generation Pup' cohort most commonly saw only the mother and there were only six occasions where only the father was seen. Owners who did not view the puppy's father had considerably increased odds of acquiring a puppy without viewing the mother. It makes sense that if the puppy has been removed from the mother then the father is also unlikely to be present.

Conclusion

Advice regarding minimum acquisition age was not followed by a quarter of this cohort. However, only a relatively low percentage of owners acquired a puppy without viewing the mother. It is speculated that prospective owners are potentially more aware of recommendations to view the mother than minimum acquisition age.

This study has identified potential characteristics of owners who were more likely to acquire a puppy against current acquisition recommendations. Targeting these specific owners with educational or media campaigns could decrease the proportion of puppies acquired in this way in the future, as it has been suggested that a more effective approach to communication/behaviour change is to segment the audience (depending on particular characteristics/beliefs) rather than a 'one size fits all' approach.²⁸

Future research within this longitudinal study will investigate the influence acquisition age has on various health/behaviour outcomes, with the potential to provide evidence for puppy purchasing recommendations regarding minimum age at acquisition.

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Disclaimer Software 1. IBM Corp. Released 2012. IBM SPSS Statistics for Windows, Version 25.0. Armonk, NY: IBM Corp 2. Sampsiz. <http://sampsiz.sourceforge.net/iface/index.html> (accessed 16 April 2019)

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