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Vet Record

ORIGINAL RESEARCH

Audit of animal-related injuries at UK veterinary schools between 2009 and 2018

John S. P. Tulloch[1] | **Kate M. Fleming**[2] | **Gina Pinchbeck**[1] | **Julie Forster**[3] | **Walter Lowe**[4] | **Carri Westgarth**[1]

[1]Institute of Infection, Veterinary and Ecological Sciences, University of Liverpool, Liverpool, UK

[2]Institute of Population Health, University of Liverpool, Liverpool, UK

[3]Royal Veterinary College, Hatfield, UK

[4]The Royal (Dick) School of Veterinary Studies, University of Edinburgh, Edinburgh, UK

Correspondence
John S.P. Tulloch, Institute of Infection, Veterinary and Ecological Sciences, University of Liverpool, Liverpool, UK.
Email: jtulloch@liverpool.ac.uk

Abstract

Background: Animal-related injuries pose a significant risk to the veterinary profession. This study aimed to describe the incidence, demographics, context and consequences of animal-related injuries at UK veterinary schools.

Methods: A multicentre audit of accident records (2009–2018) across five UK veterinary schools was performed. Injury rates were stratified by school, demographics and species. The context and cause of the injury were described. Multivariable logistic models explored factors associated with medical treatment, hospital visits and time off work.

Results: An annual rate of 2.60 (95% confidence interval 2.48–2.72) injuries per 100 graduating students was calculated, varying between veterinary schools. Injuries were more frequently recorded in staff than students, and there were significant differences between staff and students in the activities performed preceding injury. Cats and dogs were associated with the highest number of reported injuries. However, injuries associated with cattle and horses were the most severe, with significantly higher hospital attendances and more time off work taken.

Limitations: Data were based on reported injuries and likely underestimate the true injury rate. The population at risk was hard to quantify as population size and exposure were variable.

Conclusion: Further research is recommended to explore the clinical and workplace management, including recording culture, of animal-related injuries among veterinary professionals.

INTRODUCTION

The veterinary profession is one of the most hazardous professions in the UK, especially for equine veterinarians.[1] Veterinarians have three times the risk of accidents compared to medical general practitioners, which increases to nine times when comparing severe injuries.[2] In 2019, a British Veterinary Association survey of UK veterinarians found that 61% of livestock veterinarians, 65% of equine veterinarians and 66% of companion animal veterinarians had reported receiving injuries in the preceding year.[3] These injuries were primarily animal related.[1,2,4–6] Large animals posed the greatest risk,[2,7,8] with one study estimating that large animals were five times more likely to lead to an injury than companion animals,[8] and another describing that fractures were more than 10 times more frequent in large animal veterinarians than in companion animal veterinarians.[2]

Veterinary schools are an environment where new members of the profession learn how to interact with, and perform procedures on, animals as safely as possible and within current best practice. However, newly graduated veterinarians are potentially at most risk of injuries caused by animals.[7–9] This has been attributed solely to a lack of experience. However, despite numerous cross-sectional studies of veterinarians, it is unknown whether the risk of injury is inherent to the animal or due to certain human behaviours or veterinary procedures, perhaps inadvertently learnt in veterinary school. Only one study has investigated animal-related injuries in veterinary students.[10] It focused exclusively on horse-related injuries and found that 9% of students were injured during their

studies in Australia. It is unknown how animal-related injuries present at veterinary schools and whether there are any differences in the cause and types of injuries between staff and students. Therefore, the aim of this audit was to describe the incidence, demographics, context and consequences of animal-related injuries in staff and students at UK veterinary schools.

MATERIALS AND METHODS

UK veterinary schools that awarded Royal College of Veterinary Surgeons (RCVS)-accredited degrees between 2009 and 2018 (n = 7) were invited to take part in the audit. To keep universities non-identifiable, each participating university was randomly assigned an alphabetical code to represent them. Anonymised records were extracted from accident records covering the period between 1 January 2009 and 31 December 2018 if they mentioned animal involvement. Each record was read and categorised into injured person (IP) demographics, accident details and medical consequences. Information captured within IP demographics included date of injury, role (classified as staff, student or visitor), age, sex and location of the injury. Staff were not stratified into job roles as most records did not specify this; however, the context of the injuries led us to assume that they would have been working in clinical settings and most likely to have been veterinarians or nurses. Accident detail data included species involved, whether the animal was alive or dead at the point of injury, activity at the point of injury, injury cause (i.e., kick, bite), injury type (i.e., puncture, sprain) and anatomical location. The 'free animal' category within the 'activity at the point of injury' variable was defined as an animal that was not receiving any sort of procedure, mainly animals being walked or waiting (e.g., 'While grazing, the horse became agitated and kicked student in the stomach', 'Dog, with no warning, bit owner while waiting in reception'). Categories within the 'injury cause' variable included 'crushed by object'—when an animal caused an object to crush an IP ('Cow swung round hitting gate. Gate hit individual's head crushing head against a wall') and 'crushed by animal'—when an animal directly crushes the IP ('Taking rug off horse, horse moved and stepped on foot'). Medical consequences included time off work for staff, whether the IP received medical treatment or whether they subsequently visited a hospital. Receiving medical treatment meant any form of treatment, from receiving first aid to a visit to a primary care or walk-in centre. Only staff have a legal responsibility to record time off work; the Reporting of Injuries, Diseases and Dangerous Occurrences Regulations 2013 require an accident record to be kept where an accident results in time off work of more than 3 consecutive days and a report made if absence is more than 7 days.[11,12] Accident records are kept for all reported accidents; however, students are not employees, and therefore, there is no legal requirement for time taken off the course to be recorded.

An overall injury rate was calculated and stratified by year and veterinary school. Defining the denominator population (the total number of people at risk at each university) was difficult as this not only included all veterinary students and staff but also all associated professionals and all visitors (e.g., owners of animals, visiting scholars) who would have had animal contact and this information is simply not available. The total number of animals in university hospitals, laboratories and farms was a possible alternative denominator; however, ambulatory practice is an important part of a veterinary school. To calculate the number of horses in every yard and the number of animals on all farms visited was not possible. A proxy measure, the number of graduating veterinary students per year, based on the RCVS's published figures,[13] was instead used as we believe it to be proportionate to the size of the veterinary school and therefore the number of people exposed and the number of animals treated. This proxy measure ensures that veterinary schools remain unidentifiable when readers interpret the results, and any assumptions about an association between the number of injuries and the size of a veterinary school can be ignored. Additionally, to ensure that individual universities cannot be identified by the results, the number of injuries recorded at each university cannot be disclosed.

Injuries were defined as being related to either a dead or a living animal. For each category, injury rates were compared between universities, IP roles and species involved, and the overall injury rate was calculated. Multivariable logistic regression was performed using the injured dataset to see whether these variables, and year, were associated with the IP receiving medical treatment or visiting a hospital. Multivariable logistic regression was performed to see whether animal species, university and year were associated with a staff IP taking any time off work. Substantive knowledge was used to select the models with the best fit (only these will be presented). All models were checked for the presence of any interaction terms. On all three models, Hosmer–Lemeshow tests were performed to assess goodness of fit.

Datasets for each of the most prevalent animal species were created. The role of the IP, activity at the point of injury, injury cause, injury type and anatomical location were described and stratified according to whether the IP received medical treatment or visited a hospital. Differences in the prevalence of activities at the point of injury between students and staff were analysed using chi-squared tests or Fisher's exact tests, dependent upon the number of events. All statistical analyses were carried out using R language (version 3.2.0) (R Core Team 2015), and the results were deemed statistically significant when the p-value was less than 0.05.

Universities were unaware of which university was represented by each code throughout, with feedback and updates to each veterinary school provided throughout the process. As this study involved the secondary analysis of data, which was provided to

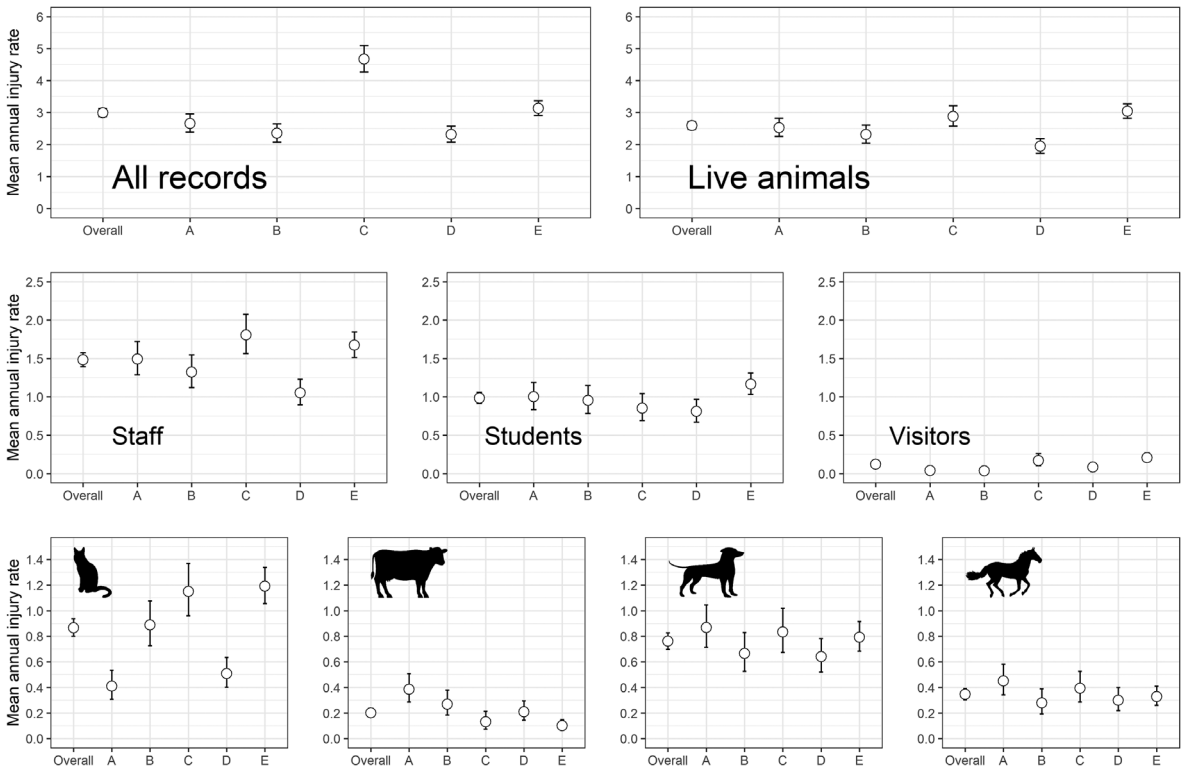

FIGURE 1 Annual animal-related injury rate (cases per 100 graduating students, with associated 95% confidence intervals) at five UK veterinary schools (A–E), stratified by the role of the injured party and the four main species involved

the research team fully anonymised, all organisations involved concluded that research ethical approval was not required and that the study was defined as an audit. This was confirmed by the University of Liverpool ethics department.

RESULTS

Five of the seven veterinary schools were able to provide datasets for analysis. Between 1 January 2009 and 31 December 2018, 2134 animal-related injuries were recorded, with an annual overall injury rate (associated with live and dead animals) of 3.00 cases per 100 graduating students (95% confidence interval [CI] 2.89–3.11). When stratified by university over time, there were no obvious annual trends (Figure S1). The demographic variables had a high degree of missing data, 78.6% (n = 1678) for age and 67.2% (n = 1434) for sex. The degree of missingness varied between universities; for age, the median missingness was 100% (range: 0%–100%), and for sex, the median was 72.9% (range: 0%–100%). Only 21.4% (n = 456) of records had information for both variables. Due to data sparsity, no further analysis included these variables.

Dead animals represented 4.4% (n = 94) of records, live animals 86.6% (n = 1849) and unclassified 9.0% (n = 191). University C accounted for 99.5% of the unclassifiable records. Dead animal-related injury analysis can be found in Supporting Information. The overall annual injury rate associated with live animals was 2.60 (95% CI 2.48–2.72) injuries per 100 graduating students per year. The annual injury rate varied between universities (Figure 1).

The annual injury rate differed depending on the roles of the IPs, with 1.48 (95% CI 1.39–1.57) injuries per 100 graduating students for staff, 0.98 (95% CI 0.91–1.06) for students and 0.12 (95% CI 0.09–0.15) for visitors. Stratification highlighted that, in all universities, staff had higher injury rates than students and visitors had lower injury rates than students, although injury rates in staff, students and visitors varied between universities.

Forty different types of animals were recorded as causing injuries; in 62 records, the type of animal causing the injury was unknown. Four species accounted for 86.7% of all recorded injuries, namely, cats (34.5%, n = 617), dogs (30.3%, n = 542), horses (13.8%, n = 246) and cows (8.1%, n = 144). Due to the predominance of these species, further analysis focused solely on them. Other species that accounted for more than 1% of injuries were mice (3.1%, n = 56), rats (2.4%, n = 42), sheep (2.1%, n = 28), rabbits (1.4%, n = 25) and ferrets (1.0%, n = 18).

The mean annual injury rate varied between species, with cats involved in 0.87 (95% CI 0.80–0.94) injuries per 100 graduating students, dogs 0.76 (95% CI 0.70–0.83), horses 0.35 (95% CI 0.30–0.39) and cows 0.20 (95% CI 0.17–0.24) (Figure 1). Injury rates varied between universities depending on species. Dog and horse-related injury rates were similar across universities, while cat-related injury rates were highly variable, and cow-related injury rates were higher than the overall rate in universities A and B. Overall, 37.3% (n = 689) of IPs were recorded as having received medical

TABLE 1 Univariable and multivariable logistic regression (adjusted for year, university and role) exploring variables associated with medical treatment for 1549 animal-related injuries at five UK veterinary schools between 2009 and 2018

	Percentage of injured persons reporting medical treatment	Univariable OR (95% CI)	*p*-Value	Adjusted OR (95% CI)	*p*-Value
Year		0.84 (0.81–0.88)	<0.001	0.81 (0.78–0.85)	<0.001
Animal					
Cow	35.4% (27.6–43.8)	Ref		Ref	
Cat	44.1% (40.1–48.1)	1.44 (0.99–2.11)	0.06	NA	
Dog	37.1% (33.0–41.3)	1.07 (0.74–1.58)	0.71	NA	
Horse	39.3% (33.1–45.7)	1.15 (0.75–1.76)	0.53	NA	
University					
A	15.9% (11.7–20.9)	Ref		Ref	
B	51.7% (45.1–58.3)	5.67 (3.75–8.70)	<0.001	6.61 (4.30–8.50)	<0.001
C	87.3% (82.7–91.1)	36.43 (22.61–60.42)	<0.001	47.1 (28.6–80.34)	<0.001
D	29.8% (24.1–36.1)	2.25 (1.46–3.50)	<0.001	2.64 (1.69–4.16)	<0.001
E	27.6% (24.0–31.5)	2.02 (1.39–2.99)	<0.001	2.31 (1.57–3.46)	<0.001
Role					
Student	35.4% (31.5–39.4)	Ref		Ref	
Staff	43.1% (39.8–46.5)	1.38 (1.12–1.72)	<0.01	1.28 (0.99–1.66)	0.05
Visitor	36.7% (26.1–48.3)	1.06 (0.64–1.71)	0.82	0.95 (0.52–1.71)	0.87

Abbreviations: CI, confidence interval; OR, odds ratio.

treatment, and 7.2% (n = 133) of IPs visited hospital due to their injuries. There odds of an IP reportedly receiving medical treatment did not differ depending on the animal species involved or the role of the IP. However, there were significant differences in medical treatment between universities, and the overall odds of reporting medical treatment decreased annually (Table 1).

The results of the Hosmer–Lemeshow test of this model, and the subsequent models, were not significant and showed that the models were well fitted. Cat and dog-related injuries were much less likely to lead to a hospital visit compared to injuries associated with cattle and horses (Table 2). Two universities (B and C) showed significantly lower hospital visit odds than the other universities.

Time off work data were only relevant for staff (n = 879); 79.5% (n = 699) of these had information available for analysis. University C had 99.4% missing data in the time off work field and was excluded from further analysis. Overall, 5.7% (n = 40) of injuries resulted in time off work. Cattle and horse-related injuries were significantly more likely to lead to time off work compared to injuries associated with cats and dogs (Table 3). Injuries at all other universities were significantly less likely to lead to time off work compared to university A.

Cats

Of the 617 injuries from cats, 72.9% (n = 450) were recorded as occurring in the universities' small animal hospitals, 23.3% (n = 144) at the universities' primary care clinics and 3.2% (n = 20) offsite. Injuries were more common in staff than students (58.1% vs. 35.8%). The predominant activities at the point of injury were handling or restraint of the cat (37.6%), clinical examination (16.9%) and drug administration (10.9%). Injuries related to clinical examinations were more likely in students than in staff (OR = 2.24, 95% CI 1.30–3.90), while 'free animals' (OR = 0.23, 95% CI 0.03–0.88) and intravenous lines (OR = 0.37, 95% CI 0.14–0.89) were significantly less likely in students (Table S2). The top three injuries were a bite to the hand (44.0%), a scratch to the hand (18.4%) and a scratch to the arm (12.0%). Bites made up 55.8% of all injuries, while scratches made up 37.5%. Almost half of cat-related injuries resulted in medical treatment (44.1%), and 4.1% of IPs visited hospital. Further stratification of the injuries is detailed in Table S3.

Dogs

Of the 542 injuries from dogs, 87.1% (n = 472) were recorded as occurring in the universities' small animal hospitals, 10.0% (n = 54) at the universities' primary care clinics and 1.3% (n = 7) offsite. Injuries were more common in staff than students (60.4% vs. 33.0%). The predominant activities at the point of injury were handling or restraint of the dog (27.6%), clinical examination (17.3%), a 'free animal' (16.5%), sedation (9.8%) and drug administration (9.8%). Injuries related to clinical examinations (OR = 2.50, 95% CI 1.48–4.24) and drug administration (OR = 2.43, 95% CI 1.24–4.80) were more likely in students than in staff (OR = 2.43, 95% CI 1.24–4.80) (Table S2). The top three injuries were a bite to the hand (52.9%), a bite to the arm (12.2%) and a bite to the head (7.8%);

TABLE 2 Univariable and multivariable logistic regression (adjusted for animal and university) exploring variables associated with hospital visits for 1549 animal-related injuries at five UK veterinary schools between 2009 and 2018

	Percentage of injured persons reporting a hospital visit	Univariable OR (95% CI)	*p*-Value	Adjusted OR (95% CI)	*p*-Value
Year (linear term)		1.00 (0.99–1.01)	0.61	NA	
Animal					
Cow	20.8% (14.5–28.4)	Ref		Ref	
Cat	4.1% (2.6–5.9)	0.16 (0.09–0.28)	<0.001	0.18 (0.10–0.33)	<0.001
Dog	4.6% (3.0–6.7)	0.18 (0.10–0.33)	<0.001	0.19 (0.10–0.34)	<0.001
Horse	16.1% (11.7–21.4)	0.72 (0.42–1.22)	0.22	0.75 (0.44–1.30)	0.30
University					
A	12.8% (9.0–17.5)	Ref		Ref	
B	4.7% (2.4–8.3)	0.34 (0.16–0.66)	<0.01	0.40 (0.19–0.81)	0.01
C	1.5% (0.4–3.8)	0.10 (0.03–0.26)	<0.001	0.14 (0.04–0.36)	<0.001
D	12.2% (8.3–17.0)	0.95 (0.55–1.62)	0.84	1.11 (0.63–1.93)	0.72
E	7.6% (5.5–10.2)	0.56 (0.35–0.92)	0.02	0.84 (0.51–1.42)	0.52
Role					
Student	8.7% (6.6–11.3)	Ref		Ref	
Staff	7.4% (5.8–9.3)	0.84 (0.57–1.23)	0.36	NA	
Visitor	3.8% (0.8–10.7)	0.41 (0.10–1.16)	0.15	NA	

Abbreviations: CI, confidence interval; OR, odds ratio.

TABLE 3 Univariable and multivariable logistic regression exploring variables associated with staff time off work for 699 animal-related injuries at four UK veterinary schools between 2009 and 2018

	Percentage of injured staff taking time off work (95% CI)	Percentage of injured staff with <7 days off work (95% CI)	Percentage of injured staff with ≥7 days off work (95% CI)	Univariable OR (95% CI)	*p*-Value	Adjusted OR (95% CI)	*p*-Value
Year (linear term)				1.00 (0.99–1.01)	0.47	NA	
Animal							
Cow ($n = 53$)	26.4% (16.4–39.6)	17.0% (8.1–29.8)	9.4% (3.1–20.7)	Ref		Ref	
Cat ($n = 280$)	1.1% (0.4–3.1)	0.7% (0.1–2.6)	0.4% (0.0–2.0)	0.03 (0.01–0.10)	<0.001	0.04 (0.01–0.13)	<0.001
Dog ($n = 269$)	3.0% (1.5–5.8)	1.5% (0.4–3.8)	1.5% (0.4–3.8)	0.09 (0.03–0.21)	<0.001	0.09 (0.03–0.22)	<0.001
Horse ($n = 97$)	15.5% (9.2–24.5)	9.3% (4.3–16.9)	6.2% (2.3–13.0)	0.51 (0.22–1.17)	0.11	0.51 (0.21–1.23)	0.13
University							
A	14.5% (9.8–20.9)	9.2% (5.6–14.9)	5.3% (2.7–10.0)	Ref		Ref	
B	2.3% (0.8–6.6)	1.6% (0.4–5.5)	0.8% (0.1–4.3)	0.14 (0.03–0.42)	<0.01	0.20 (0.04–0.62)	0.01
D	3.0% (1.2–7.4)	2.2% (0.8–6.4)	0.7% (0.1–4.1)	0.18 (0.05–0.49)	<0.01	0.18 (0.05–0.51)	<0.01
E	3.5% (1.9–6.4)	1.8% (0.8–4.1)	1.8% (0.8–4.1)	0.22 (0.10–0.46)	<0.01	0.35 (0.15–0.79)	0.01
Overall		3.4% (2.3–5.1)	2.3% (1.4–3.7)				

Abbreviations: CI, confidence interval; OR, odds ratio.

bites made up 78.6% of all injuries. Over a third of dog-related injuries resulted in medical treatment (37.1%), and 4.6% of IPs visited hospital. Further stratification of the injuries is detailed in Table S4.

Horses

Of the 246 injuries from horses, 88.2% ($n = 217$) were recorded as occurring in the universities' equine hospitals and 6.5% ($n = 16$) offsite. Injuries were more common in staff than students (53.7% vs. 44.3%). The predominant activities at the point of injury were a 'free animal' (25.7%), a clinical examination (15.4%), sedation (14.9%) and handling or restraint of the horse (11.9%). Injuries related to 'free animals' were more likely in students than in staff (OR = 1.72, 95% CI 0.92–3.26) (Table S2). The top injuries were a kick to the leg (17.4%), a crushed foot (11.3%), a butt to the head (7.4%) and a kick to the head (7.0%); kicks made up 37.8% of all injuries. Over a third of horse-related injuries resulted in medical treatment (39.3%),

and around one in six injuries led to a hospital visit (16.1%). Further stratification of the injuries is detailed in Table S5.

Cows

Of the 144 injuries from cattle, 44.4% (n = 64) were recorded as occurring offsite, 35.4% (n = 51) on the university farm and 16.0% (n = 23) at the university farm practice. Injuries were more common in staff than students (54.6% vs. 44.8%). The predominant activities at the point of injury were a clinical examination (21.7%), a foot trim (20.9%), a 'free animal' (20.2%) and a veterinary procedure (14.7%). Injuries related to clinical examinations were more likely in students than in staff (OR = 3.76, 95% CI 1.46–10.85) (Table S2). The top injuries were a kick to the leg (12.8%), hand crushed by an object (8.3%), scalpel to the hand (8.3%) and a needlestick to the hand (7.5%); kicks made up 30.7% of all injuries. Over a third of cow-related injuries resulted in medical treatment (35.4%), and around one in five injuries led to a hospital visit (20.8%). Further stratification of the injuries is detailed in Table S6.

DISCUSSION

This is the first multicentre study to describe animal-related injuries at veterinary schools. Companion animals led to the largest number of reported injuries, while large animals accounted for the highest proportion of injuries leading to hospital visits and time off work. Differences were noted between the completeness and level of contextual detail within injury records and the types of activities occurring at the point of injury between staff and students. Differences in injury consequences between universities and the varied completeness of records are suggestive of poor reporting and recording cultures around injuries at veterinary schools.

Animal differences

The percentage of staff injured by animals in different specialties was similar to studies based in clinical practice.[2,3] In these studies, injury rates were higher in large animal practice than in small animal practice, with a higher percentage of severe injuries.[2] Higher rates of injury associated with companion animals at veterinary schools compared to clinical practice are likely due to relative exposure. There are greater numbers of staff working with companion animals rather than with large animals, and students spend more time on clinical rotations (with greater animal care responsibilities) with companion animals. Our results confirm that large animals represent the greatest risk in terms of injury severity.

Cattle interactions were responsible for the most severe injuries. More than one in four staff members injured by cattle took time off work, and one in five injuries led to hospitalisation. Our data support previous findings that most injuries are caused by kicks and crushes[5,14] that occur when the animal is being moved or restrained and are primarily to the limbs and head.[14] Students were more likely than staff to be recorded as injured while performing a clinical examination. This may be due to a lack of experience in performing clinical examinations while maintaining awareness of the cow's temperament and having peripheral awareness of other animals nearby. Many students have little experience of interacting with farm animals and more instruction may be needed to enhance their awareness of cows' body language and enable them to handle large animals safely.[15]

Our findings support that most horse-related injuries are caused by kicks and crushes, and are primarily to heads and legs.[1,5,6,10] It is a concern that almost one in five injuries were to the head (20.9%), and almost a third of these resulted in hospitalisation. This emphasises the need for all those working with horses to wear helmets. There is no guidance from the RCVS regarding helmet wearing, with each veterinary school having their own policy. The British Equine Veterinary Association provides the following advice: 'Protective headgear should be worn by staff as appropriate that is correctly fitted and secured…. If in doubt wear a hat'.[16] The hospitalisation rate (16.1%) is similar to Australian equine veterinarians (18.0%) but lower than previously recorded in UK practising veterinarians (33%), suggestive of an improvement in working safely with horses.[1,5] Previously, procedural activities have been recognised as the main source of injury, in particular sedated horses, lameness and dental examinations.[1,5] These remain prevalent in this audit, but a quarter of all injuries are due to 'free animals', and these were more prevalent in students than in staff. Lack of experience and exposure to horses may result in students who are less able to read and respond to horses' body language.[17]

Dog-related injuries were more prevalent but less likely to result in a hospital visit. The most common injury reported was caused by bites, reflecting previous research.[4,5,7–9] A surprising number of injuries were to the head (14.3%), given that adults tend to have their hands, arms and legs bitten, while children tend to have their heads bitten.[18] Three of the most common pre-injury activities, handling, clinical examination and sedation, can involve having one's head close to the dog's head. These procedures accounted for 63.8% of all head injuries caused by dogs. Many of the sedation-related injuries involved the immediate recovery of a dog after anaesthesia and the intubation of a sedated dog. More attention should be given to dog behaviour during riskier activities, low-stress handling techniques should be taught and used,[19] and muzzle training should be normalised.

Cat-related injuries were the most prevalent, but the least severe, with the fewest hospital visits and

least time off work. As found elsewhere, injuries were almost all caused by bites and scratches to the hands and arms.[2,4] Students were more likely to be injured during clinical examinations, while staff were more likely to be injured by a 'free animal' or during the placement of an intravenous line. It is not clear why there are these differences, but it may be related to exposure and that more students perform clinical examinations while staff perform more intravenous line placements. These procedures may warrant further exploration to understand how injuries occur so that injury prevention strategies may be developed. Cat bites are a serious injury, with infection rates ranging from 30% to 60%, double that of dog bites.[20,21] They readily lead to deep infections and, if left untreated, can require surgical treatment. Our analysis, with 43% receiving medical treatment and 5.9% attending a hospital, suggests that cat bites are not seen as serious health risks. National Institute for Health and Care Excellence guidelines state that prophylactic antibiotics should be prescribed if a cat bite breaks the skin or draws blood and should be considered if it breaks the skin and blood is not drawn.[22] Antibiotic treatment is straightforward, and universities should ensure that all IPs are assessed by a health professional. Again, low-stress handling techniques for cats are recommended.[19]

A recent survey found that 58% of all veterinarians had received needlestick injuries in the last 5 years.[8] Our study found a much lower prevalence, 6.6% when working with live animals and 15.4% with dead animals. It is unclear whether this is due to safer procedures or whether there is underreporting of this injury. The content of the syringe was only recorded 27.5% of the time, and included harmful drugs such as barbiturates, abortifacients, radioactive substances and tilmicosin (an antibiotic that can cause death). In the medical profession, there is a strong avoidance and reporting culture concerning needlesticks due to the risk of blood-borne infections.[23] This risk is much lower for veterinarians, but the risk from some drugs is much higher, especially when delivered at doses intended for large animals.[24] This is evidenced by 5.8% of needlestick IPs requiring hospital treatment. Due to the dangers inherent in some commonly used veterinary drugs, we would argue that an attitude change around needlestick injuries and their reporting and treatment needs to occur.

Injury reporting culture

In the medical profession, underreporting and injury concealment have been associated with underestimating the legitimacy of recording injuries, time pressure, concerns about reputation and career, stigmatisation, fear of income loss and distress associated with time off work (especially if they define their identity through their profession).[25,26] Little work has explored this in the veterinary profession. However, underreporting and injury concealment have been noted in previous veterinary research, where only 37% of UK equine veterinarians officially recorded an accident,[1] and no equine veterinary students reported an injury.[10] Overall, we saw an annual trend of decreasing odds of reported medical treatment, which is likely reflective of a changing reporting culture rather than fewer IPs needing treatment, as no such trend was seen in those being hospitalised. Our study saw significant differences in injury rate, medical treatment rate and time off work between universities. These differences could be due to injuries varying between universities, or that recording and reporting differs between universities. The differences in reporting rates are probably substantial and may reflect differences in the collective attitude, behaviours, beliefs and values of the respective organisations towards safety culture. The large variation in missing data between universities may indicate that reporting and recording is likely to be a major factor. There was a high degree of missing information about the events surrounding the injury and the injury itself (Tables S3–S6). These data were garnered from free text and were often brief; for example, 'dog bite to hand' could be the sole information recorded. There could be many reasons for incomplete records and there are likely similarities to those of the medical profession.

Staff had higher rates of injury and were more likely to record receiving medical treatment than students. However, injuries resulting in hospitalisations, indicative of more serious injuries, occurred at a similar rate. These differences in non-hospitalisation injury rates are minor and were likely due to staff being obliged to report injuries to their employers, unlike students, rather than a truly higher rate.[12] We do not know whether students took time off work when injured. Students have been reported to avoid treatment, or self-treat, when injured by horses and continue with their studies despite a 14-day median time to recovery.[10] Low injury reporting rates and injury concealment are common in vocational training, where reporting would involve potential missed training and negative career repercussions.[27] This is seen in medical students, who report the following reasons for lack of reporting: not knowing the reporting procedure, time pressure, stigma of the injury and that it might negatively influence grades or future career[28]; these all seem plausible for veterinary students.

The final evidence of a poor recording culture is that most injuries had no report of treatment or first aid. Assessing the injuries described, it is unlikely that this did not occur and we do not know why it was not recorded; there may be no prompt to record it or that the IP, for a variety of reasons, may opt to not record it. Overall, these results suggest that completeness of records may be associated with injury severity and resultant time off work, leading to potentially biased estimates. Considering this, a general attitude shift and harmonisation of accident recording should occur.

Limitations

It was challenging to define a denominator to calculate injury rates. Our proxy measure cannot adjust for the differences in animal exposure that each university will have, for example, if a university has a larger feline department, this could explain why cat-related injuries are variable between universities. This is also true of the differences in exposure between staff and students; for example, students may perform specific procedures (with potentially higher levels of risk) more frequently than staff. Another limitation is that these data were sourced from accident records, and their quality and completeness are reliant on the degree of recording by IPs and their ability to record it in the reporting software (i.e., some demographic data may not be required fields). Time off work information is primarily reported to human resources departments and may not be added to an injury record. Furthermore, these data are often collected after return to work, so may not always be captured on the accident record. It is therefore likely that there are missing time off work data and that our estimates underestimate the prevalence. The above limitations indicate that there is a potential need for improvement to the recording systems and for a push to improve the completeness of data captured. Finally, these data are likely to underestimate the number of injuries that have occurred, especially minor injuries for which reporting is deemed of low benefit when compared with the cost of time and effort. As discussed, many IPs are unlikely to report and record their injuries. In addition, data were only extracted if an animal was explicitly mentioned in the injury record, and therefore, some records may have been missed. From these data, we cannot estimate the rate of underreporting and can therefore only suspect its presence.

CONCLUSION

Through this multicentre audit, we have characterised the type of animal-related injuries occurring at UK veterinary schools and their potential causes. These data are rich in information and are a credit to each respective health and safety team working to change attitudes regarding workplace safety. There have been some very serious injuries, yet despite this, the recording of injury details by veterinary professionals could be improved. We have four recommendations following this work. First, an exploration of some of the more frequent veterinary activities that lead to serious injury (particularly those requiring hospital attendance) is required so that injury prevention strategies can be developed. This could also include more enhanced training on workplace-related hazards from veterinary schools and within the profession. Second, standardised accident record keeping should be developed across universities rather than the university-specific approach that currently exists. Third, within the veterinary profession, the need for good recording must be stressed and should focus on the need for complete injury data to inform injury prevention strategies. Finally, a cultural shift within the veterinary profession needs to occur that reduces any blame, shame or stigmatisation of the IP and instead focuses on using learning to improve injury prevention measures and ensure accurate and responsible recording of the injuries. This is already starting to occur; due to this work, one university has adopted a new hard hat policy for all those working with equids. The veterinary profession needs to remember that the goal of injury prevention is 'neither to find fault, to assign blame, nor to punish offenders. The real goal is … to eliminate the danger before something happens'.[29]

AUTHOR CONTRIBUTIONS

Conceptualisation, methodology, formal analysis, writing—original draft and visualisation: John S.P. Tulloch. *Methodology, interpretation of results and writing—review and editing*: Kate M. Fleming, Gina Pinchbeck and Carri Westgarth. *Resources, data curation and writing—review and editing*: Julie Forster and Walter Lowe. All authors reviewed the results and approved the final version of the paper.

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CONFLICT OF INTEREST STATEMENT

The authors declare they have no conflicts of interest.

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The authors received no specific funding for this work.

DATA AVAILABILITY STATEMENT

The data that support the findings of this study are available on request from the corresponding author. The data are not publicly available due to privacy or ethical restrictions.

ETHICS STATEMENT

As this study involved the secondary analysis of data, which was provided to the research team fully anonymised, all organisations involved concluded that research ethical approval was not required and that the study was defined as an audit. This was confirmed by the University of Liverpool ethics department.

ORCID

Carri Westgarth https://orcid.org/0000-0003-0471-2761

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SUPPORTING INFORMATION

Additional supporting information can be found online in the Supporting Information section at the end of this article.

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