

Perceptions regarding workplace hazards at a veterinary teaching hospital

Dustin R. Weaver, MPH; Lee S. Newman, MD, MA; Dennis C. Lezotte, PhD; Paul S. Morley, DVM, PhD, DACVIM

Objective—To assess perceptions of personnel working at a veterinary teaching hospital regarding risks of occupational hazards and compare those perceptions with assessments made by occupational safety experts.

Design—Cross-sectional study.

Study Population—A representative sample of personnel (n = 90) working at the veterinary teaching hospital at Colorado State University and a panel of 3 occupational safety experts.

Procedures—Hospital personnel ranked perceptions of 14 physical, chemical, and biological workplace hazards and listed the injuries, illnesses, and near misses they had experienced. The expert panel provided consensus rankings of the same 14 hazards for 9 sections of the facility. Risk perceptions provided by the 2 sources were compared.

Results—Risk perceptions did not differ significantly between hospital personnel and the expert panel for most of the site-specific comparisons (94/126 [75%]). Personnel perceived greater risks for some physical hazards (loud noises, sharps injuries, and ionizing radiation) and some chemical or materials exposures (insecticides or pesticides and tissue digester emissions). In contrast, the expert panel perceived greater risks for physical hazards (bite or crush and restraining and moving animals), chemical exposures (anesthetic waste gas), and biological exposures (*Toxoplasma gondii*, antimicrobial-resistant bacteria, and allergens).

Conclusions and Clinical Relevance—Participants and safety experts had similar perceptions about occupational risks, but there were important differences where hospital personnel apparently overestimated or underappreciated the risks for workplace hazards. This type of study may be useful in guiding development of optimal workplace safety programs for veterinary hospitals. (*J Am Vet Med Assoc* 2010;237:93–100)

The veterinary profession has a greater than average risk for occupational disease and injury, compared with many other occupations.^{1–3} This includes reportedly high risks of leukemia, cancers of the brain, zoonotic diseases, unplanned abortion, vehicular accidents, suicide, and physical injury.^{1,2} Previous reports^{3,4} suggest that veterinarians have a 61% to 68% chance of sustaining a major animal-related injury during their career. Hazardous workplace tasks that may result in animals biting or kicking are unique to animal-related occupations and represent up to 70% of work-related health insurance claims.⁵ Zoonotic agents and allergens also present notable health risks to veterinarians. A 2007 survey⁶ of registered practicing veterinarians in King County, Wash, found that 28% (105/371) experienced zoonotic illnesses during their careers, with the most common (n = 72) being dermatophytosis.

Veterinary teaching hospitals represent a unique and relatively unexplored working environment in terms of workplace hazards. The unique nature of vet-

ABBREVIATIONS	
JLV-VTH	James L. Voss Veterinary Teaching Hospital at Colorado State University
CI	Confidence interval

erinary teaching hospitals within the veterinary profession is attributable to the high referral case load, the relative inexperience and naïveté associated with student populations, and the constant introduction of emerging techniques and novel technologies. Despite these obvious challenges, veterinary teaching hospitals have been inconsistent in terms of education related to identification and control of workplace hazards.⁷

The safety climate (ie, the employee perception of employer commitment to safety) has been found to strongly correlate with injury rates and the adoption of safe work practices.^{8–10} Inaccurate perceptions of various risks may induce stress and poor workplace satisfaction.^{8,10,11} Unfortunately, because of the great variety of tasks assigned to

From the Animal Population Health Institute, College of Veterinary Medicine and Biomedical Sciences, Colorado State University, Fort Collins, CO 80523 (Weaver, Morley); the Health Sciences Center, University of Colorado Denver, 12101 E Colfax Ave, Denver, CO 80217 (Newman, Lezotte); and the Departments of Epidemiology (Weaver, Newman, Morley) and Biostatistics and Informatics (Lezotte), Colorado School of Public Health, University of Colorado, Denver, CO 80262.

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Address correspondence to Dr. Morley (Paul.Morley@colostate.edu)

veterinary personnel and the high levels of underreporting of occupational illnesses and injuries, the full effect of worker perception in veterinary medicine is not fully understood.^{7,12,13} The purposes of the study reported here were to assess the perceptions of personnel working at a veterinary teaching hospital regarding risks of occupational hazards and compare those perceptions with assessments made by a panel of occupational safety experts.

Materials and Methods

Overview—A representative sample of personnel working at the JLV-VTH was selected to participate in the study and asked to assess health and safety risks regarding 14 physical, chemical, and biological hazards encountered in the workplace. They were then asked to list the injuries, illnesses, and injury near misses that they had experienced. These risk assessment rankings were compared with consensus rankings generated by a panel of 3 occupational safety experts for the same 14 hazards in 9 sections of the facility. Hospital personnel and the expert panel were blinded to each other's responses when completing their assessments. The study protocol was reviewed and approved by the Colorado State University Institutional Review Board.

Study population—The sampling frame was developed by obtaining a list of all personnel working at the JLV-VTH from the hospital administration. This included all students, staff, house officers, and faculty (451 employees and 136 final-year veterinary students). To create the study cohort, the goal was to generate a sample of study participants with occupational exposures that would be representative of the entire facility and different education and training backgrounds. Thus, personnel were categorized into 9 strata by service section and job classification (ie, small animal medicine and surgery veterinarians, small animal clinical staff, large animal medicine and surgery veterinarians, large animal clinical staff, other clinical veterinarians [eg, radiology, cardiology, ophthalmology, dermatology, and anesthesiology], microbiology and pathology technical staff, maintenance and custodial staff, administrative staff, and final-year veterinary students). An evenly weighted random sample was selected from each strata to receive invitations to participate ($n = 140$).¹⁴ Personnel were contacted by e-mail and invited to participate in the study. Those individuals who were enrolled in the study signed written informed consent statements prior to interviews. A panel of 3 occupational safety experts was selected and included 2 certified industrial hygienists who were not veterinarians and an occupational medicine physician (LSN).

Interviews—Data were collected from study participants by use of scripted interviews^a lasting approximately 20 to 30 minutes; interviews were conducted between August 2007 and July 2008. Interview questions were read directly from the script by trained interviewers to reduce variability that might influence how participants responded to questions. Responses of participants were kept confidential, and their identity was only linked to paper forms or computer databases by ID codes. After completion of the data analysis, this ID link was destroyed to ensure confidentiality of responses.

Scripted interviews consisted of 17 questions that were designed to capture data in 4 general categories. Participants were first asked questions regarding demographics and veterinary hospital-related job experience (ie, age, gender, education level, job description, and years of experience). Participants were then asked to define and provide examples of important chemical, biological, and physical hazards that were encountered in the JLV-VTH. Participants were also asked to rank specific safety and health hazards at the JLV-VTH. After the scripted interview was completed, an addendum was given to each participant to complete without the interviewer in the room. This addendum asked respondents to report up to 6 injuries, illnesses, or near misses that they had experienced while working in the veterinary hospital in the year prior to the interview and to list the single most severe job-related event (including actual injuries, illnesses, and near misses) that they had experienced during their career. Information about these previous experiences was collected as open-ended responses and then was categorized by one of the investigators (DRW) to facilitate summarization. Questions regarding personal experiences were addressed at the end of the interviews to minimize the potential that recall of injury and illness would bias responses regarding importance of the various workplace hazards. The interview scripts and questionnaires were pilot tested with 3 veterinarians and 3 nonveterinarians prior to study initiation.

As a measure of data reliability, the ability of individuals to define and understand issues related to different types of hazards was assessed by asking participants to define and give an example of a physical, biological, and chemical hazard. The trained interviewers assessed the quality of these answers and assigned a score of 1 to 5 (1 = poor, response was completely inaccurate; 3 = average, response was acceptable; and 5 = excellent response).

In the section regarding hazard perceptions, study participants were asked to give examples of physical, biological, and chemical hazards and then to rank their exposure to 14 specific hazards (ie, biting, kicking, or crushing by animals; moving or lifting, falling, or slipping; ionizing radiation; sharps; loud noises; anesthetic waste gas; pesticides or insecticides; disinfectants; antimicrobial drugs; *Toxoplasma gondii*; *Salmonella enterica*; bacteria resistant to antimicrobial drugs; sensitizing allergens [eg, dander, amniotic fluid, and animal feed]; and emissions from a tissue digester^b) in relation to the severity of the hazard and also in terms of the frequency of exposure. Six-point Likert scales were used by participants to quantify risk perceptions regarding severity (0 = hazard is harmless; 5 = hazard is very dangerous) and frequency (0 = no exposure; 5 = constant exposure). This list of hazards was not intended to be exhaustive; rather, it was based on a subjective assessment of concerns previously expressed by JLV-VTH personnel and also on a review of the available literature related to occupational hazards in veterinary facilities. Participants were also asked to rank the level of their concern regarding physical, biological, and chemical hazards with a 6-point Likert scale for each (0 = no concern, 3 = moderate concern, and 5 = extremely concerned).

Review of workplace hazards by occupational safety experts—After interview data were collected from JLV-VTH personnel, a panel of 3 occupational safety experts conducted a site visit to assess workplace hazards at the JLV-VTH. These experts were blinded to information provided in interviews. Additionally, the experts had not worked or spent a substantial amount of time in the JLV-VTH and were therefore considered unbiased observers regarding the facility and its personnel. The experts conducted this audit as part of a guided tour of the facility in 2 days in May 2008. After visiting each of 9 areas of the VTH facility (food animal hospital, small animal surgery, other small animal hospital areas, equine surgery, other equine hospital areas, diagnostic imaging, laboratory diagnostics [eg, microbiology, immunology, and pathology], support services [eg, pharmacy, central supply, laundry, and maintenance], and administrative areas [ie, reception and medical records]), the safety experts provided a consensus evaluation (ie, a single score) for the same 14 hazards (for each of the 9 hospital areas) in terms of the perceived severity and frequency of exposure to personnel working in those areas; the same 6-point Likert scales were used for these assessments.

Data analysis—Data were collected on paper forms, entered into a computer spreadsheet, and then validated to ensure data integrity. Descriptive statistics were calculated for participant demographics and other responses. Reports of previous injuries, illnesses, and near misses were categorized post hoc as events involving bites or scratches from small animals; events involving kicks or crushing by large animals; events involving lifting, moving, or restraining animals; infections or exposures to zoonotic agents; events involving equipment (ie, hit, fall, crush, or strain); slip or fall event; sharps injuries; repetitive motion injuries; events related to anesthetic gas exposure; events involving burns; exposure to emissions from the tissue digester; allergen exposures; physical assault by clients or coworkers; and other types of events.

The frequency and severity scores regarding potential hazards that were obtained from each person interviewed and the consensus scores from the expert panel were multiplied to transform them into a single Likert-derived risk score for each hazard (risk score = frequency score $\times$ severity score; possible range = 0 to 25). Interviewees were then categorized to facilitate analyses according to their training and employment category (veterinarian, animal health technician, facility maintenance or animal care personnel, central supply personnel, other technical support personnel, and veterinary students and house officers) and according to their primary work area on the basis of the same 9 hospital areas that were used to categorize observations from the expert panel (ie, small animal surgery, other small animal hospital areas, equine surgery, other equine hospital areas, food animal hospital, laboratory diagnostics [eg, microbiology, immunology, and pathology], support services [eg, pharmacy, central supply, laundry, and maintenance], diagnostic imaging, and administrative areas [ie, reception and medical records]). The expert panel's risk score for a specific hazard was then subtracted from the risk score of the interviewee

for each hazard in every hospital area (possible range, -25 to 25). If the interviewee's risk score matched the expert panel's risk score, the difference was 0. The difference was a negative number if hospital personnel perceived less risk, compared with the expert panel, and the difference was a positive number if hospital personnel perceived more risk, compared with the expert panel.

The Wilcoxon signed rank test was used to test the hypothesis that the median for all risk score differences was 0. Data were then stratified by hazard and used to test the hypotheses that the median risk difference for each of the 14 hazards was 0. These omnibus tests were conducted to limit the potential for type I statistical errors associated with multiple statistical comparisons. If these tests were significant, indicating that the median was different from 0 for a hazard, then the data for the hazard were tested for each hospital area or group to evaluate whether personnel opinions for subgroups (hazard-area groups) differed systematically from expert opinions. The Bowker symmetry test was used to evaluate whether participant scores for concern differed by hazard type (physical vs biological vs chemical). A critical α for all statistical tests was defined a priori as $P < 0.05$. Statistical analyses were performed with commercial software.^c

Results

A total of 140 hospital personnel were selected as potential participants by use of stratified random sampling from personnel rosters. Ninety (64.3%) of these individuals agreed to participate and were interviewed between August 2007 and July 2008. Participants were considered to be generally representative of personnel working in all areas of the hospital. Participants (Table 1) were fairly evenly distributed among age categories from 26 to 55 years of age. Almost all (87/90 [96.7%]) had some college education, and more than half (49/90 [54.4%]) had completed or were enrolled in graduate or professional degree programs. Most (67/90 [74.4%]) participants were female and had at least 6 years of experience working in veterinary hospitals. The administrative personnel were somewhat different from other personnel groups in that they spent most of their time performing office-related duties, whereas the other groups had direct or indirect contact with animals and their environments. Almost all participants had a good to excellent understanding of physical, biological, and chemical hazards; 94.4% (85/90), 92.2% (83/90), and 94.4% (85/90) of respondents provided acceptable or excellent definitions and examples of these types of hazards, respectively.

Self-reported injuries and illnesses in the workplace—Overall, 94.4% (85/90) of all participants identified a specific event as being the most serious work-related health event in their careers (Table 2); these events did not necessarily occur in the year preceding the survey. However, 86.7% (78/90) did report at least 1 work related-health event occurring in the previous year, and a total of 152 events were reported for this period. Although personnel were not asked to differentiate between actual injuries or illnesses and those that would be considered near misses, it was clear from reports that 36.8% (56/152) of events reported from the previous

Table 1—Number (%) of participants in a study of workplace hazards at the JLV-VTH, by demographic group.

Variable	Category	All participants (n = 90)	Faculty (n = 22)	Animal care staff (n = 40)	Administrative staff (n = 9)	Students and house officers (n = 19)
Age (y)	19–25	5 (5.6)	0	4 (10.0)	0	1 (5.3)
	26–35	32 (35.6)	4 (18.2)	13 (32.5)	0	15 (78.9)
	36–45	19 (21.1)	8 (36.4)	7 (17.5)	1 (11.1)	3 (15.8)
	46–55	23 (25.6)	7 (31.8)	12 (30.0)	4 (44.4)	0
	> 55	11 (12.2)	3 (13.6)	4 (10.0)	4 (44.4)	0
Gender	Male	23 (25.6)	11 (50.0)	6 (15.0)	2 (22.2)	5 (26.3)
	Female	67 (74.4)	11 (50.0)	34 (85.0)	7 (77.8)	14 (73.7)
Highest education	High school	3 (3.3)	0	3 (7.5)	0	0
	Some college	14 (15.6)	0	13 (32.5)	1 (11.1)	0
	Undergraduate degree	24 (26.7)	0	20 (50.0)	4 (44.4)	0
	Graduate or professional degree*	49 (54.4)	22 (100)	4 (10.0)	4 (44.4)	19 (100)
Veterinary experience (y)	0–5	10 (11.1)	1 (4.5)	6 (15.0)	1 (11.1)	2 (10.5)
	6–15	45 (50.0)	7 (31.8)	20 (50.0)	2 (22.2)	16 (84.2)
	16–25	20 (22.2)	9 (40.9)	6 (15.0)	4 (44.4)	1 (5.3)
	≥ 26	15 (16.7)	5 (22.7)	8 (20.0)	2 (22.2)	0
Hospital section	Large animal	26 (28.9)	9 (40.9)	13 (32.5)	0	4 (21.1)
	Small animal	32 (35.6)	9 (40.9)	15 (37.5)	2 (22.2)	6 (31.6)
	Support	27 (30.0)	3 (13.6)	11 (27.5)	4 (44.4)	9 (47.4)
	Administration	5 (5.6)	1 (4.5)	1 (2.5)	3 (33.3)	0

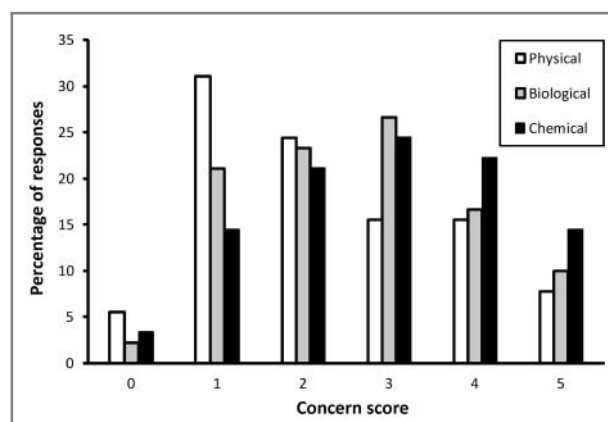
For some variables, percentage values do not add to 100% because of rounding.
 *Graduate or professional degree was defined as having obtained or being enrolled in a postbaccalaureate (MS or PhD) or veterinary medical degree program.

Table 2—Number (%) of work-related injuries, illnesses, and near misses reported by personnel (n = 90) working at the JLV-VTH, by event classification.

Type of reported event*	Events in the previous year (n = 152)†	Most serious event (n = 85)‡
Animal-related event†	66 (43.4)	50 (58.8)
Slip, fall, or equipment-related events§	23 (15.1)	10 (11.8)
Sharps	19 (12.5)	10 (11.8)
Infectious agents	13 (8.6)	8 (9.4)
Other types of events	31 (20.4)	7 (8.2)

*Includes reports of both near misses and actual injuries or illnesses. †Excludes individuals who reported no events. ‡Bite-related injuries, scratches, kicks, and crushing or strains caused by interactions with animals. §Includes physical injuries involving equipment such as hits, crushes, and strain injuries.

year and 23.5% (20/85) of events reported as the most severe event were near misses. It could not be determined whether the remainder of reports (96/152 [63.2%] and 65/85 [76.5%], respectively) represented near misses or were actual injuries or illnesses. Approximately half of the health-related events reported by participants were related to interactions with animals (eg, bites, scratches, kicks, and crushing) in the hospital; this included 43.4% (66/152) of events from the previous year and 58.8% (50/85) of the most serious events. The next most commonly reported events were physical injuries or near misses related to slips or falls, moving equipment, or falling equipment or similar events. Sharps injuries were the third most commonly reported event in the previous

Figure 1—Level of concern reported by personnel at the JLV-VTH (n = 90) regarding physical, biological, and chemical hazards at the hospital (0 = no concern; 5 = extreme concern). Scores were significantly ($P < 0.001$) different among the hazard types.

year, and exposure to infectious agents was the fourth most common type of event reported. Notably, events and near misses involving exposures to chemical hazards were infrequent relative to other types of hazards.

Risk perception by personnel—Participants' concern for various hazards varied significantly ($P = 0.001$) by type of hazard. Overall, participants reported that they had greatest concern regarding chemical hazards, followed by biological hazards, and had lesser concern for physical hazards (Figure 1); 36.7% (33/90) of participants reported they were very concerned or extremely concerned (score, 4 or 5) regarding chemical hazards,

compared with 26.7% (24/90) regarding biological hazards and 23.3% (21/90) regarding physical hazards.

Values for differences between risk scores provided by participants and those provided by the expert panel ranged from -25 to 20, indicating there was potentially

a large discrepancy between risk perceptions of individual personnel and the expert panel. Overall, the median of all risk score differences was found to be significantly different from 0 ($P = 0.003$), as were median scores for 12 of the 14 hazards (Table 3). Typically, person-

Table 3—Mean difference between the perceived risk among JLV-VTH personnel and the risk perception of a panel of 3 occupational safety experts.

Hazard category	Hospital group or area*	No.	Mean risk difference†	95% CI	P value‡
Bites, kicks, or crushing by animals	All	90	-3.4	-4.9 to -2.0	< 0.001
	Small animal (not surgery)	31	-5.8	-7.7 to -3.9	< 0.001
	Equine (not surgery)	15	-8.2	-11.6 to -4.9	< 0.001
Moving or lifting	All	90	-3.6	-5.4 to -1.9	< 0.001
	Small animal (not surgery)	31	-4.5	-7.3 to -1.6	0.003
	Diagnostic imaging	7	-10.6	-18.5 to -2.6	0.04
Sharps	All	90	2.5	1.1 to 3.8	0.01
	Equine surgery	8	3.3	0.5 to 6.0	0.02
	Support services	6	16.2	7.8 to 24.6	0.03
Ionizing radiation	All	90	2.7	1.7 to 3.6	< 0.001
	Small animal (not surgery)	31	3.7	2.1 to 5.4	< 0.001
	Small animal surgery	7	3.4	0.8 to 6.0	0.03
	Equine surgery	8	8.3	1.6 to 14.9	0.02
Loud noises	All	90	1.8	0.9 to 2.7	< 0.001
	Small animal (not surgery)	31	2.2	0.5 to 3.9	0.006
Anesthetic waste gas	All	90	-3.1	-4.2 to -1.9	< 0.001
	Small animal (not surgery)	31	-4.2	-6.1 to -2.3	< 0.001
	Small animal surgery	7	-8.7	-11.6 to -5.8	0.02
	Equine surgery	15	-4.7	-5.7 to -3.6	< 0.001
	Diagnostic imaging	7	-3.6	-5.6 to -1.5	0.03
Emissions from tissue digester	All	90	9.4	7.7 to 11.2	< 0.001
	Small animal (not surgery)	31	9.0	5.8 to 12.3	< 0.001
	Small animal surgery	7	8.0	2.8 to 13.2	0.02
	Equine (not surgery)	15	7.4	4.1 to 10.7	< 0.001
	Equine surgery	8	15.8	6.6 to 24.9	0.02
	Diagnostic imaging	7	13.3	7.0 to 19.6	0.02
	Support services	6	19.2	12.0 to 26.3	0.03
Pesticides and insecticides	All	90	2.7	1.7 to 3.8	< 0.001
	Small animal (not surgery)	31	2.2	0.9 to 3.5	< 0.001
	Equine surgery	8	8.5	1.5 to 15.5	0.03
Disinfectants	All	90	-2.1	-3.6 to -0.7	0.002
	Small animal (not surgery)	31	-5.0	-7.1 to -2.9	< 0.001
	Laboratory diagnostics	9	-4.9	-8.4 to -1.4	< 0.001
Antimicrobial drugs	All	90	0.3	-0.6 to 1.1	0.21
<i>Toxoplasma gondii</i>	All	90	-3.4	-4.9 to -2.0	< 0.001
	Small animal (not surgery)	31	-5.8	-7.7 to -3.9	< 0.001
	Equine (not surgery)	15	-8.2	-11.6 to -4.9	< 0.001
<i>Salmonella enterica</i>	All	90	-0.8	-2.2 to 0.6	0.12
Antimicrobial-resistant bacteria	All	90	-1.4	-2.7 to -0.2	0.004
	Small animal (not surgery)	31	0.8	-0.6 to 2.1	0.01
	Small animal surgery	7	2.4	1.4 to 3.5	0.03
	Equine (not surgery)	15	1.0	-0.8 to 2.8	0.04
Sensitizing allergens	All	90	-4.4	-5.7 to -3.1	< 0.001
	Small animal (not surgery)	31	6.1	4.3 to 7.9	< 0.001
	Small animal surgery	7	8.3	5.6 to 11.0	0.02
	Equine (not surgery)	15	4.7	1.4 to 7.9	0.01

*Overall differences are shown for all hazard categories; subgroup differences are only shown for hospital areas or groups for which risk score differences were significantly different from 0. †Possible range, -25 to 25; mean values were negative if personnel perceived lower risk than did the experts and positive if personnel perceived greater risk than did the experts. ‡P values from the Wilcoxon signed rank test of the null hypothesis that median risk score difference = 0.

nel perceived significantly less risk, compared with the expert panel, for animal-related hazards, moving and lifting, exposure to anesthetic waste gases, exposure to disinfectants, exposure to *T gondii* or antimicrobial-resistant bacteria, and exposure to sensitizing allergens. In contrast, hospital personnel perceived greater risk than did the expert panel for sharps, ionizing radiation, loud noises, emissions from the tissue digester, and exposure to pesticides and insecticides. However, these significant differences in risk perception were not identified in all hospital groups or areas. In fact, significant differences in risk perception were not identified in 2 hospital groups or areas (the food animal hospital and administrative areas) for any of the 14 hazards. Thus, among all 126 hazard-area subgroups that were evaluated, only 25% (32/126) of the risk score differences were significantly different from 0, indicating a mismatch in perceptions between personnel and the expert panel. The largest mean difference was found regarding exposure to emissions from the tissue digester; significant differences were found regarding this potential hazard for more hospital groups or areas than for any other hazard. The hospital section that was found to differ most commonly from the expert panel's risk perception was the small animal hospital (other than surgery; 11/14 hazards), followed by small animal surgery, equine surgery, and other equine hospital areas (5/14 hazards each).

Discussion

The present report provides insights into the extent of work-related injuries and illnesses in a veterinary teaching hospital and illustrates the disconnect that can exist between staff perceptions of risk, expert assessments of risk, and self-reported health events and near misses. In the JLV-VTH, some important mismatches between workers' perceptions of hazards, compared with perceptions of experts regarding those same hazards, were identified. However, of the 14 hazards we examined, most were perceived similarly by JLV-VTH personnel and occupational safety experts. This suggests that it can be challenging for supervisors to identify specific workplace hazards that have caused misperceptions and to selectively educate their employees. For example, in the present study, self-reported concern regarding general hazard types was greatest for chemical hazards, whereas nearly all of the health events and near misses reported by the same personnel involved physical hazards. By properly aligning employees' perceptions of workplace hazards through targeted training, employers can foster an optimally safe climate and reduce workplace morbidity.^{8,10,11}

Animal-related physical injury poses a substantial risk to the workforce in veterinary hospitals. The results of the present study were consistent with previous reports,^{3,5} in that half of all health-related events reported by respondents were related to direct contact with animals. In a survey³ of nearly 1,000 AVMA members in Minnesota and Wisconsin, 64% reported a major animal-related injury in their career and 10% had missed at least 1 working d/y because of animal-related injury. Nearly 70% of the AVMA PLIT workers' compensation

claims and half of the losses involved animal-related injury in 2006.⁵ Interestingly, in our study, the expert panel's assessment of physical injury risks matched the participants' reported experiences better than did the participants' own perception of physical risks. Another major mismatch of perceptions related to chemical hazards in the JLV-VTH. This class of hazards was the most concerning to workers; however, health events related to chemical hazards were rarely reported by participants as causing injuries, illnesses, or near misses. There was also a mismatch between the risk perceptions regarding chemical hazards of participants and the risk perceptions of the expert panel in the present report. Findings of the present study may help to guide the design of comprehensive occupational safety programs at veterinary teaching hospitals and enable supervisors to focus hazard training of personnel groups toward topics in which misperceptions are greatest.

There are limitations of the present study because it took place at 1 time in a single veterinary teaching hospital; hence, many of the hazards and perceptions examined may be specific to the JLV-VTH. However, our results suggest that this approach to investigating workplace hazards may be useful in tailoring occupational safety programs at other veterinary facilities. Results from a larger prospective study that evaluated participants in different working environments may be more applicable to the veterinary profession. In addition, a prospective approach would not have the limitations that cross-sectional studies have with regard to determining causality. The present study relied on the qualitative expertise of occupational safety experts and did not include quantitative environmental sampling. These experts were not familiar with internal factors in the JLV-VTH. This was done intentionally so that their perception of risk would be unbiased. However, although all of the experts were familiar with hospital-related hazards and occupational safety, none were veterinarians or experts in zoonotic diseases. As such, these experts were less familiar with the frequency of exposure to hazards unique to veterinary hospitals and were also less familiar with techniques specifically used to manage these unique hazards. For example, human infection with *T gondii*, one of the biological hazards examined in the present study, is associated with direct and indirect exposure to cat feces. This hazard is moderately important in veterinary medicine but very important to public health. It requires 24 hours for sporulation of oocysts in cat feces,¹⁵ and at the JLV-VTH, cat feces were always removed and disposed of within minutes to a few hours after defecation. In addition, personnel were familiar with the importance of hand washing. The expert panel perceived this biological hazard as being a greater risk to workers than workers perceived, and no exposures or illnesses were reported. Further, cats are present only in the small animal hospital. The expert panel's risk perception may therefore have been overestimated regarding this specific hazard because of their lack of familiarity with this aspect of hospital hygiene practices in veterinary hospitals. Although it is possible that the experts' lack of familiarity with veterinary medicine may have biased their perceptions of other hazards and a different set of experts may have provided different assessments, we believe that this panel's assessments of

other hazards were appropriate and representative of the best estimate of true health risks for veterinary personnel in this facility.

It would have been interesting to assess the relationship between apparent risk-perception mismatches and the likelihood of clinically important health events in the present study. However, this was not possible within the framework and methods used for this study. Primarily, we did not attempt to differentiate between perceived illnesses and illnesses that were confirmed by a physician. Whereas some reported events were clearly true events (eg, burns and bites) and some were clearly near misses (eg, almost hit or kicked), for many reported events, it was not possible to differentiate whether some reports were influenced by fears and perceptions (eg, psychophysiologic illness), nor was it possible to clearly determine the seriousness of all reported events or near misses even if it was clear that injuries or illnesses had occurred.

Regardless, the perception of risk for any given hazard was a reality to each participant, and our study stressed the importance of not overlooking worker perceptions. The adoption of protective behaviors by workers relies heavily on the perceptions that they have regarding workplace hazards.¹⁰ It appeared that participants were likely to have a greater magnitude of mismatched risk perception regarding hazards that they were less familiar with. This should not be overlooked because every worker's perception manifests itself in the worker's actions and words, and these influence others so that the end result becomes either a contagious misguided perception or a contagious correct one.⁹ At the JLV-VTH, the chemical digester is the principal disposal mechanism for carcasses and waste animal tissues. This digester is a sealed metal cylinder that uses high pressure, high temperature, and extreme alkaline conditions to transform biological matter into an agar-like solution composed of water and molecular building blocks (eg, amino acids and fatty acids). Emissions from the digester are actively scavenged outside the cylinder with a separate, dedicated ventilation system, but there is still an aversive odor that is detectable in the waste emissions. Although the expert panel did not perceive casual exposure to odors from these emissions to be an important hazard, many of the study participants were apparently very concerned about the health risk associated with these emissions. Anecdotally, some hospital personnel had reported concerns related to these emissions because the digester was sometimes used to dispose of animals known to be infected with prion diseases (eg, cervids with chronic wasting disease and sheep with scrapie), despite excellent evidence that prions are effectively destroyed by this digestion process and the lack of physical exposure. Six of the 9 hospital sections reported increased perceived risk for the digester with a greater magnitude of difference than with any other hazard. Although not every veterinary hospital will have a tissue digester, many will have equipment or other workplace hazards that personnel are unfamiliar with. It is important that hospital personnel be educated about the risks, benefits, and best safety precautions associated with new or unfamiliar technology prior to introduction.

When hazards persist in the workplace, workers often become indifferent to the effect that these hazards may have on them and their coworkers. The hazards slowly become commonplace, and soon workers perceive these hazards as benign, when in actuality the hazard may pose a substantial risk. In the present study, for example, participants were relatively inured to physical hazards and risks of anesthetic waste gases at the JLV-VTH. Small animal and equine surgery, small animal areas outside surgery areas, and diagnostic imaging respondents perceived the risk of anesthetic gases to be significantly less than what the experts perceived it to be. Anesthetic waste gases have been cited^{16,17} as an important risk to veterinarians, even more so than human medical doctors, because larger animals such as horses may use large volumes of anesthetic gas during a surgical procedure, and physical facilities in veterinary hospitals are often not designed with particular attention to this potential hazard. The waste gas from these surgeries is thought to result in higher ambient air concentrations, and this is worse in facilities that do not have sufficient scavenging systems. Anesthetic gases such as sevoflurane, isoflurane, and, to a lesser degree, methoxyflurane are often used in veterinary surgery, and the National Institute for Occupational Safety and Health estimates that 50,000 US veterinarians are exposed to anesthetic waste gases, often at concentrations that exceed the recommended limit of 2 ppm.¹⁶ Exposure to waste anesthetic gas has been associated with kidney and liver diseases, abortion, leukemia, and neurologic disorders¹⁶; however, these adverse health effects are thought to be underreported because outcomes are usually delayed and the exposure is more insidious than with other hazards. Jeyaretnam and Jones¹ found that 21.8% of respondents identified exposure to anesthetic gases as a major health concern. Although the expert panel in the present study did not sample air concentration or ventilation rates, respondents did not report any adverse health effects from exposure to these gases. However, education and monitoring are suggested for operating rooms, recovery suites, and diagnostic imaging areas in both small and large animal sections.

Methods used in the present study may be applied in other work environments as a practical means for measuring worker perceptions of workplace hazards and preventing injury and illness in the veterinary workforce.

- a. Interview scripts and survey instruments are available from the corresponding author upon request.
- b. BioMEER CPS 4000 V Tissue Digester, Hydrol-Pro Technologies, Zephyrhills, Fla.
- c. SAS, version 9.2, SAS Institute Inc, Cary, NC.

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From this month's *AJVR*

Renal and cardiorespiratory effects of treatment with lactated Ringer's solution or physiologic saline (0.9% NaCl) solution in cats with experimentally induced urethral obstruction

Marina G. M. C. M. Cunha et al

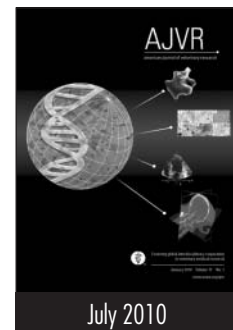
Objective—To compare the renal and cardiorespiratory effects of IV treatment with lactated Ringer's solution (LRS) or physiologic saline (0.9% NaCl) solution (PSS) in severely decompensated cats with urethral obstruction (UO).

Animals—14 cats (4 cats were used only to establish infusion rates).

Procedures—An occluded urethral catheter was used to induce UO in each cat. After development of severe metabolic acidosis, hyperkalemia, and postrenal azotemia, the obstruction was relieved (0 hours); LRS or PSS (5 cats/group) was administered IV (gradually decreasing rate) beginning 15 minutes before and continuing for 48 hours after UO relief. Ten minutes before urethral catheter placement (baseline), at start of fluid therapy (SFT), and at intervals during fluid administration, various physical and clinicopathologic evaluations were performed.

Results—Metabolic acidosis was detected in the PSS-treated group at SFT and 2 hours after relief of UO and in the LRS-treated group only at SFT. The PSS-treated group had significantly lower blood pH and bicarbonate concentrations at 8 through 48 hours and lower base excess values at 2 through 48 hours, compared with the LRS-treated group. Hypocalcemia and hypernatremia were detected in the PSS-treated group at 2 and 12 hours, respectively. Absolute serum potassium and chloride concentrations did not differ significantly between groups at any time point.

Conclusions and Clinical Relevance—Treatment with LRS or PSS appears to be safe and effective in cats with experimentally induced UO; however, LRS was more efficient in restoring the acid-base and electrolyte balance in severely decompensated cats with UO. (*Am J Vet Res* 2010;71:840–846)



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