Risk Factors for Injury among Veterinarians

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Abstract: Work-related injuries among veterinarians are a major problem, but little is known of the specific risk factors involved. The purpose of this nested case-control study, conducted from a comprehensive population-based study of practicing Minnesota veterinarians, was to identify risk factors for job-related injuries. We questioned cases (N = 193) on exposures occurring in the month before their injury, and we questioned controls (N = 495) on exposures occurring in a randomly selected month. We used logistic regression to model the dependence of veterinary work-related injury on each exposure of interest and associated confounders. We observed increased rates for prior injuries (RR = 1.7, 95% CI = 1.1–2.6), participation in sports (RR = 1.7, 95% CI = 1.05–2.6), no sharps boxes present (RR = 1.8, 95% CI = 1.01–3.2), current smoking (RR = 4.1, 95% CI = 1.8–9.1), and 6 or fewer hours of sleep (RR = 1.8, 95% CI = 1.0–3.3). We identified a dose response for lifting patients, as follows: lifting 41–75 lb (RR = 3.1, 95% CI = 1.6–5.9), lifting 76–100 lb (RR = 3.2, 95% CI = 1.6–5.9), and lifting more than 100 lb (RR = 6.1, 95% CI = 2.5–15.0). Decreased rates were observed for participation in aerobic activities (RR = 0.6, 95% CI = 0.4–0.99), perception of lower risk (RR = 0.4, 95% CI = 0.2–0.9), and experience (RR = 0.6, 95% CI = 0.4–0.9). (EPIDEMIOLOGY 2002;13:80–86)

Key words: injury, veterinarian injuries, risk factors, occupational injuries.

Occupational injuries are a major source of morbidity and mortality among all workers; among the approximately 65,000 practicing veterinarians in the United States, little is known of the extent of risk factors for work-related trauma. Based on previous studies, the injury rate for veterinarians is at least 10 per 100 veterinarians per year[1–4] and was shown to be 23 per 100 in the comprehensive study that served as the basis for the current effort.[5]

Reporting of such injuries is limited. Although workers' compensation claims might be a source of data for those who claim these benefits, many veterinarians treat their own injuries; from one study, it was estimated that two-thirds of those injured treated themselves with methods beyond first aid such as suturing or antibiotics.[2]

There are few studies of injuries to veterinarians. Those that exist are descriptive and of limited value owing to varying definitions of injury and low response rates.[1–4]

In the overall study,[5] there were two primary aims: (1) to identify the rates of injury among veterinarians who practiced in Minnesota during 1996 and (2) to ascertain the specific risk factors involved. The research design used an initial comprehensive survey followed by a nested case-control study among the cohort of veterinarians. In this paper, information is presented from the case-control effort.

Subjects and Methods

Population

We studied the cohort of all veterinarians licensed to practice veterinary medicine in Minnesota during 1996. A list of all licensed veterinarians in Minnesota (N = 2,687) was obtained from the State Veterinary Licensing Board. An initial comprehensive survey was mailed during February 1997 to determine active practice status of the respondents, whether or not they were injured during 1996, details of any injuries, demographic data, and practice information; follow-up to nonrespondents 1 month later served to improve response. From these mailings a total of 1,023 practicing veterinarians who

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Support for this effort was provided in part by the Regional Injury Prevention Research Center, Division of Environmental and Occupational Health, School of Public Health, University of Minnesota; Occupational Injury Epidemiology and Control Program, Midwest Center for Occupational Health and Safety, University of Minnesota (T42/CCT 510422); and Midwest Veterinary Supply Inc (Russell R. Wiley, president).

Submitted October 2, 2000; final version accepted June 1, 2001.

sustained a total of 351 injuries was identified. Injuries were approximately uniform throughout all months (6.1–9.5%), except for a slight increase in December (13.6%). About 95% of respondents worked in any given month. Comprehensive data are described elsewhere.[5]

Selection of Cases and Controls

All animal-related injury events (N = 287) reported by veterinarians in the initial survey were identified as cases; persons were identified as many as four times as cases. To select controls, all persons in the cohort were given up to 12 numbers from 1 to 12 to represent the months of 1996 in which they were practicing; for cases, the injury month and the month before the injury were eliminated as control months. Then, controls (N = 720) were randomly selected from all eligible person-months. Thus, control persons could have reported no animal-related injury or could have sustained their animal-related injury in a month other than the one selected as a control. Control persons could be selected several times; most persons were selected only once or twice.

Data Collection

A conceptual model was used in developing the survey instruments and in analyzing and interpreting the data. This model was based on knowledge of the veterinary working environment, consultation with other veterinarians, previous published information, and information about injury occurrence mechanisms. Potential risk factors were grouped into categories to aid in development of questions (Table 1). The overall model of injury included all potential sources of injury; the current effort concerns only animal-related injury outcomes.

All persons selected were mailed a comprehensive survey in July 1997 asking about exposures in the month before their injury (cases) or the randomly selected month (controls). Separate questionnaires encoded for the respective month, along with explanatory letters, were sent to all participants. Persons who received more than one questionnaire (*ie*, were selected as controls more than once, or sustained multiple injuries) were allowed to indicate "same" in relevant portions of the questionnaires if they felt the information remained unchanged from the first questionnaire they completed. Information was collected on a variety of exposures as determined from the conceptual model (Table 1).

TABLE 1. Exposures of Interest and Potential Confounders Identified from the Conceptual Model of Veterinary Injury, Minnesota Veterinary Injury Study

Demographic
Age
Gender
Years in practice/experience*
Specialty training*
Other personal factors
Hours worked*
Other employment
Hours of sleep
Emergency work
Prior injuries
Health status
Aerobic or sports activities*
Medications used
Smoking
Alcohol use
Body mass
Behavior around animals*
Attitudes and beliefs
Beliefs about injury prevention*
Training in safety
Perception of risk
Environmental: animal-related factors
Type of practice—animals treated
Usual species worked with*
Behavior of animal patients
Sizes of animal patients
Size of practice
Weight of animals lifted*
Environmental: non-animal-related factors
Availability and use of assistants*
Training of assistants*
Time spent sitting or standing
Safety measures in place*
Height of work tables*
Availability of lift devices*
Driving as part of work
Flooring
Lighting

* Exposures of interest.

Analysis

Several exposures, determined through the conceptual model, were identified as factors of primary interest for the analysis. These included: availability and utilization of technical assistance; use of safety measures in the usual working environment; type of practice/animals treated; fatigue factors including hours of sleep, emergency coverage, and hours worked per week; and lifting and physical fitness. We used unconditional logistic regression to calculate crude rate ratios for each exposure of interest and to model the dependence of animal-related injury among practicing veterinarians on each exposure of interest along with the pertinent confounders.

For each exposure of interest, we used the conceptual model to identify potential confounders[6] to enter into the analysis. Each analytic model was evaluated using Proc Logistic in SAS[7] to determine the relevant rate ratios. Several variables in the models were continuous in nature and were assessed both as continuous and categorical: age, years of experience, body mass index, hours worked, hours of sleep, and percentages of time engaged in emergency work and time spent in various activities.

Results

Among the 287 cases and 720 controls who were sent surveys, 193 cases (67%) and 495 controls (69%) responded. Characteristics of the 193 cases and 495 controls are shown in Table 2. In Table 3, environmental

TABLE 2. Characteristics of 193 Cases and 495 Controls, Minnesota Veterinary Injury Study

Variable	Cases		Controls	
	No.	%	No.	%
Age, years				
24–35	64	33.2	111	22.4
36–45	77	39.9	183	37.0
46–55	39	20.2	142	28.7
56–80	13	6.7	59	11.9
Years in veterinary practice				
5 or less	53	28.2	69	14.1
6–10	47	25.0	102	20.9
11–20	50	26.6	149	30.5
21 and over	38	20.2	168	34.5
Gender				
Male	105	54.4	335	67.7
Female	88	45.6	160	32.3
Hours worked				
<10	3	1.6	23	4.6
10–30	21	10.9	66	13.3
31–60	150	77.7	365	73.7
over 60	19	9.8	41	8.3
Body mass index >28	83	43.0	245	49.7
Aerobics, regular participation	66	34.2	193	39.0
Sports, any participation	108	56.0	248	50.1
Alcohol use	136	70.5	378	76.4
Binge drink, >5 drinks, on one occasion	14	7.2	51	10.3
Current cigarette use	19	9.8	17	3.4
Any large-animal work*	116	60.1	236	47.7
Prior injury	59	30.6	99	20.0
Allergy, any	56	29.2	85	17.4
Believe work-related injuries can be prevented	54	28.0	81	16.4
Driving, work related	120	62.5	277	56.5
Use right hand primarily	172	89.6	423	86.3
Type of clinical practice				
Small animal†	78	41.0	229	49.7
Mixed, mostly small animal	18	9.5	39	8.5
Feline‡	0	0.0	2	0.4
Exotic/zoo	0	0.0	1	0.2
Large animal*	19	10.0	34	7.4
Mixed, mostly large animal	48	25.3	107	23.2
Swine‡	0	0.0	4	0.9
Poultry‡	0	0.0	2	0.4
Equine‡	4	2.1	8	1.7
50:50 mixed	19	10.0	24	5.2
Other§	4	2.1	11	2.4

* Large-animal practice may include cattle, pigs, horses, and small ruminants.
† Small-animal practice may include dogs, cats, pet rodents, birds, or reptiles.
‡ Practice limited to single species.
§ Other includes such things as: academic/research, laboratory animal, regulatory, specialty, and sales barn.

safety measures present in the working environment are shown for cases and controls.

In Table 4, we present crude and multivariate rate ratios for variables included in the final model. Increased rates were found for those veterinarians who had 5 or fewer years of experience (RR = 3.1, 95% CI = 1.4–6.8) and 6–10 years (RR = 1.9, 95% CI = 0.9–4.0), compared with more than 20 years; smoked currently (RR = 4.1, 95% CI = 1.8–9.1); incurred prior injuries (RR = 1.7, 95% CI = 1.1–2.6); slept 6 or fewer hours per night on average (RR = 1.8, 95% CI = 1.0, 3.3); sat less than 1 hour per day (RR = 3.2, 95% CI = 1.6–6.3); stood less than 1 hour per day (RR = 1.7, 95% CI = 0.9–3.0); and participated in any type of sports (RR = 1.7, 95% CI = 1.0–2.6).

We found a dose-response effect in weight of patients lifted without assistance. Compared with lifting ≤40 lb, increasing rates were seen for lifting 41–75 lb (RR = 3.1, 95% CI = 1.6–5.9), 76–100 lb (RR = 3.2, 95% CI = 1.6–5.9), and >100 lb (RR = 6.1, 95% CI = 2.5–15.0). Those who did not use hydraulic lifts experienced a slight increase in risk (RR = 1.3, 95% CI = 0.7–2.5), and those who said the lifts were not needed experienced a large increase (RR = 5.9, 95% CI = 2.3–15.0). A decreased rate of injury was seen for the perception of low risk of injury in the work, compared with the perception of a high risk of injury (RR = 0.4, 95% CI = 0.2–0.9).

Availability of technician assistance was also considered an important potential risk factor to examine. There were higher rates for those who answered "frequently" or "sometimes" compared with those who said they always had assistance when working with animals (RR = 1.8, 95% CI = 0.9–3.9, and RR = 1.9, 95% CI = 0.9–4.1, respectively). A similar result was seen when veterinarians were asked about the availability of sharps boxes used for disposal of needles in their usual

TABLE 3. Various Environmental Controls Used in the Usual Work Place, Minnesota Veterinary Injury Study

Environmental Control	Cases		Controls	
	No.	%	No.	%
Sharps boxes				
Yes	131	68.2	406	83.7
No	36	18.8	54	11.1
NA	25	13.0	25	5.2
Adequate lighting				
Yes	139	72.4	370	76.3
No	48	25.0	104	21.4
NA	5	2.6	11	2.3
Staff meetings for safety procedures				
Yes	50	26.0	163	33.9
No	107	55.7	255	53.0
NA	35	18.2	63	13.1
Hydraulic lifts				
Yes	21	10.9	74	15.3
No	142	74.0	378	78.1
NA	29	15.1	32	6.6
Labels on hazardous chemicals				
Yes	129	67.2	397	82.4
No	35	18.2	62	12.9
NA	28	14.6	23	4.8
Material safety data sheets readily available				
Yes	114	59.4	357	73.8
No	45	23.4	90	18.6
NA	33	17.2	37	7.6
Anesthesia used for restraint during radiology				
Yes	112	58.3	277	57.5
No	25	13.0	86	17.8
NA	55	28.6	119	24.7

NA = not applicable.

work environment. Those who responded "not available" had increased rates of injury (RR = 1.8, 95% CI = 1.0–3.2); those who responded "not applicable" had an even greater rate (RR = 4.8, 95% CI = 2.2–10.4).

Decreased rates were identified for increasing age (36–45 years, RR = 0.6, 95% CI = 0.4–0.9; 46–55 years, RR = 0.4, 95% CI = 0.3–1.0; 56–80 years, RR = 0.3, 95% CI = 0.2–1.3), male gender (RR = 0.5, 95% CI = 0.3–0.8), use of alcohol (RR = 0.6, 95% CI = 0.4–0.9), sitting from 1 to <4 hours per day *vs* ≥4 hours (RR = 0.6, 95% CI = 0.3–1.2), and participation in aerobic activities (RR = 0.6, 95% CI = 0.4–1.0).

To evaluate potential selection bias, we sent a brief questionnaire to all nonresponding cases (N = 91) and controls (N = 168). The return rate for this brief survey was 35% for cases and 37% for controls. A sample of the original cohort that had not responded in the initial phase of the study was also contacted (N = 110). In Table 5, results for one variable (hours of sleep) are shown from this substudy. This information was used to evaluate the potential effect of nonresponse bias. Specifically, this bias may influence the effect estimates if it is nonrandom with respect to injury and exposure status (for example, if exposed cases were more likely to respond than the other groups). It appears that exposed cases, and unexposed controls to a lesser extent, were more likely to participate in the study than were unexposed cases and exposed controls. This selection would appear to exaggerate the effect estimates that we report.

Discussion

Limitations of the study include the fact that data were collected retrospectively and required the participants to recall events that had occurred in the past. Cases had the opportunity to be reminded of the injury they had reported in the initial comprehensive survey and reply regarding the month before this event. Controls were randomly assigned a month and thus did not have a marker event to stimulate their memories. In many veterinary environments, the activities and species of animals treated vary throughout the year, so it was important to account for the seasonal variation by focusing on a 1-month period, even though results in the initial survey found slightly increased proportions of injuries only in December and comparable numbers of veterinarians working in each month. Participants who were selected more than once as a control were allowed to indicate "same" on questionnaires if they felt the exposures were similar to those identified in the first questionnaire they completed. This prompting may have resulted in imprecision in measuring the differences among months. Few participants took advantage of this option and completed each questionnaire separately.

TABLE 4. Crude Rate Ratios (RR) and Logistic Regression Analysis for Animal Work-Related Veterinary Injuries, Minnesota Veterinary Injury Study

	Case	Control	Crude RR	95% CI	Adjusted RR	95% CI
Age, years						
24–35	64	111	1.0		1.0	
36–45	77	183	0.6	0.4–0.9	0.6	0.4–0.9
46–55	39	142	0.4	0.2–0.6	0.5	0.3–1.0
56–80	13	59	0.3	0.2–0.5	0.6	0.2–1.3
Years in veterinary practice						
5 or less	53	69	3.4	2.1–5.6	3.1	1.4–6.8
6–10	47	102	2.0	1.2–3.3	1.9	0.9–4.0
11–20	50	149	1.5	0.9–2.4	1.1	0.6–2.3
21 and more	38	168	1.0		1.0	
Gender						
Female	88	160	1.0		1.0	
Male	105	335	0.6	0.4–0.8	0.5	0.3–0.8
Hours worked						
<10	3	23	1.0		1.0	
10–30	21	66	2.4	0.7–8.9	0.9	0.2–4.0
31–60	150	365	3.2	0.9–10.7	1.2	0.3–4.4
>60	19	41	3.6	0.9–13.3	1.2	0.3–5.2
Current smoking						
Yes	19	17	3.1	1.6–6.0	4.1	1.8–9.1
No	153	469	1.0		1.0	
Alcohol use						
Yes	136	378	0.7	0.5–1.1	0.6	0.3–0.9
No	57	116	1.0		1.0	
Prior injury						
Yes	59	99	1.8	1.2–2.6	1.7	1.1–2.6
No	134	396	1.0		1.0	
Hours of sleep						
6 hours or fewer	34	64	1.5	1.0–2.4	1.8	1.0–3.3
>6 hours	141	404	1.0		1.0	
Hours spent sitting						
4 or more	22	88	1.0		1.0	
1–3.9	52	299	0.7	0.4–1.2	0.6	0.3–1.2
<1	102	99	4.1	2.4–7.1	3.2	1.6–6.3
Hours spent standing						
4 or more	43	220	1.0		1.0	
1–3.9	63	186	1.5	1.0–2.3	0.8	0.5–1.4
<1	70	79	3.9	2.5–6.1	1.7	0.9–3.1
Aerobics, regular participation						
Yes	66	193	0.8	0.6–1.1	0.6	0.4–1.0
No	127	302	1.0		1.0	
Perception of risk						
High	24	27	1.0		1.0	
Moderate	93	125	0.9	0.5–1.7	1.2	0.6–2.5
Low	72	323	0.3	0.2–0.5	0.4	0.2–0.9
None	1	13	0.1	0.0–0.8	0.04	0.0–0.1
Any large-animal work						
Yes	116	236	1.7	1.2–2.3	1.5	0.7–3.0
No	77	259	1.0		1.0	
Weight of animals lifted						
≤40 pounds	32	155	1.0		1.0	
41–75 pounds	82	178	2.4	1.5–3.8	3.1	1.6–5.9
76–100 pounds	63	128	2.5	1.6–4.2	3.2	1.6–5.9
>100 pounds	18	34	2.7	1.4–5.5	6.1	2.5–15.0
Animal lifted						
Chest high	18	18	1.0		1.0	
Waist high	142	352	0.4	0.2–0.8	0.5	0.3–0.9
Technician assist, restraint, without client present						
Always	59	184	1.0		1.0	
Frequently	83	180	1.4	1.0–2.1	1.8	0.9–3.9
Sometimes	26	38	2.1	1.2–3.8	1.9	0.9–4.1
Rarely	0	11			1.9	0.9–4.5
Never	8	8	3.1	1.1–8.7	1.3	0.3–5.1
NA	17	74	0.7	0.4–1.3	0.6	0.2–1.4
Hydraulic lifts†						
Yes	21	74	1.0		1.0	
No	142	378	1.3	0.8–2.2	1.3	0.7–2.5
NA	29	32	3.2	1.6–6.4	5.9	2.3–14.9
Anesthesia, restraint†						
Yes	112	277	1.0		1.0	
No	25	86	0.6	0.4–1.0	0.5	0.3–0.9
NA	55	119	0.9	0.6–1.4	2.3	1.3–4.0
Sharps boxes present						
Yes	132	416	1.0		1.0	
No	36	54	2.1	1.3–3.3	1.8	1.0–3.2
NA	25	25	3.1	1.7–5.7	4.7	2.2–10.4

NA = not applicable.
* Adjusted for age, gender, hours worked, type of practice, weight of animal lifted, height lifted, prior injuries, activities, cigarette or alcohol use, and use of sharps boxes.
† Adjusted for all confounders, as above, except this variable replaces "Sharps boxes present" in the model.

TABLE 5. Sensitivity Analysis Substudy, Minnesota Veterinary Injury Study

Formula for selection bias factor, related to the two-by-two Table data presentation:

$$\frac{SAj * SBo}{SAo * SBj}$$

Hours of Sleep per Night	Cases	Controls	Total
Study data			
≤6	52 (27%)	91 (18.4%)	
>6	140 (73%)	404 (81.6%)	
Total	192	495	687
Substudy data			
≤6	2 (6%)	15 (24.2%)	
>6	30 (94%)	47 (75.8%)	
Total	32	62	94

RR from study = 1.52.

Two Plausible Scenarios for Selection Probabilities					
SA_j	SB_j	SA_o	SB_o	Factor	Corrected RR
0.7	0.3	0.6	0.35	1.4	1.2
0.7	0.3	0.6	0.3	1.2	1.3

Because cases who were also picked as controls were allowed to indicate "same" on these questionnaires if they perceived that the information did not vary, this option may have decreased our ability to distinguish differences in exposures between the cases and controls.

Because the relevant hazard period for injuries is usually very short, immediately preceding the injury, asking about average exposure history for the prior month may miss important short-term changes. For exposures that are more stable through time, such as type of practice or demographic characteristics, this issue should be less problematic. There is also a potential for information bias when asking about exposures several months after the incident; those injured may recall more details, or remember specific incidents, whereas the controls may have less specific memory triggers.

It was not possible to control for some important confounders, especially the behavior of a veterinarian toward a particular animal involved in an injury or toward animals in general and the behavior of the animal involved in the injury. For the veterinarian's behavior, there is no good, reliable measure of this item; for the animal's behavior, comparable control information cannot be readily obtained.

Veterinarians may change jobs or tasks fairly often, which may blur the determination of past exposures. There also is a difference in exposure assessment between the small-animal practitioner, who is in the same setting each day, and the large-animal practitioner, who spends much of the day traveling among a variety of farms and sales barns and also works in a clinic.

The finding of an increased rate for current smoking behavior has some substantiation from previous studies, including increased injury risk from motor vehicle crashes[7,8] and other sources.[9,10] Potential behavioral differences between smokers and nonsmokers and the possibility of carbon monoxide effects[8,9,11,12] have been reported.

Although the association of decreased alcohol use and injury appears contrary to the known relation between alcohol use and injury outcomes,[13] most of the available data are case-based and do not consider the overall population exposures. The finding from the current effort is consistent with two case-control studies that addressed farming-related injuries[14] and dairy operation-related injuries.[15]

Increasing years of experience were associated with decreasing rates of injury. This effect may reflect the position within the practice, owner *vs* associate, and learning to work better with patients and their owners over time. It may also reflect the type of work done, as the more experienced veterinarian may be involved in more specialty-type practices. The increased rate of injury with 6 or fewer hours of sleep per night is consistent with earlier data from Belloc and Breslow,[16] who examined the relation between amount of sleep and general health.

Acknowledgments

We thank George Maldonado, Division of Environmental and Occupational Health, School of Public Health, University of Minnesota, for his important contributions to design, analysis, and interpretation.

References

1. Langley R, Pryor W Jr, O'Brien K. Health hazards among veterinarians: a survey and review of the literature. *J Agromed* 1995;2:23–52.
2. Landercasper J, Cogbill T, Strutt PJ, Landercasper BO. Trauma and the veterinarian. *J Trauma* 1988;28:1255–1259.
3. Hashemi K, Brown R, Buckley A. Accidents in practice. *Vet Rec* 1993;133:580.
4. Poole A. Survey of occupational hazards in companion animal practices. *J Am Vet Med Assoc* 1998;212:1386–1388.
5. Gabel C. A study of risk factors for injuries among Minnesota veterinarians (Doctoral thesis). Minneapolis: University of Minnesota, 2000.
6. SAS Institute. SAS Software Release 6.12. Cary, NC: SAS Institute, 1996.
7. Maldonado G, Greenland S. Simulation study of confounder-selection strategies. *Am J Epidemiol* 1993;138:923–935.
8. Brison R. Risk of automobile accidents in cigarette smokers. *Can J Public Health* 1990;81:102–106.
9. Tsai S, Cowles S, Ross C. Smoking and morbidity frequency in a working population. *J Occup Med* 1990;32:245–249.

10. Reynolds K, Heckel H, Witt C, *et al.* Cigarette smoking, physical fitness, and injuries in infantry soldiers. *Am J Prev Med* 1994;10: 145–150.
11. DiFranza J, Winters T, Goldberg R, Cirillo L, Biliouris T. The relationship of smoking to motor vehicle accidents and traffic violations. *NY State J Med* 1986;86:464–467.
12. Liddell F. Motor vehicle accidents (1973–1976) in a cohort of Montreal drivers. J Epidemiol Community Health 1982;36:140–145.
13. Baker D. Interpersonal trauma and animal-related experiences in female and male military veterans: implications for program development. *Mil Med* 1998;163:20–25.
14. Elkington J. A case-control study of farmwork related injuries in Olmsted County, Minnesota (Doctoral thesis). Minneapolis: University of Minnesota, 1990.
15. Boyle D. Case-control study of dairy operation injuries (Doctoral thesis). Minneapolis: University of Minnesota, 1995.
16. Belloc N, Breslow L. Relationship of physical health status and health practices. *Prev Med* 1972;1:409–421.