

# Confidence of veterinary surgeons in the United Kingdom in treating and diagnosing exotic pet species

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## Abstract

**Background** With exotic pet species commonplace in the UK, owners are increasingly seeking veterinary advice regarding the health and welfare of their small mammals and reptiles. This study aimed to assess the confidence of veterinarians in the UK in treating and diagnosing rabbits, guinea pigs, small mammals and reptiles.

**Methods** A 41-question survey was promoted via social media, including on interest groups focused specifically at veterinary professionals. A total of 131 practising veterinarians in the UK completed the questionnaire.

**Results** Frequency of presentation of exotic pets to a practice had a significant effect ( $P < 0.01$ ) on the confidence of veterinarians in treating them. Veterinarians who were presented with exotics more frequently had increased self-reported knowledge of their health and disease and were more confident in treating, diagnosing and anaesthetising them. Knowledge of and confidence in diagnosing and treating exotic pets were significantly less than for dogs and cats ( $P < 0.001$ ). There was a significant effect of length of time qualified on confidence in treating exotic pet species ( $P < 0.01$ ).

**Conclusions** Increased provision and engagement with continuing professional development may increase veterinary confidence in diagnosing, treating and anaesthetising exotic pet species that are less commonly encountered in practice.

## Introduction

Current figures indicate that 0.6 million rabbits, 0.4 million guinea pigs, 0.5 million small rodents (hamsters, gerbils and rats) and 0.8 million reptiles are kept as household pets in the UK.<sup>1</sup> While these numbers are much lower than reported for dogs (9.0 million) and cats (7.5 million), when combined they still represent a significant number (2.3 million) of animals that could be presented for veterinary treatment. These may also be conservative figures, as a recent survey conducted by the People's Dispensary for Sick Animals (PDSA) suggested that 0.9 million rabbits are currently owned in the UK.<sup>2</sup> Consequently, the demand for appropriate veterinary care of a range of exotic pet species has increased.<sup>3</sup> For diagnosis and treatment of exotic pet species to be successful, all veterinary staff should

have an understanding of species-specific normal and abnormal behaviour,<sup>3,4</sup> biology, husbandry and medical parameters, as well as be able to effectively monitor anaesthesia.<sup>5</sup> Furthermore, it has been proposed that the majority of health problems occurring in exotic species are due to inadequate husbandry provided by owners.<sup>6</sup> Therefore, it is crucial that veterinary surgeons provide practical education to owners regarding husbandry.<sup>7</sup> This is of particular importance considering that owners may obtain incorrect or contradictory information from internet resources.<sup>8,9</sup>

Current attitudes and knowledge towards exotic species are purportedly similar to cats 25 years prior, where treatment of the feline patient was still a relatively under-researched area with lower levels of veterinary confidence.<sup>10</sup> Concerns have also been raised regarding the lack of awareness of the differing clinical requirements among exotic species, with one author suggesting that treating guinea pigs (and other rodents) as 'small rabbits' is a common but harmful misconception that prevails among some clinicians.<sup>11</sup> Another factor that complicates the effective clinical treatment of exotic species is that many are prey species which exhibit a tendency to hide illness and pain better than cats and dogs.<sup>12,13</sup> Consequently, patients are often

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not seen by a veterinary surgeon until they are a critical case.<sup>3</sup> Studies have also demonstrated that during anaesthesia, the mortality rates of exotic patients are much higher than of cats and dogs,<sup>14 15</sup> possibly as a result of a smaller scope for elective surgeries and a lack of specific exotic patient anaesthetic equipment.<sup>15</sup>

It has been proposed to the American Veterinary Medical Association that the problem of lack of specialist knowledge among veterinary graduates in the USA could be mitigated through increased specialism in education and specific licences being allocated based on a student's chosen area of academic focus (including companion exotics as an option).<sup>16</sup> However, detractors suggest that this approach might prevent unanticipated career changes for graduates.<sup>17</sup> A questionnaire-based study conducted in the Netherlands identified a higher than anticipated percentage (10 per cent) of consultations involving exotic species and recommended that, in order to prepare veterinary students appropriately for companion animal practice, an attempt should be made to increase clinical exposure to avian and exotic animal diseases.<sup>18</sup>

Veterinarians in the UK are required to engage in mandatory continuing professional development (CPD).<sup>19</sup> In a study investigating the attitudes of veterinarians towards CPD in the UK, recent graduates were more intrinsically and extrinsically motivated to participate. Perceived barriers to participation in CPD included it not being provided at a convenient time, location or level, and a lack of workplace support.<sup>20</sup> If more recent graduates are more motivated to participate in CPD, it could be hypothesised that they are more confident in dealing with exotic pet species; conversely, more experienced graduates may have encountered more cases of these species in clinical practice over time.

The aim of this study was to investigate whether UK-based first-opinion veterinary surgeons report a lack of knowledge and confidence when dealing with exotic species and whether they feel willing and able to undertake CPD to increase their confidence when presented with these species in practice.

## Materials and methods

### Questionnaire distribution

A 41-question questionnaire was created and published online from January 2, 2019 to April 30, 2019. Distribution of the online survey was achieved via the social media site Facebook, alongside promotion by The Veterinary Times and the Rabbit Welfare Association and Fund. The questionnaire was also promoted directly to practices in which industry contacts had already been established. There was no incentive to complete the survey; it was entirely at the discretion of individuals as to whether they wished to participate in the research. Inclusion criteria dictated that participants had to be a currently practising Royal College of Veterinary Surgeons (RCVS) registered

veterinary surgeon resident within the UK and working in a first-opinion small animal or mixed practice.

### Informed consent

All participants were over the age of 18 and were required to read an informed consent paragraph before clicking to start the survey. The introductory paragraph also included information on the purpose of the survey and data protection. All participants were made aware that they had the right to withdraw their responses up to the point of data processing. Respondents were asked to create a unique six-digit identifier so that their responses could be identified if they wished to withdraw.

### Questionnaire design

The questionnaire included multiple-choice, Likert-scale and open-ended questions divided into four sections. The first section asked the respondents to provide some basic demographic information including the location of their practice, how long they had been qualified, their age and the country in which they completed their veterinary degree. The second section asked the respondents to provide some information about the frequency with which they are presented with different exotic species in practice. Options available included 'daily', 'twice weekly', 'weekly', 'fortnightly', 'monthly', 'yearly' and 'never'.

The third section asked the respondents to rate on a scale of 1 to 10 their knowledge and confidence in diagnosing and treating cats and dogs, rabbits, guinea pigs, small rodents (mice, rats, gerbils, hamsters and degus) and reptiles individually. For questions rating knowledge, 1 means least knowledgeable and 10 most knowledgeable. For questions rating confidence, 1 means not at all confident and 10 fully confident. For the question where the respondents were asked to rate their knowledge, feline and canine health and disease were separated, whereas for questions assessing confidence cats and dogs were combined.

In the final section, the respondents were asked what they thought were the main barriers to developing knowledge confidence in treating exotic pet species presented within practice (eg, low numbers of these pets seen in practice, lack of interest in these species among veterinary professionals). The respondents were asked to state whether they felt current opportunities for exotic pet CPD were sufficient, whether they would be interested in engaging with further CPD and if their veterinary degree had contained sufficient content on these species. Veterinarians were also asked to state whether they felt that exotic patient welfare is compromised by a lack of knowledge and confidence among veterinary professionals.

### Data analysis

Data collected were non-parametric due to the categorical and ordinal options for questions. All

statistical analyses were performed in the statistical software package R V.3.5.1, packages FSA, plyr, pastecs and PMCMR.<sup>21</sup> The effect of demographic factors and frequency of species presented to the practice on veterinary confidence was tested using Kruskal-Wallis tests. Where categories contained five or less respondents, these were removed from statistical analysis. Where significance was identified in the main test ( $P < 0.05$ ), Dunn's post-hoc tests with the Bonferroni correction applied were used to identify significant differences between categories; reported adjusted  $P$  values were significant at  $P < 0.05$ . To test for an effect of species on veterinary confidence, a Friedman analysis of variance was performed, and where significant differences were identified a Nemenyi post-hoc was performed; this test is conservative and accounts for a family-wise error, hence no  $P$  value adjustment was performed.

## Results

A total of 131 respondents completed the questionnaire in full. These were all practising veterinary surgeons working in first-opinion small animal practice in the UK.

### Respondent demographics

The majority of respondents were from England (80.92 per cent;  $n=106$ ), with the remainder split between Wales (8.40 per cent;  $n=11$ ), Scotland (7.63 per cent;  $n=10$ ) and Northern Ireland (3.05 per cent;  $n=4$ ). Of the respondents, 12.2 per cent ( $n=16$ ) were male, 85.50 per cent ( $n=112$ ) were female and 2.29 per cent ( $n=3$ ) preferred not to say. Of the respondents, 43.51 per cent ( $n=57$ ) were aged 21–30, 31.30 per cent ( $n=41$ ) were aged 31–40, 15.27 per cent ( $n=20$ ) were aged 41–50,

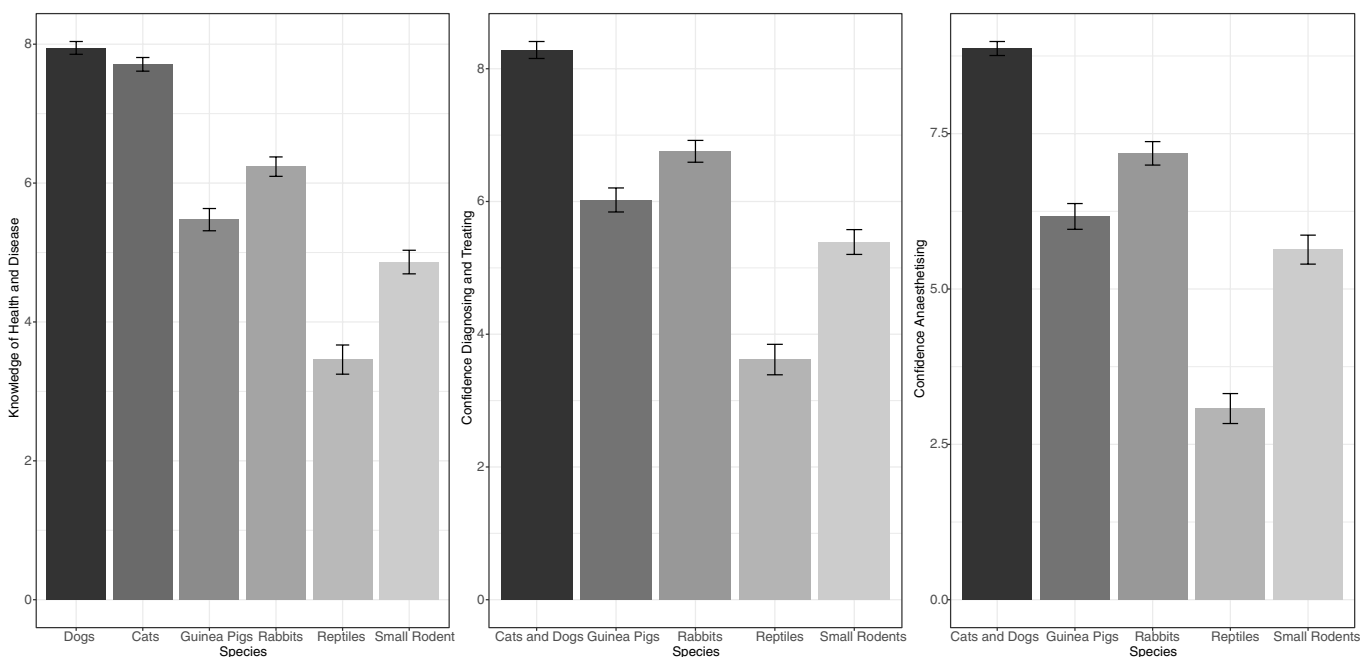
and 8.40 per cent ( $n=11$ ) were aged 51–60. The length of time respondents had been qualified varied, with 9.16 per cent ( $n=12$ ) qualified for less than one year, 29.01 per cent ( $n=38$ ) qualified between one and five years, 24.43 per cent ( $n=32$ ) qualified between six and 10 years, 12.98 per cent ( $n=17$ ) qualified between 11 and 15 years, 9.16 per cent ( $n=12$ ) qualified between 16 and 20 years, and 15.28 per cent ( $n=20$ ) qualified over 20 years.

### Effect of species on knowledge and confidence in diagnosis, treatment and anaesthesia

Species had a significant main effect on a veterinarian's self-rated knowledge of health and disease ( $X^2_5=479.62$ ,  $P < 0.001$ ; [figure 1](#)). There was no significant difference between knowledge of canine and feline health and disease ( $P=0.735$ ). There were significant differences ( $P < 0.05$ ) in knowledge of health and disease of all other species ([table 1](#)). Species had a significant main effect on a veterinarian's confidence in treating and diagnosing ( $X^2_4=383.33$ ,  $P < 0.001$ ; [figure 1](#)). There were significant differences ( $P < 0.05$ ) in confidence in treating and diagnosing all species ([table 1](#)). Species had a significant main effect on a veterinarian's confidence in anaesthetising ( $X^2_4=389.46$ ,  $P < 0.001$ ; [figure 1](#)). There was no significant difference in confidence in anaesthetising guinea pigs and small rodents ( $P=0.340$ ). There were significant differences in confidence in anaesthetising all other species ([table 1](#)).

### Effect of the frequency of exotic pets seen on knowledge and confidence in diagnosis, treatment and anaesthesia

The frequency of presentation of different exotic pet species is shown in [table 2](#).



**Figure 1** Species difference in veterinary knowledge and confidence. Mean values are shown for knowledge of health and disease, confidence in diagnosing and treating, and confidence in anaesthetising all species. Error bars represent standard error of the mean. Knowledge and confidence were rated on a scale of 1 to 10. For knowledge, 1 means least knowledgeable and 10 means most knowledgeable. For questions rating confidence, 1 means not at all confident and 10 means fully confident.

**Table 1** Pairwise comparisons of the effect of species on knowledge of health and disease, confidence in treating and diagnosing, and confidence in anaesthetising

Knowledge of health and disease					
	Dogs	Rabbits	Guinea pigs	Small rodents	Reptiles
Cats	0.735	<0.001***	<0.001***	<0.001***	<0.001***
Dogs	–	<0.001***	<0.001***	<0.001***	<0.001***
Rabbits	–	–	0.002**	<0.001***	<0.001***
Guinea pigs	–	–	–	0.024*	<0.001***
Small rodents	–	–	–	–	0.019*
Confidence in treating and diagnosing					
	Rabbits	Guinea pigs	Small rodents	Reptiles	
Cats and dogs	<0.001***	<0.001***	<0.001***	<0.001***	
Rabbits	–	<0.001***	<0.001***	<0.001***	
Guinea pigs	–	–	0.005**	<0.001***	
Small rodents	–	–	–	<0.001***	
Confidence in anaesthetising					
	Rabbits	Guinea pigs	Small rodents	Reptiles	
Cats and dogs	<0.001***	<0.001***	<0.001***	<0.001***	
Rabbits	–	<0.001***	<0.001***	<0.001***	
Guinea pigs	–	–	–	0.340	
Small rodents	–	–	–	<0.001***	

Exact P values are shown apart from P<0.001. Reported P values are significant at \*P<0.05, \*\*P<0.01 and \*\*\*P<0.001.  
Categories with less than or equal to five respondents were not included in statistical analysis.

### Rabbits

Frequency of rabbits seen had a significant main effect ( $X^2_4=30.24$ ,  $P<0.001$ ) on knowledge of rabbit health and disease. It also had a significant main effect ( $X^2_4=24.14$ ,  $P<0.001$ ) on confidence in diagnosing and treating rabbits and a significant main effect ( $X^2_4=30.95$ ,  $P<0.001$ ) on confidence in anaesthetising rabbits. Overall, veterinarians who were presented with rabbits more frequently rated themselves as more knowledgeable and more confident in treating, diagnosing and anaesthetising them. Significant effects ( $P<0.05$ ) of frequency of presentation on knowledge of health and disease, confidence in treating and diagnosing, and confidence in anaesthetising are shown in [table 3](#).

### Guinea pigs

Frequency of guinea pigs seen had a significant main effect ( $X^2_4=28.18$ ,  $P<0.001$ ) on knowledge of guinea pig health and disease. It also had a significant main effect ( $X^2_4=19.31$ ,  $P<0.001$ ) on confidence in diagnosing and treating guinea pigs and a significant main effect

**Table 3** Pairwise comparisons of the effect of frequency of presentation on knowledge of rabbit health and disease, confidence in treating and diagnosing, and confidence in anaesthetising

Knowledge of health and disease				
	Twice weekly	Weekly	Fortnightly	Monthly
Daily	0.437	0.027*	0.004**	<0.001***
Twice weekly	–	0.403	0.177	0.004**
Weekly	–	–	0.515	0.223
Fortnightly	–	–	–	0.333
Confidence in treating and diagnosing				
	Twice weekly	Weekly	Fortnightly	Monthly
Daily	0.257	0.216	0.048*	<0.001***
Twice weekly	–	0.760	0.853	0.017*
Weekly	–	–	0.978	0.067
Fortnightly	–	–	–	0.219
Confidence in anaesthetising				
	Twice weekly	Weekly	Fortnightly	Monthly
Daily	0.312	0.102	0.087	<0.001***
Twice weekly	–	0.762	1.000	<0.001***
Weekly	–	–	0.948	0.022*
Fortnightly	–	–	–	0.028*

Exact adjusted P values are shown apart from P<0.001. Reported P values are significant at \*P<0.05, \*\*P<0.01 and \*\*\*P<0.001.  
Categories with less than or equal to five respondents were not included in statistical analysis.

( $X^2_4=25.27$ ,  $P<0.001$ ) on confidence in anaesthetising guinea pigs. Overall, veterinarians who were presented with guinea pigs more frequently rated themselves as more knowledgeable and more confident in treating, diagnosing and anaesthetising them. Significant effects ( $P<0.05$ ) of frequency of presentation on knowledge of health and disease, confidence in treating and diagnosing, and confidence in anaesthetising are shown in [table 4](#).

### Small rodents (mice, gerbils, rats, hamsters and degus)

Frequency of small rodents seen had a significant main effect ( $X^2_5=29.44$ ,  $P<0.001$ ) on knowledge of small rodent health and disease. It also had a significant main effect ( $X^2_5=27.52$ ,  $P<0.001$ ) on confidence in diagnosing and treating small rodents and a significant main effect ( $X^2_5=19.12$ ,  $P<0.01$ ) on confidence in anaesthetising small rodents. Overall, veterinarians who were presented with small rodents more frequently rated themselves as more knowledgeable and more confident in treating, diagnosing and anaesthetising them. Significant effects ( $P<0.05$ ) of frequency of

**Table 2** Frequency of presentation of exotic pet species to the veterinary practice

Species	Frequency of presentation						
	Daily	Twice weekly	Weekly	Fortnightly	Monthly	Yearly	Never
Rabbits	42 (32.00)	35 (26.72)	20 (15.27)	18 (13.74)	13 (9.99)	2 (1.15)	1 (0.76)
Guinea pigs	12 (9.16)	34 (25.95)	23 (17.56)	26 (19.85)	32 (24.43)	2 (1.15)	2 (1.15)
Small rodents	9 (6.87)	24 (18.32)	20 (15.27)	28 (21.37)	40 (30.53)	9 (6.87)	1 (0.76)
Reptiles	7 (5.34)	9 (6.87)	7 (5.34)	6 (4.58)	27 (20.61)	45 (34.35)	30 (22.90)

The percentage of veterinarians (out of a total of 131) who selected each category is indicated in parentheses after the number of respondents.  
Categories with less than or equal to five respondents were not included in statistical analysis.

**Table 4** Pairwise comparisons of the effect of frequency of presentation on knowledge of guinea pig health and disease, confidence in treating and diagnosing, and confidence in anaesthetising

Knowledge of health and disease				
	Twice weekly	Weekly	Fortnightly	Monthly
Daily	0.388	0.021*	0.285	<0.001***
Twice weekly	–	0.251	0.552	<0.001***
Weekly	–	–	0.337	0.414
Fortnightly	–	–	–	0.018*
Confidence in treating and diagnosing				
	Twice weekly	Weekly	Fortnightly	Monthly
Daily	0.824	0.725	0.778	0.004**
Twice weekly	–	1.000	1.000	0.002**
Weekly	–	–	0.843	0.137
Fortnightly	–	–	–	0.068
Confidence in anaesthetising				
	Twice weekly	Weekly	Fortnightly	Monthly
Daily	0.628	0.127	0.357	0.002**
Twice weekly	–	0.096	0.293	<0.001***
Weekly	–	–	0.917	0.423
Fortnightly	–	–	–	0.119

Exact adjusted P values are shown apart from P<0.001. Reported P values are significant at \*P<0.05, \*\*P<0.01 and \*\*\*P<0.001.

presentation on knowledge of health and disease, confidence in treating and diagnosing, and confidence in anaesthetising are shown in [table 5](#).

### Reptiles

Frequency of reptiles seen had a significant main effect ( $X^2_6=66.96$ ,  $P<0.001$ ) on knowledge of reptile health and disease. It also had a significant main effect

**Table 5** Pairwise comparisons of the effect of frequency of presentation on knowledge of small rodents health and disease, confidence in treating and diagnosing, and confidence in anaesthetising

Knowledge of health and disease					
	Twice weekly	Weekly	Fortnightly	Monthly	Yearly
Daily	0.567	0.019*	0.010*	0.002**	<0.001***
Twice weekly	–	0.213	0.101	0.019*	0.003**
Weekly	–	–	0.905	1.000	0.330
Fortnightly	–	–	–	1.000	0.386
Monthly	–	–	–	–	0.439
Confidence in treating and diagnosing					
	Twice weekly	Weekly	Fortnightly	Monthly	Yearly
Daily	0.581	0.085	0.032*	<0.05*	<0.001***
Twice weekly	–	0.560	0.208	0.106	<0.001***
Weekly	–	–	1.000	1.000	0.066
Fortnightly	–	–	–	0.850	0.080
Monthly	–	–	–	–	0.076
Confidence in anaesthetising					
	Twice weekly	Weekly	Fortnightly	Monthly	Yearly
Daily	0.802	0.221	0.033*	0.022*	0.004**
Twice weekly	–	1.000	0.422	0.339	0.054
Weekly	–	–	0.893	1.000	0.428
Fortnightly	–	–	–	0.971	0.676
Monthly	–	–	–	–	0.760

Exact adjusted P values are shown apart from P<0.001. Reported P values are significant at \*P<0.05, \*\*P<0.01 and \*\*\*P<0.001.  
Categories with less than or equal to five respondents were not included in statistical analysis.

( $X^2_6=66.38$ ,  $P<0.001$ ) on confidence in diagnosing and treating reptiles and a significant main effect ( $X^2_6=68.63$ ,  $P<0.001$ ) on confidence in anaesthetising reptiles. Overall, veterinarians who were presented with reptiles more frequently rated themselves as more knowledgeable and more confident in treating, diagnosing and anaesthetising them. Significant effects ( $P<0.05$ ) of frequency of presentation on knowledge of health and disease, confidence in treating and diagnosing, and confidence in anaesthetising are shown in [table 6](#).

### Effect of length of time qualified on knowledge and confidence in diagnosis, treatment and anaesthesia Rabbits

Length of time qualified had a significant main effect ( $X^2_6=26.44$ ,  $P<0.001$ ) on knowledge of rabbit health and disease. Veterinarians who had been qualified less than a year ( $P=0.018$ ) or between one and five years ( $P=0.015$ ) rated themselves as significantly less knowledgeable of rabbit health and disease as those who had been qualified between 16 and 20 years. Length of time qualified also had a significant main effect ( $X^2_6=27.37$ ,  $P<0.001$ ) on confidence in diagnosing and treating rabbits. Veterinarians who had been qualified less than a year were less confident than those who had been qualified between 11 and 15 years ( $P=0.014$ ), between 16 and 20 years ( $P=0.002$ ), and between 21 and 25 years ( $P=0.015$ ). Veterinarians who had been qualified between one and five years were significantly less confident than those who had been qualified between 16 and 20 years ( $P=0.015$ ). Length of time qualified also had a significant main effect ( $X^2_6=29.56$ ,  $P<0.001$ ) on confidence in anaesthetising rabbits. Veterinarians who had been qualified less than a year were less confident anaesthetising rabbits than those who had been qualified between 11 and 15 years ( $P<0.001$ ) and between 16 and 20 years ( $P=0.006$ ). Veterinarians who had been qualified between one and five years were significantly less confident than those who had been qualified between 11 and 15 years ( $P=0.005$ ) and those between 16 and 20 years ( $P=0.014$ ).

### Guinea pigs

Length of time qualified had a significant main effect ( $X^2_6=21.85$ ,  $P<0.01$ ) on knowledge of guinea pig health and disease. Veterinarians who had been qualified less than a year ( $P=0.037$ ) or between one and five years ( $P=0.037$ ) were significantly less knowledgeable than those who had been qualified between 11 and 15 years. Length of time qualified also had a significant main effect ( $X^2_6=20.29$ ,  $P<0.01$ ) on confidence in diagnosing and treating guinea pigs. Veterinarians who had been qualified less than a year were significantly less confident in diagnosing and treating guinea pigs than those who had been qualified between six and 10 years ( $P=0.048$ )

**Table 6** Pairwise comparisons of the effect of frequency of presentation on knowledge of reptile health and disease, confidence in treating and diagnosing, and confidence in anaesthetising

Knowledge of health and disease						
	Twice weekly	Weekly	Fortnightly	Monthly	Yearly	Never
Daily	1.000	1.000	1.000	0.576	<0.001***	<0.001***
Twice weekly	–	0.972	1.000	1.000	0.003**	<0.001***
Weekly	–	–	1.000	1.000	0.014*	<0.001***
Fortnightly	–	–	–	1.000	0.034*	0.003**
Monthly	–	–	–	–	<0.001***	<0.001***
Confidence in treating and diagnosing						
	Twice weekly	Weekly	Fortnightly	Monthly	Yearly	Never
Daily	1.000	1.000	1.000	0.394	<0.001***	<0.001***
Twice weekly	–	1.000	1.000	1.000	0.006**	<0.001***
Weekly	–	–	0.905	1.000	0.006**	<0.001***
Fortnightly	–	–	–	1.000	0.024*	0.002**
Monthly	–	–	–	–	0.001**	<0.001***
Confidence in anaesthetising						
	Twice weekly	Weekly	Fortnightly	Monthly	Yearly	Never
Daily	0.848	0.390	0.748	0.048*	<0.001***	<0.001***
Twice weekly	–	1.000	0.875	1.000	0.006**	<0.001***
Weekly	–	–	1.000	1.000	0.148	<0.01***
Fortnightly	–	–	–	1.000	0.064	0.008**
Monthly	–	–	–	–	0.005**	<0.001***
Yearly	–	–	–	–	–	0.557

Exact adjusted P values are shown apart from P<0.001. Reported P values are significant at \*P<0.05, \*\*P<0.01 and \*\*\*P<0.001. Categories with less than or equal to five respondents were not included in statistical analysis.

or between 11 and 15 years (P=0.022). Length of time qualified also had a significant main effect ( $X^2_6=31.71$ , P<0.001) on confidence in anaesthetising guinea pigs. Veterinarians who had been qualified for less than a year were significantly less confident anaesthetising guinea pigs than those who had been qualified between 11 and 15 years (P<0.001), between 16 and 20 years (P=0.009), and between 21 and 25 years (P=0.027). Veterinarians who had been qualified between one and five years were significantly less confident than those who had been qualified between 11 and 15 years (P=0.001).

#### Small rodents

Length of time qualified had a significant main effect ( $X^2_6=27.56$ , P<0.001) on knowledge of small rodent health and disease. Veterinarians who had been qualified between one and five years were significantly less knowledgeable than those who had been qualified between 11 and 15 years (P=0.01) and between 16 and 20 years (P=0.03). Length of time qualified also had a significant main effect ( $X^2_6=21.91$ , P<0.001) on confidence in diagnosing and treating small rodents. Veterinarians who had been qualified for less than a year or between one and five years were significantly less confident in diagnosing and treating small rodents than those who had been qualified between 11 and 15 years (P=0.048) and between 16 and 20 years (P=0.033). Length of time qualified also had a significant main effect ( $X^2_6=32.23$ , P<0.001) on confidence in anaesthetising small rodents. Veterinarians who had been qualified

for less than a year were significantly less confident in anaesthetising small rodents than those who had been qualified between 11 and 15 years (P=0.004) and between 16 and 20 years (P=0.004). Veterinarians who had been qualified between one and five years were significantly less confident than those who had been qualified between 11 and 15 years (P=0.004) and between 16 and 20 years (P=0.006).

#### Reptiles

Length of time qualified had no significant effect on knowledge of reptile health and disease ( $X^2_6=10.92$ , P>0.05). It also had no significant effect on confidence in diagnosing and treating reptiles ( $X^2_6=10.12$ , P>0.05). Length of time qualified had a significant main effect on confidence in anaesthetising reptiles ( $X^2_6=14.33$ , P<0.05). Veterinarians who had been qualified between one and five years were significantly less confident anaesthetising reptiles than those who had been qualified between 16 and 20 years (P=0.039).

#### CPD and training

The majority of respondents (42.75 per cent; n=56) disagreed that there was adequate content in their veterinary degree on exotic pets, with 29.77 per cent (n=39) strongly disagreeing, 13.74 per cent (n=18) agreeing, 10.69 per cent (n=14) neither agreeing nor disagreeing, and 3.05 per cent (n=4) strongly agreeing. The majority of respondents agreed (36.66 per cent; n=48) that they had sufficient access to exotic pet CPD, 28.24 per cent (n=37) disagreed, 25.20 per cent (n=33)

neither agreed nor disagreed, and 9.92 per cent (n=13) strongly agreed. The majority of respondents (86.26 per cent; n=113) stated that they would be interested in further training opportunities focused specifically on exotic pet health and welfare, with 13.74 per cent (n=18) stating that they would not be interested in this.

When questioned on what they felt was the main barrier to development of confidence and knowledge in the diagnosis and treatment of exotic pet species, the majority (44.27 per cent; n=58) of respondents selected 'exotic species seen too infrequently in practice to build experience', 27.48 per cent (n=36) chose 'lack of interest in these species amongst veterinary professionals', and 15.27 per cent (n=20) chose 'lack of content in degree/university degree programme'. The remaining responses (12.98 per cent; n=17) were split between other categories which included options such as 'no career benefit' and 'limited time for study'. The majority of respondents agreed (72.75 per cent; n=56) that a lack of confidence and knowledge among veterinary professionals compromises the welfare of exotic pet species, 29.77 per cent (n=39) strongly agreed, 16.03 per cent (n=21) neither agreed nor disagreed, 9.16 per cent (n=12) disagreed, and 2.29 per cent (n=3) strongly disagreed.

## Discussion

In the present study, veterinarians who saw exotic pet species more frequently were more confident in treating, diagnosing and anaesthetising them. Veterinarians who saw rabbits daily rated themselves as significantly more knowledgeable on their health and disease and were more confident in diagnosis, treatment and anaesthesia than those who saw rabbits less frequently. Rabbits were seen more frequently than any other exotic pet species, with the majority of veterinarians surveyed reporting that they saw them daily. However, veterinarians were still significantly less confident in diagnosing, treating and anaesthetising rabbits than cats and dogs. Veterinarians cited lack of frequency of presentation of exotic pet species as the main barrier to them improving their confidence and knowledge, yet rabbits were seen relatively frequently. However, this question was not subdivided for different species, so there may have been different barriers for species seen more frequently (eg, rabbits) compared with reptiles which most respondents saw yearly. In this survey, the authors did not question veterinarians on how often they saw cats and dogs, but research has shown them to be presented more frequently than rabbits and other species.<sup>22</sup> It is suggested that perhaps seeing a case daily is insufficient to build knowledge through experiential learning as has been reported for other species.<sup>23</sup> The majority of respondents to this survey disagreed that there was sufficient content on exotic pets within the veterinary degree, which supports research that suggests that recent graduates need to obtain a number

of clinical skills in their first year in practice as opposed to from taught content.<sup>24,25</sup> Therefore, it can be proposed that more formalised taught content in veterinary degrees may be beneficial in building confidence rather than reliance on experience gained during clinical placements and post-graduation.

The second most frequently seen species was guinea pigs, followed by small rodents, then reptiles, which is in agreement with current pet ownership statistics for the UK.<sup>12</sup> Veterinarians who saw guinea pigs more frequently were more confident in their knowledge and ability. The majority of respondents stated that they saw guinea pigs twice weekly, yet veterinarians were significantly less confident in all areas for this species than for rabbits. This suggests that the difference between presentation daily and twice weekly may result in decreased levels of knowledge and confidence. Rabbits and guinea pigs represent a substantial proportion of patients being presented to the veterinary practice, and there is a legislative responsibility for veterinarians to ensure that they are up to date with developments in the care of these species.<sup>26</sup> Over a quarter of respondents felt that a lack of interest in exotic pet species was the greatest barrier to development of knowledge and confidence, yet the majority stated that they would be interested in further CPD opportunities if available. This is positive as CPD enables veterinarians to adapt to developments in the profession and deliver the high quality of care that owners expect.<sup>19</sup> Consequently, exotic pet-specific CPD needs to be convenient<sup>20</sup> in addition to practices encouraging exotic interests within the team to develop areas of specialism. Previous research has suggested that increased clinical exposure to exotic species is required for veterinary students and that veterinary curricula should reflect the increasing importance of these species.<sup>18</sup>

Veterinarians who had been qualified between 11 and 20 years were the most knowledgeable and confident demographic in treating, diagnosing and anaesthetising exotic pet species. Interestingly, with the exception of treating and diagnosing guinea pigs, veterinarians who had been qualified between six and 11 years were no more confident or knowledgeable than those who had been qualified less than six years. However, caution must be maintained in the interpretation of knowledge data as these were self-reported, and more confident, experienced clinicians may perceive themselves to be more knowledgeable than those who have recently graduated. However, veterinarians who had been qualified for longer than 20 years rated themselves as no more knowledgeable or confident than recent graduates. It has been proposed that recent graduates should be provided with appropriate CPD and examples of good practice from experienced veterinarians to build their confidence and knowledge in a supportive environment.<sup>27</sup> The exception to length of time qualified having a

significant effect on knowledge and confidence was in diagnosing and treating reptiles. This is likely related to the infrequent presentation of reptiles and possibly due to veterinarians referring reptiles to a specialist rather than treating and diagnosing them themselves. The Royal Society for the Prevention of Cruelty to Animals (RSPCA) recommends identifying a reptile veterinarian before purchasing a reptile, whereas they do not specify the requirement for an exotic specialist veterinarian in their guidance on pet rodents or rabbits.<sup>28</sup>

Knowledge of and confidence in treating, diagnosing and anaesthetising exotic pet species were significantly less than for cats and dogs, with the majority of respondents agreeing that this represented a welfare concern for these species. Consequently, work needs to be done to understand how this can be addressed, particularly for rabbits and guinea pigs which are seen frequently by small animal vets. This survey only surveyed 131 veterinarians practising within the UK, and as such the results are not generalisable to all clinicians within the UK, with further research required to identify whether the results are consistent with other countries. Future work could assess the knowledge of veterinarians surrounding the health and disease of these species to identify a potential skills gap.

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**Data availability statement** All data relevant to the study are included in the article or uploaded as supplementary information. The authors are happy to provide the full version of the questionnaire to interested parties. Please contact the corresponding author for further details.

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