Workplace Safety and Health for the Veterinary Health Care Team

John D. Gibbins, DVM, MPH[a,*], Kathleen MacMahon, DVM, MS[b]

KEYWORDS

• Occupational safety • Occupational health • Regulations • Needlestick injuries
• Hazardous drugs • Animal bites

KEY POINTS

- Employers should develop and implement a comprehensive safety and health program, including written standard operating procedures, that address occupational safety and health risks that are specific to their clinic. This program should be consistent with national, regional, state, and other applicable standards and regulations.
- A written infection control plan is an important component of a comprehensive veterinary clinic safety and health program.
- Management commitment, employee involvement, and initial and refresher training for staff on all aspects of the program are keys to success.
- Many resources are available to help employers develop clinic guidelines to prevent occupational injuries and illnesses from bites and scratches, sharps, and hazardous drugs, as well as other hazards commonly encountered in veterinary medicine. Some of these resources are provided at the end of this article.

INTRODUCTION

Veterinary practice is associated with a large number of potential chemical, biological, physical, and psychological hazards that vary with the workplace setting and the type of tasks performed. Veterinary employers are responsible for ensuring that workplace hazards are identified and evaluated, from animal-related hazards to chemical

The authors have nothing to disclose.
The findings and conclusions in this report are those of the authors and do not necessarily represent the views of the National Institute for Occupational Safety and Health.

[a] Division of Surveillance, Hazard Evaluations, and Field Studies, National Institute for Occupational Safety and Health, Centers for Disease Control and Prevention, 1090 Tusculum Avenue, MS R-10, Cincinnati, OH 45226, USA; [b] Education and Information Division, National Institute for Occupational Safety and Health, Centers for Disease Control and Prevention, 1090 Tusculum Avenue, MS C-14, Cincinnati, OH 45226, USA
* Corresponding author.
E-mail address: jgibbins@cdc.gov

Vet Clin Small Anim ■ (2015) ■–■
http://dx.doi.org/10.1016/j.cvsm.2014.11.006 **vetsmall.theclinics.com**
0195-5616/15/$ – see front matter Published by Elsevier Inc.

exposures. Employers should develop and implement a comprehensive, customized, written safety and health program to address and prevent those hazards. A program that identifies and addresses recognized workplace hazards is an important step toward preventing workplace illnesses and injuries. Training employees about the hazards they are exposed to and encouraging them to report work-related illnesses and injuries are important aspects of an effective safety and health program. A written infection control plan is an important component of a comprehensive safety and health program.

The principles of occupational safety and health are universal and many of the recognized hazards are found worldwide in veterinary clinics. This article focuses on workplace standards in the United States but other countries have similar workplace standards and guidance.

The elements and principles of workplace standards relevant to veterinary clinics are reviewed, including the US Occupational Safety and Health Administration (OSHA) Recordkeeping, Hazard Communication, Personal Protective Equipment, Respiratory Protection, and Bloodborne Pathogens Standards. Information about selected veterinary safety and health hazards is presented, including sharps injuries, animal bites and scratches, and hazardous drug exposures. Strategies to reduce the potential for adverse safety and health effects of workplace hazards and resources for training and education are provided. Information about the cost of work-related injuries and illnesses and the economic incentives of an effective safety and health program that prevents these costly incidents is presented. Additional information about each of these topics is provided in the Resources section.

GENERAL CLINIC PREVENTION

Developing an Occupational Safety and Health Program

Developing and implementing a comprehensive workplace safety and health program that identifies and addresses the serious hazards of each workplace is an important foundation for preventing illnesses and injuries. Management commitment and employee involvement in the development, communication, and implementation of the program are critical to its success (**Box 1**). A worksite evaluation that assesses all workplace activities and processes is needed to identify workplace hazards. It is helpful to consider the typical hazards that are found in many veterinary workplaces; however, it is also important to identify any additional or different potential hazards in each specific workplace. Employers should develop written standard operating procedures that address the hazards in their workplace. International and national resources with information about common hazards found in veterinary clinics are provided in the Resources section.

Box 1
Safety and health program critical elements

1. Management commitment and employee involvement
2. Worksite analysis to identify hazards
3. Hazard prevention and control
4. Training for employees, supervisors, and managers

From OSHA. OSHA fact sheet: effective workplace safety and health management systems. 2014. Available at: https://www.osha.gov/Publications/safety-health-management-systems.pdf. Accessed July 5, 2014.

Assistance with a workplace hazard evaluation can be obtained from a professional consultant trained in industrial hygiene or other occupational safety and health professional (see Resources). Before hiring a consultant, individuals should consider evaluating the consultant's experience in veterinary clinic settings and asking for references from colleagues in the veterinary profession. In the United States, OSHA has a consultation program that provides assistance with workplace compliance. The US National Institute for Occupational Safety and Health (NIOSH) may help evaluate workplace health hazards if requested by employees, employee representatives, or employers through its Health Hazard Evaluation program. NIOSH may provide assistance and information by phone and in writing, or may visit the workplace to assess exposure and employee health. Based on their findings, NIOSH recommends ways to reduce hazards and prevent work-related illness (see Resources).

Having an illness and injury reporting system in place and encouraging employees to report work-related incidents is a key component of an occupational safety and health program. Evaluating and analyzing these incidents can help refine and tailor the safety and health program to the workplace-specific hazards of concern. A reevaluation of workplace hazards should be conducted periodically and after any change in a process, material, or equipment to ensure the program is current and effective.

A written infection control plan is a critical component of a comprehensive safety and health program because it protects employees from potential biological hazards in veterinary practice. Important elements of an infection control program include

- Identifying and recognizing potential biological hazards
- Applying the hierarchy of controls, including elimination, substitution, engineering controls, administrative controls, and personal protective equipment (PPE), to prevent and reduce risks (**Box 2**)
- Training employees about their risks and how to prevent or minimize them
- Reporting and recording of workplace-related injuries and illnesses.

Occupational Safety and Health Standards

Overview

Workplace standards that apply to veterinary clinics depend on the potential hazards in the clinic. Even for those employers who may not be required to comply with some standards, voluntarily following the provisions of the relevant standards is important to prevent or minimize work-related injuries and illnesses. The standards presented here include Recordkeeping, Hazard Communication, Personal Protective Equipment, Respiratory Protection, and Bloodborne Pathogens. Adhering to these standards reinforces an infection control plan and contributes to a comprehensive safety and health program. Additional workplace standards may apply to veterinary clinics depending on the potential hazards in the facility such as noise, radiation, and waste anesthetic gases (see Resources).

Employers should be aware of local, state, regional, and federal workplace regulations that apply to their practice. In the United States, in addition to federal OSHA, 25 states, Puerto Rico, and the Virgin Islands have OSHA-approved state plans. State plans set workplace safety and health standards that are at least as effective as comparable federal standards. They can also promulgate standards covering hazards not addressed by federal standards. For example, California has an Aerosol Transmissible Diseases Standard, the first US standard to protect workers from occupational exposure to infectious diseases that can be transmitted by inhaling air that contains viruses, bacteria, or other infectious agents. It was designed to make recommended infection control practices legally enforceable. There is no similar federal standard.

Box 2
Examples of the hierarchy of controls for infection control

The hierarchy of controls should be followed to most effectively protect workers from hazards. These controls are listed in decreasing order of effectiveness; elimination is the most effective control. An example of each type of control is provided.

Elimination

- Remove the hazard from the workplace
  - Do not admit animals with potential high-risk zoonotic diseases if the facility is not properly equipped.

Substitution

- Switch to the use of a less risky hazard.
  - Switch to the use of needleless devices.

Engineering controls

- Prevent exposure to a hazard or place a barrier between the hazard and the worker.
  - Install a dedicated ventilation system for isolation rooms.

Administrative controls

- Implement changes in work practices and management policies.
  - Require rabies preexposure vaccination for high-risk workers.

PPE

- Use gloves, safety eyewear, masks, hearing protection, respirators, or other protective equipment when other controls cannot effectively reduce exposures.
  - Wear nonlatex gloves when handling animals with skin lesions.

Adapted from NIOSH. NIOSH veterinary safety and health hazard prevention and infection control. 2014. Available at: http://www.cdc.gov/niosh/topics/veterinary/hazard.html. Accessed August 7, 2014.

Summarized below is information about workplace occupational safety and health regulations with a focus on US standards. The principles of occupational safety and health are universal but regulations and requirements may vary by country, region, or state. Each employer should be informed about the occupational safety and health regulations that apply to their clinic. Additional information about each of the workplace standards summarized below is provided in the Resources section.

Employer responsibility for workplace safety and health

Employers are responsible for identifying and assessing the serious, recognized hazards in their workplace, and preventing and minimizing the risks to workers exposed to these hazards. Various groups can be exposed to hazards in veterinary clinics, including full-time workers, temporary workers, interns, volunteers, and observers. The legal obligations to protect these individuals vary with the country, region, or state. For example, some US OSHA state plans may extend coverage to certain volunteers and other workers exempt from federal OSHA authority. Employers should know and follow the regulations that apply to their facility. Workers' compensation and other insurance provisions vary. Regardless, employers are encouraged to include all personnel, whatever their employment status, in their occupational safety and health programs. Individuals should not be allowed to participate in clinic activities

that they have not been trained and equipped for. This may lead to excluding some individuals, such as one-time or occasional observers, from certain activities because of the burden of training and providing protection.

Some workers, such as immunocompromised or pregnant workers, may require additional considerations and protections. See elsewhere in this issue for information about zoonotic disease risk in these populations by Stull and Stevenson and discussion about the legal implications of zoonotic disease transmission in veterinary practices by Marsh and Babcock.

In the United States, the Occupational Safety and Health (OSH) Act of 1970 mandates that US employers provide employees with a safe and healthy workplace. The General Duty Clause of the OSH Act Section 5(a)(1) requires that every employer provide employment and a place of employment that is free from recognized hazards that cause or are likely to cause death or serious physical harm to employees (**Box 3**). It is intended to protect employees against those hazards that an employer's industry is aware of but for which there are no established standards. Examples of hazards for which OSHA has applied the General Duty Clause include occupational exposure to infectious diseases such as tuberculosis. When a hazard-specific OSHA standard is available, such as those described below, it would apply and be enforced rather than the General Duty Clause.

Recordkeeping

Maintaining records of workplace injuries and illnesses is an important component of a workplace safety and health program. In the United States, the OSHA Recordkeeping Regulation (29 CFR Part 1904) requires employers to prepare and maintain records of serious workplace injuries and illnesses (**Box 4**). Injuries and illnesses that should be recorded include those that result in time away from work, restricted work, transfer to another job, loss of consciousness, or medical treatment beyond first aid. OSHA provides specific forms (Forms 300, 300A, and 301) to record work-related incidents (see Resources). An incident is considered work-related if an event or exposure in the employee's work environment caused or contributed to the condition, or if a preexisting injury or illness is significantly aggravated by the employee's work environment. All employers covered by the OSH Act must report the death of any employee from a work-related incident or the in-patient hospitalization of 3 or more employees as a result of a work-related incident to OSHA within 8 hours. Employers cannot retaliate or discriminate against a worker for reporting an injury or illness.

All small businesses with up to 10 employees are exempt from compliance with the Recordkeeping regulation. However, reporting and recording workplace injuries and illnesses is an important component of a comprehensive safety and health program.

Box 3
Employer responsibility for workplace hazards, US OSHA General Duty Clause

1. A workplace hazard is present to which employees were exposed
2. The hazard is recognized by the employer or employer's industry
3. The hazard causes or is likely to cause serious harm or death
4. Feasible methods exist to substantially reduce the hazard

From OSHA. Letter of interpretation: elements necessary for a violation of the General Duty Clause. 2003. Available at: https://www.osha.gov/pls/oshaweb/owadisp.show_document?p_table=interpretations&p_id=24784. Accessed June 30, 2014.

Box 4
Recordkeeping for work-related injuries and illnesses

1. Collect relevant information about the incident
   - US OSHA Form 301: Injury and Illness Incident Report
2. Maintain a log of work-related injuries and illnesses to document information about incidents
   - US OSHA Form 300: Log of Work-related Injuries and Illnesses
3. Summarize the year's incidents at the end of the calendar year
   - US OSHA Form 300A: Summary of Work-related Injuries and Illnesses
   - Post in the workplace between February 1 and April 30
4. Review and analyze incidents to inform prevention and control of future incidents

Recording this information provides employees with information about hazards and incidents in the workplace and allows targeting of hazards that may need additional emphasis to prevent future incidents. A working group made up of employer and employee representatives can be established to discuss work-related incidents in a constructive and nonpunitive manner to help prevent future incidents. Employee privacy should be maintained to the greatest extent possible.

Hazard Communication Standard

Training workers about the chemicals they are exposed to is a critical component of a workplace safety and health program. In the United States, the OSHA Hazard Communication Standard (29 CFR 1910.1200) requires that employers of workers who handle, store, or use potentially dangerous chemicals develop a written hazard communication program (**Box 5**). A hazardous chemical is any chemical classified as a physical hazard (eg, flammable gas or gas under pressure), health hazard (eg, eye irritant or carcinogen), simple asphyxiant, combustible dust, pyrophoric gas, or hazard not otherwise classified (see Resources). The standard applies to all hazardous chemicals on the premises, whether they are currently in use or stored. This standard is known as the right-to-know law. It ensures that employees exposed to chemicals are informed of the hazards associated with the chemicals and the precautions that should be used when handling them. The Hazard Communication Standard does

Box 5
US OSHA hazard communication program steps

1. Learn the standard and identify responsible staff.
2. Prepare and implement a written hazard communication program.
3. Ensure containers, including secondary containers, are labeled.
4. Maintain safety data sheets for all hazardous workplace chemicals.
5. Inform and train employees; document the training.
6. Evaluate and reassess the program.

From OSHA. OSHA fact sheet: steps to an effective hazard communication program for employers who use hazardous chemicals. 2014. Available at: https://www.osha.gov/Publications/OSHA3696.pdf. Accessed June 30, 2014.

not apply to household consumer products when they are used in the workplace similar to consumer use. That is, the workplace exposure has a similar duration and frequency as consumer exposure. For example, if window cleaner is used in a similar quantity and a similar frequency as used by a consumer it would be exempt.[1] Other products, such as hydrogen peroxide, if used in greater quantities and more frequently than consumer use would not be exempt.

The US OSHA Hazard Communication Standard was updated in 2012 to align with the United Nations' Globally Harmonized System of Classification and Labeling of Chemicals (GHS), an international standardized approach to hazard communication (see **Box 6**). The GHS provides a common approach to classifying chemicals and communicating hazard information on labels and safety data sheets (previously called material safety data sheets). It provides a basis for harmonization of chemical rules and regulations at the national and international levels. Different countries are at various stages of considering and implementing GHS. The revised US standard, known as the right-to-understand law, provides employees with consistent and understandable information on the appropriate handling and safe use of hazardous chemicals. By June 2015, US employers will be required to comply with all modified provisions of the revised standard. US employers were required to have trained employees on the new label elements and safety data sheet format by December 2013 (see Resources).

Personal protective equipment

PPE is an important control for protecting workers when engineering, work practice, and administrative controls are not feasible or do not provide sufficient protection against workplace hazards. In the United States, the OSHA Personal Protective Equipment Standard (29 CFR 1910.132) requires that PPE be provided at no cost to the employee. Employers should clean, repair, and replace PPE as needed.

Worker training about PPE should include the following information:

- When it is needed
- What type is needed
- How to put it on, adjust, wear, and take it off
- Its limitations
- Its proper care, maintenance, useful life, and disposal.

Box 6
Major changes to the US OSHA Hazard Communication Standard, 2012

- Hazard classification: Chemical manufacturers and importers are required to determine the hazards of the chemicals they produce or import.
- Labels: Chemical manufacturers and importers must provide a label that includes a signal word, pictogram, hazard statement, and precautionary statement for each hazard class and category.
- Safety Data Sheets: The new format requires 16 specific sections, ensuring consistency in presentation of important protection information.
- Information and training: Employees should have been trained by December 2013 on the new label elements and safety data sheet format, in addition to the current training requirements.

From OSHA. OSHA fact sheet: hazard communication standard final rule. 2014. Available at: https://www.osha.gov/dsg/hazcom/HCSFactsheet.html. Accessed August 7, 2014.

If PPE is used, a PPE program should be implemented, including the following elements:

- The hazards present
- The selection, maintenance, and use of PPE
- The training of employees
- Monitoring of the program to ensure its ongoing effectiveness.

Respiratory protection

A respirator is a specific type of PPE that protects employees from inhaling dangerous substances, such as chemicals and infectious particles. Unlike surgical masks, respirators are specifically designed to provide respiratory protection by forming a tight seal against the wearer's skin and filtering out airborne particles, including pathogens.[2] Surgical masks are not respirators; they do not form a tight seal against the skin or filter very small airborne pathogens.[2] An example of when a respirator may be needed is when a clinic employee is exposed to a zoonotic respiratory pathogen such as avian influenza.

Respirators should only be used when all other controls, including engineering controls, are not feasible. Engineering control systems, such as adequate general ventilation or using local ventilation to remove contaminants from the air, are the preferred control methods for reducing worker inhalation exposures. Selecting the right respirator requires an assessment of the workplace operations, processes, or environments creating the respiratory hazard. Selection of an appropriate respirator and its proper wear and use are critical to its effectiveness. The specific respiratory hazard and its airborne concentrations should be assessed by an industrial hygienist or experienced safety professional before choosing a respirator (see Resources).

In the United States, respirators should only be used in the context of a complete written respiratory protection program as required by the OSHA Respiratory Protection Standard. Fit-testing, medical evaluation, and the other OSHA-required procedures are essential to assure that the respirator will achieve the required protection. The OSHA standard sets requirements for the fit-testing of respirators to ensure a proper seal is maintained between the respirator's sealing surface and the wearer's face. The OSHA standard also contains requirements for determining that workers can use respirators safely, for training and educating employees in the proper use of respirators, and for maintaining respirators properly.

Employees may choose to wear a respirator even if it is not required by the employer or the OSHA standard. Employers who allow voluntary respirator use must make sure the worker is medically able to use the respirator, the respirator does not create a hazard, and the respirators are properly cleaned, stored, and maintained. Employers must provide the respirator users with the information contained in the OSHA Respiratory Protection Standard 1910.134, Appendix D (revise to Appendix D). Veterinary clinics located outside of the United States should follow standards established by their regulatory organizations (see Resources).

Bloodborne pathogens standard

Protecting workers from bloodborne pathogens is another important component of a comprehensive workplace safety and health program. In the United States, the OSHA Bloodborne Pathogens Standard (29 CFR 1910.1030) protects employees from potentially infectious organisms that may be present in blood. Although this standard applies primarily to occupational exposures to human blood, occupational exposures to animal blood used for research and known to be infected with the human immunodeficiency virus (HIV), hepatitis B virus, or hepatitis C virus are also covered.[3,4] The

standard does not protect workers from exposure to blood from companion animals, other domestic animals, animals in zoos, or research animals not known to be infected with these pathogens.

The US National Association of State Public Health Veterinarians (NASPHV) recommends voluntary compliance with the OSHA Bloodborne Pathogens Standard to protect employees working in veterinary or other animal settings.[5] Standard precautions, good work practices, engineering controls, and the proper use of PPE should be considered to prevent or minimize occupational exposures to animal blood because of the potential risk of transmission of zoonotic pathogens (see later discussion).

SELECTED HAZARDS AND PREVENTION

Information about sharps, needlestick injuries, and animal bites and scratches, and strategies for prevention are provided below. For information about other common hazards see the Resources section.

Sharps

Developing, implementing, and consistently following safe sharps handling procedures is a key component of a clinic's infection control and occupational health program. Needlestick and sharps injury (NSI) prevention receives a great deal of attention and research in human medicine, primarily due to the risk posed from HIV and viral hepatitis infections. However, NSIs are also a common occurrence in veterinary medicine: 64% to 93% of veterinary personnel report at least 1 NSI in their career.[6] An Australian survey of 664 veterinarians found that approximately 75% reported at least 1 NSI in the previous 12 months.[7] Syringe and suture needles were the most common cause of NSIs in this study. Reported risk factors for exposure to an NSI that was previously used (contaminated) were female gender, working in small or mixed animal practice, less experience, and working more hours and/or seeing more patients per week.[8]

In human and veterinary medicine, many NSIs go unreported and are often only reported if complications occur.[6,8]

Potential complications from NSI in veterinary medicine include:

- Direct physical trauma with potential for nerve damage, especially to the fingers and hands
- Secondary wound infection due to contamination with infectious agents from the animal's skin
- Injection of syringe contents that may contain killed or modified live vaccines; antibiotics; hazardous drugs, such as chemotherapeutic agents and hormones; sedatives; and anesthetics, such as ketamine and narcotics. Effects can range from local irritation to severe systemic and fatal effects[9]
- Transmission of zoonotic pathogens.

Much less is known about the potential for zoonotic infections from NSI in veterinary medicine than bloodborne pathogen infections widely recognized as occupational hazards in human medicine. However, there are case reports of infection with *Bartonella* species in veterinarians associated with NSI.[10,11] The potential for zoonotic transmission through NSIs for organisms such as arboviruses or *Blastomyces* or for newly emerging infectious diseases is also a concern.[12]

The OSHA bloodborne pathogens standard does not apply to animal blood except in certain cases where animals are used for research on human bloodborne pathogens. However, the use of sharps (as well as animal bites) in veterinary practice poses

the potential for staff and clients to be exposed to human blood. If an NSI involves a needle or other sharp contaminated with human blood, the bloodborne pathogens standard does apply. For this reason, clinics should have an exposure control plan for human blood as part of their overall infection control plan and should voluntarily comply with the OSHA bloodborne pathogens.[5] OSHA provides a fact sheet with guidelines about developing an exposure control plan at: https://www.osha.gov/OshDoc/data_BloodborneFacts/bbfact01.pdf.

Preventing Needlestick and Other Sharps Injuries

Practical steps can be taken to reduce and prevent NSI in veterinary clinics (**Boxes 7** and **8**). In addition to these steps, employers and individuals who serve as the clinic infection control coordinator should evaluate the availability and feasibility of implementing safety devices such as retractable needles or needleless devices when appropriate.

Animal Bites and Scratches

According to the American Veterinary Medical Association Professional Liability Insurance Trust (AVMA PLIT) injury from animal contact accounted for 82% of workers' compensation claims filed between January 1, 2007 and June 30, 2011. Workers'[13] in 2012, 48% of all claims were due to injuries from dogs, with an average cost of $3192, and 46% were due to cat injuries, with an average cost of $1580 (Andrew Starrenburg, HUB International Limited, 2014, personal communication). In 2008, the average cost of a dog bite–related hospital stay was $18,200.[14] In approximately 75% of dog and cat bites in the veterinary clinic setting in 2012, wounds were to the fingers or thumbs, hands, lower arms, or wrists (HUB International Limited, 2014, personal communication). Bite wounds to fingers, hands, and wrists are higher-risk due to the greater potential of bone, joint, tendon, or nerve involvement. These wounds can result in infections or nerve damage and lead to long-term disability

Box 7
Steps for reducing needlestick and sharps injuries

- Educate all employees and volunteers about safe sharps handling and potential adverse health effects from needlestick injuries; periodic refresher training is also necessary.
- Educate clients about safe handling and disposal if sharps are to be used for home treatment (such as subcutaneous fluid administration).
- Use trained personnel, not clients, to restrain animals; this protects staff and clients.
- Do not recap needles unless necessary as part of a medical procedure such as a fine needle aspirate. If necessary, use a one-hand scoop method or use forceps to recap the needle (see **Box 8**).
- Place approved sharps containers in easily accessible and visible areas where sharps are used.
- Promptly dispose of used sharps in approved containers.
- Never try to remove anything from a sharps container; do not overfill containers.
- Ensure employees and volunteers report all injuries. Record information about the incident. Analyze and discuss how the injury occurred to help prevent future incidents.
- Dispose of sharps containers and materials and/or medical waste in accordance with laws and ordinances specific to the locale (ie, country, region, state).

Adapted from Weese JS, Jack DC. Needlestick injuries in veterinary medicine. Can Vet J 2008;49:780–4.

Box 8
Procedure for recapping needle when medically indicated (one-handed scoop technique)

- Place needle cap on horizontal surface such as a table top
- Hold syringe with attached needle in one hand
- Use the needle to scoop up the cap without using the other hand
- Secure cap by pushing against a hard surface or by using forceps

Adapted from Scheftel JM, Elchos BL, Cherry B, et al. Compendium of veterinary standard precautions for zoonotic disease prevention in veterinary personnel: National Association of State Public Health Veterinarians Veterinary Infection Control Committee 2010. J Am Vet Med Assoc 2010;237(12):1403–22.

and inability to perform intricate tasks such as surgery. Bite wounds may result in more severe secondary infections in immunocompromised people.

A survey of certified veterinary technicians (CVTs) in Minnesota evaluated work-related injuries to include animal bites.[15] Among CVTs who reported bite-related injuries, the bite injury rate was significantly higher for respondents less than 26 years of age.[15] The rate of bite injury was also higher in this study for those who reported they believed work-related injuries could not be prevented. This suggests that education about injury prevention in general, and bite prevention in particular, may be beneficial for veterinary technicians.

A wide variety of aerobic and anaerobic bacteria have been cultured from dog and cat bite wounds, with polymicrobial infections commonly seen.[16] Such mixed infections can present challenges for antimicrobial therapy and patient management.

The most common pathogen implicated in animal bites is *Pasteurella multocida*; numerous evaluations have found the bacteria in the oral cavity of most healthy cats. Cats are the main reservoir for *Bartonella henselae*, the agent most commonly associated with cat-scratch disease. *B clarridgeiae* has also been associated with clinical cat-scratch disease, and should be considered in patients who demonstrate negative serology for *B henselae* when cat scratch-disease is suspected.[17] Although rare, serious infections and deaths have been seen from the zoonotic transmission of the agents responsible for tularemia (*Francisella tularensis*) and plague (*Yersinia pestis*).[17–19] Human cases of sporotrichosis have been associated with cat bites and scratches as well as exposure to infected cats in which no wound was reported, such as administering medications.[20] Blastomycosis has been reported in a veterinary assistant following a dog bite.[21]

Rabies in dogs and cats is rare in the United States. In 2012, approximately 92% of the 6162 rabid animals reported to the Centers for Disease Control and Prevention were in wildlife.[22] Rabid cats (257) outnumbered rabid dogs (84); 1 human case was reported and was attributed to bat exposure in the United States and symptom development, treatment, and diagnosis abroad.[22] However, rabies risk to animals and humans varies considerably by country and region; it is important to know the regional epidemiology of rabies to appropriately manage disease risk in workers. Preexposure vaccination should be offered to veterinary staff, especially high-risk workers, such as those in frequent contact with potentially rabid bats, raccoons, skunks, cats, dogs, or other high-risk species.[23] Vaccination of employees who handle high-risk animals in addition to bite prevention is a cornerstone of an infection control program given the high human case fatality ratio and the high cost if postexposure prophylaxis is not given in a timely manner. Animal rabies vaccination programs are also crucial given the availability of an inexpensive and highly effective vaccine for dogs and cats.

Due to the potential for atypical and mixed infections following bite wounds, individuals who are bitten or who develop nonspecific health symptoms when working with animals should inform their health care provider about their occupational history.

As discussed previously regarding sharps, animal bite wounds and scratches have the potential to expose clinic staff and clients to human blood. Clinics should have an exposure control plan for human blood and body fluids, and instruct employees about potential hazards and safe first aid techniques for responding to situations in which they may be exposed to human blood. Numerous organizations, such as the American Red Cross, offer courses in bloodborne pathogen training, first aid, and cardiopulmonary resuscitation that can assist in staff education.

Prevention of Animal Bites and Scratches

Appropriate animal restraint during all procedures is key for the safety of the animal and for clinic personnel who are doing the restraining and/or performing medical procedures. All staff should be trained on the proper methods of animal restraint for all species they will work with. Although some studies have shown that veterinary staff still commonly rely on clients to assist in animal restraint,[24] this practice is discouraged. Although clients often want to help and feel their involvement may cause less stress for their pet, allowing clients to restrain animals puts both clinic staff and the client at risk and exposes the clinic owner to liability should a bite, scratch, NSI, or other type of injury occur. Physical restraints, such as muzzles, bite-resistant gloves, restraint bags, sedation, and anesthesia, should be used when appropriate. Aggressive tendencies should be noted in the patient's medical records and posted on cages. The use of color-coded collars also allows clinic staff to readily recognize potentially aggressive animals. Situational awareness and remaining alert to changes in animal behavior is key because animals may react in unexpected ways when in a new environment or if ill or in pain. As with other types of occupational injuries, bites and scratches should be reported to supervisors and appropriate first aid and medical treatment provided. An investigation into the circumstances that led to the bite or scratch should occur with the goal of preventing future occurrences. Human and veterinary health care providers should follow the appropriate reporting requirements to animal control, public health, or other officials for investigation of animal bites. Information about injury prevention training resources and development of a formal, written animal bite response policy are provided at the end of this article.

Hazardous Drug Exposures

Drugs are classified as hazardous if studies in animals or humans indicate that exposures to them have a potential for causing cancer, developmental or reproductive toxicity, or harm to organs. Hazardous drugs, as defined by NIOSH, include drugs that are known or suspected to cause adverse health effects from exposures in the workplace.[25] Most hazardous drugs used in small animal clinical practice are antineoplastic agents; however, some antiviral agents, hormones, and bioengineered drugs are also considered hazardous. NIOSH, in coordination with other organizations, maintains and periodically updates the NIOSH List of Antineoplastic and Other Hazardous Drugs in Healthcare Settings.[26] This list may not be all-inclusive because, first, drugs used by a facility may receive Food and Drug Administration approval and enter the market place after this list was released, and, second, this list of hazardous drugs was developed for human health care settings.

There is a great deal of overlap in hazardous drugs used in human and veterinary medicine, especially in the area of antineoplastic agents. However, some drugs that should be considered hazardous may be used exclusively in veterinary medicine, such as xylazine and tilmicosin. Tilmicosin is an antibiotic used to treat bovine

respiratory disease that has been associated with serious adverse effects and fatalities from accidental injection or suicide.[27] Additionally, some drugs may be listed under a drug name that may not be commonly recognized in veterinary medicine; for example, prostaglandin F_2 alpha (Lutalyse) is listed as dinoprostone.

Prevention of Hazardous Drug Exposures

For these reasons, and to ensure compliance with the OSHA Hazard Communications Standard, employers must develop and maintain a list of all pharmaceuticals and chemicals to include hazardous drugs that is specific to their facility. Sources of information that can be used to develop a hazardous drug inventory include the NIOSH list (see previous discussion), safety data sheets (formerly known as material safety data sheets), package inserts, drug manufacturers, professional organizations, and the medical literature.

In addition to developing a drug inventory list, employers are responsible for providing initial and refresher training on the safe handling and potential health effects of hazardous drugs to their employees. This training should be documented by the employer and delivered in a format that enhances comprehension and ensures that employees consistently follow safe practices. The use of written standard operating procedures and checklists are tools to help ensure safe drug administration for both the animal and employees. Safe work practices are important for all employees. Precautions are especially important for women who may be or become pregnant, and employees who may be immunocompromised. Resources for training are listed at the end of this section.

The safe handling of hazardous drugs requires a cradle-to-grave approach. Applying the hierarchy of controls (elimination, substitution, engineering, administrative, and PPE) to the following steps in hazardous drug administration, where appropriate, is recommended (**Box 9**).

Chemotherapy spill kits should be located wherever drugs are handled or stored in the facility. Cages should be labeled to alert staff that an animal has been treated with chemotherapeutic agents so precautions can be followed. In larger hospitals with more staff who may work in other departments of the hospital such as radiology, consider using a color-coded collar that identifies the animal as having recently received chemotherapy to alert staff and remind owners that precautions with waste should be followed for at least 48 to 72 hours following treatment with most drugs.[28] With proper planning, training of staff, and written standard operating procedures, veterinarians can ensure that employees are protected from hazardous drug exposures while providing excellent care for their clients and their pets.

Box 9
Steps in hazardous drug administration in which controls are needed

- Hazardous drug delivery to the clinic
- Drug preparation for administration (intravenous and oral)
- Drug transport in the clinic
- Drug administration to the animal
- Cleaning of tables, counters, floors, cages, and runs
- Disposal of animal waste, body fluids, and drug administration supplies such as intravenous bags
- Laundering of bedding, scrubs, smocks, and lab coats

SUMMARY

1. Veterinary employers should develop and implement a comprehensive workplace safety and health program, including written standard operating procedures that address occupational safety and health risks that are specific to their clinic. This program should be consistent with national, regional, state, and other applicable standards and regulations.
2. A written infection control plan is an important component of a comprehensive clinic safety and health program. Management commitment, employee involvement, and initial and refresher training for staff on all aspects of the program are keys to success.
3. Many resources are available to help employers develop clinic guidelines to prevent occupational injuries and illnesses from bites and scratches, sharps, and hazardous drugs, as well as other hazards commonly encountered in veterinary medicine. Some of these resources are provided at the end of this article.

RECOMMENDED RESOURCES

Veterinary Occupational Hazards

- International Labour Organization Occupational Safety and Health: http://www.ilo.org/safework/lang–en/index.htm
- World Health Organization Occupational Health: http://www.who.int/occupational_health/en/
- European Agency for Safety and Health at Work: https://osha.europa.eu/en
- Canadian Centre for Occupational Health and Safety: http://www.ccohs.ca/
- Canada Labour Program Health and Safety: http://www.labour.gc.ca/eng/health_safety/
- United Kingdom Health and Safety Executive: http://www.hse.gov.uk/index.htm
- OSHA International: https://www.osha.gov/international/
- NIOSH Veterinary Safety and Health topic page: http://www.cdc.gov/niosh/topics/veterinary/
- NORA Healthcare Sector Veterinary Goals: http://www.cdc.gov/niosh/nora/comment/agendas/hlthcaresocassist/
- NASPHV Veterinary Standard Precautions Compendium: http://www.nasphv.org/Documents/VeterinaryPrecautions.pdf
- Human-Animal Medicine textbook, Occupational Health of Animal Workers (chapter): http://www.sciencedirect.com/science/book/9781416068372

Safety and Health Programs

- OSHA Safety and Health Program Management Guidelines: https://www.osha.gov/pls/oshaweb/owadisp.show_document?p_table=FEDERAL_REGISTER&p_id=12909
- OSHA Fact Sheet: Voluntary Safety and Health Program Management Guidelines: https://www.osha.gov/OshDoc/data_General_Facts/vol_safetyhealth_mngt_.pdf
- OSHA Sample Safety and Health Program for Small Business: https://www.osha.gov/SLTC/etools/safetyhealth/mod2_sample_sh_program.html
- NASPHV Model Infection Control Plan for Veterinary Practices: http://www.nasphv.org/Documents/ModelInfectionControlPlan.doc
- AVMA Guidelines for Veterinary Practice Facilities: https://www.avma.org/KB/Policies/Pages/Guidelines-for-Veterinary-Practice-Facilities.aspx
- OSHA On-site Consultation: https://www.osha.gov/dcsp/smallbusiness/consult.html
- NIOSH Health Hazard Evaluation Program: http://www.cdc.gov/niosh/hhe/

OSHA Business Case for Safety and Health: https://www.osha.gov/dcsp/products/topics/businesscase/index.html

US OSHA Standards
- OSHA Law and Regulations: https://www.osha.gov/law-regs.html
- State OSHA Programs: https://www.osha.gov/dcsp/osp/
- OSHA Small Business Handbook: https://www.osha.gov/Publications/smallbusiness/small-business.html
- OSHA Safety and Health Training Resources: https://www.osha.gov/dte/library/index.html

General Duty Clause
- Occupational Safety and Health Act of 1970—General Duty Clause: https://www.osha.gov/pls/oshaweb/owadisp.show_document?p_id=3359&p_table=oshact

Recordkeeping
- OSHA Recordkeeping Standard: https://www.osha.gov/recordkeeping/index.html
- OSHA Recordkeeping Training Presentations: https://www.osha.gov/recordkeeping/RKpresentations.html
- OSHA Injury and Illness Recordkeeping Forms: https://www.osha.gov/recordkeeping/RKforms.html

Hazard Communication
- OSHA Hazard Communication: https://www.osha.gov/dsg/hazcom/index.html
- OSHA Small Entity Compliance Guide for Employers that Use Hazardous Chemicals: https://www.osha.gov/Publications/OSHA3695.pdf
- OSHA Fact Sheet: Training Requirements for the Revised Hazard Communication Standard: https://www.osha.gov/Publications/OSHA3642.pdf
- OSHA Model Plans and Programs for the OSHA Bloodborne Pathogens and Hazard Communications Standards: https://www.osha.gov/Publications/osha3186.html
- OSHA Interpretation: Hazard Communication Standard in veterinary practice: http://www.osha.gov/pls/oshaweb/owadisp.show_document?p_table=INTERPRETATIONS&p_id=21120
- OSHA Interpretation: Hazard Communication Standard and veterinary drugs: https://www.osha.gov/pls/oshaweb/owadisp.show_document?p_table=INTERPRETATIONS&p_id=21343

Personal Protective Equipment
- OSHA Personal Protective Equipment: https://www.osha.gov/SLTC/personalprotectiveequipment/index.html

Respiratory Protection
- OSHA Small Entity Compliance Guide for the Respiratory Protection Standard: https://www.osha.gov/Publications/3384small-entity-for-respiratory-protection-standard-rev.pdf
- OSHA Sample Respiratory Protection Program: https://www.osha.gov/Publications/3384small-entity-for-respiratory-protection-standard-rev.pdf
- OSHA Respiratory Protection Training Videos: https://www.osha.gov/SLTC/respiratoryprotection/training_videos.html
- NIOSH Respirators: http://www.cdc.gov/niosh/topics/respirators/

NIOSH Respirators For Respirator Users: http://www.cdc.gov/niosh/npptl/respusers.html
NIOSH Podcast: General Instructions for Disposable Respirators: http://www2c.cdc.gov/podcasts/player.asp?f=11298
NIOSH Poster: How to Properly Put On and Take Off a Disposable Respirator: http://www.cdc.gov/niosh/docs/2010-131/

Bloodborne Pathogens and Needlestick and Sharps Injuries
CDC Sharps Safety for Healthcare Settings: http://www.cdc.gov/sharpssafety/
OSHA Bloodborne Pathogens and Needlestick Prevention: https://www.osha.gov/SLTC/bloodbornepathogens/index.html
OSHA Model Plans and Programs for the OSHA Bloodborne Pathogens and Hazard Communications Standards: https://www.osha.gov/Publications/osha3186.html
OSHA Standards Interpretation: Application of the Bloodborne Pathogens Standard to Veterinary Clinics: http://www.osha.gov/pls/oshaweb/owadisp.show_document?p_table=INTERPRETATIONS&p_id=24608
Resources for pet owners, veterinary staff, and public health personnel can be found at Worms and Germs blog: www.wormsandgermsblog.com.

Bites and Scratches
The American Red Cross offers online and classroom training on first aid, bloodborne pathogens, and cardiopulmonary resuscitation: http://www.redcross.org/
The American VeterinaryMedical Association dog bite prevention materials for staff and clients: https://www.avma.org/public/pages/Dog-Bite-Prevention.aspx
Employee training modules and tools on a variety of topics to include animal restraint and bite prevention: http://avmaplit.com/Default.aspx?id51609

Hazardous Drugs
Documents and Web sites
NIOSH Occupational Exposure to Antineoplastic Agents: http://www.cdc.gov/niosh/topics/antineoplastic/
National Veterinary Cancer Registry: http://nationalveterinarycancerregistry.org/
Veterinary Cancer Society: http://www.vetcancersociety.org/members/
NIOSH Workplace Solutions: Medical Surveillance for Healthcare Workers Exposed to Hazardous Drugs: http://www.cdc.gov/niosh/docs/wp-solutions/2013-103/pdfs/2013-103.pdf
NIOSH Workplace Solutions: Safe Handling of Hazardous Drugs for Veterinary Healthcare Workers: http://www.cdc.gov/niosh/docs/wp-solutions/2010-150/pdfs/2010-150.pdf
AVMA Disposal of Hazardous Pharmaceutical Wastes: https://www.avma.org/Advocacy/National/Federal/Pages/Disposal-of-Hazardous-Pharmaceutical-Wastes.aspx
Books
Crump K, Thamm, D. Cancer chemotherapy for the veterinary health team. Wiley-Blackwell. ISBN 978-0-8138-2116-0.

REFERENCES

1. OSHA. OSHA frequently asked questions: hazard communication. 2014. Available at: https://www.osha.gov/html/faq-hazcom.html. Accessed August 7, 2014.

2. OSHA. OSHA standards interpretation: application of the bloodborne pathogens standard to veterinary clinics. 2002. Available at: https://www.osha.gov/pls/oshaweb/owadisp.show_document?p_table=INTERPRETATIONS&p_id=24608. Accessed July 5, 2014.
3. NIOSH. Respirator awareness: your health may depend on it, personal protective equipment for healthcare workers. Cincinnati (OH): U.S. Department of Health and Human Services, Centers for Disease Control and Prevention, National Institute for Occupational Safety and Health, DHHS (NIOSH); 2013. Publication No. 2013-138.
4. OSHA. OSHA fact sheet: OSHA's bloodborne pathogens standard. 2011. Available at: https://www.osha.gov/OshDoc/data_BloodborneFacts/bbfact01.pdf. Accessed July11, 2014.
5. NASPHV. Compendium of veterinary standard precautions. J Am Vet Med Assoc 2010;237(12):1403–22.
6. Weese JS, Faires M. A survey of needle handling practices and needlestick injuries in veterinary technicians. Can Vet J 2009;50(12):1278–82 [PubMed: 20190978].
7. Leggat PA, Smith DR, Speare R. Exposure rate of needlestick and sharps injuries among Australian veterinarians. J Occup Med Toxicol 2009;4(25) [PubMed: 19712488].
8. Haiduven DJ, Simpkins SM, Phillips ES, et al. A survey of percutaneous/mucocutaneous injury reporting in a public teaching hospital. J Hosp Infect 1999;41(2):151–4 [PubMed: 10063478].
9. Thompson RN, McNicholl BP. Needlestick and infection with a horse vaccine. BMJ Case Rep 2010;2010:1–2 [PubMed: 22767480].
10. Lin JW, Chen CM, Chang CC. Unknown fever and back pain caused by *Bartonella henselae* in a veterinarian after a needle puncture: a case report and literature review. Vector Borne Zoonotic Dis 2011;11(5):589–91 [PubMed: 20569013].
11. Oliveira AM, Maggi RG, Woods CW, et al. Suspected needlestick transmission of *Bartonella vinsonii* subspecies *berkhoffii* to a veterinarian. J Vet Intern Med 2010;24(5):1229–32 [PubMed: 20695992].
12. Weese JS, Jack DC. Needlestick injuries in veterinary medicine. Can Vet J 2008;49:780–4 [PubMed: 18978971].
13. JAVMA News. AVMA PLIT lists top claims for business insurance. October 15, 2012. Available at: https://www.avma.org/News/JAVMANews/Pages/121015m.aspx. Accessed December 8, 2014.
14. Holmquist L, Elixhauser A. Emergency department visits and inpatient stays involving dog bites, 2008. Rockville (MD): Agency for Healthcare Research and Quality; 2010. Available at: http://www.hcup-us.ahrq.gov/reports/statbriefs/sb101.pdf. Accessed June 23, 2014.
15. Nordgren LD, Gerberich SG, Alexander BH, et al. Evaluation of factors associated with work-related injuries to veterinary technicians certified in Minnesota. J Am Vet Med Assoc 2014;245(4):425–33 [PubMed: 25075827].
16. Abrahamian FM, Goldstein EJ. Microbiology of animal bite wound infections. Clin Microbiol Rev 2011;24(2):231–46 [PubMed: 21482724].
17. Kordick DL, Hilyard EJ, Hadfield TL, et al. *Bartonella clarridgeiae*, a newly recognized zoonotic pathogen causing inoculation papules, fever, and lymphadenopathy (cat scratch disease). J Clin Microbiol 1997;35(7):1813–8 [PubMed: 9196200].
18. Weinberg AN, Branda JA. Case 31–2010: a 29-year-old woman with fever after a cat bite. N Engl J Med 2010;363(16):1560–8 [PubMed: 20942673].

19. Gage KL, Dennis DT, Orloski KA, et al. Cases of cat-associated human plague in the Western US, 1977–1998. Clin Infect Dis 2000;30:893–900 [PubMed: 10852811].
20. Dunstan RW, Langham RF, Reimann KA, et al. Feline sporotrichosis: a report of five cases with transmission to humans. J Am Acad Dermatol 1986;15(1):37–45 [PubMed: 3722508].
21. Gnann JW, Bressler GS, Bodet CA, et al. Human blastomycosis after a dog bite. Ann Intern Med 1983;98(1):48–9 [PubMed: 6848043].
22. Dyer JL, Wallace R, Orciari L, et al. Rabies surveillance in the United States during 2012. J Am Vet Med Assoc 2013;243(6):805–15 [PubMed: 24004227].
23. CDC. Human rabies prevention—United States, 2008: recommendations of the Advisory Committee on Immunization Practices. MMWR Recomm Rep 2008; 57(RR-3):1–28 [PubMed: 18496505].
24. Anderson M. Video observation of infection control practices in veterinary clinics and apetting zoo, with emphasis on hand hygiene and interventions to improve hand hygiene compliance [Ph.D Thesis]. Ontario (Canada): University of Guelph; 2013.
25. NIOSH. NIOSH Alert: preventing occupational exposures to antineoplastic and other hazardous drugs in health care settings. Cincinnati (OH): U.S. Department of Health and Human Services, Centers for Disease Control and Prevention, National Institute for Occupational Safety and Health, DHHS (NIOSH); 2004. Publication No. 2004–165.
26. NIOSH. NIOSH List of antineoplastic and other hazardous drugs in healthcare settings 2012. Cincinnati (OH): U.S. Department of Health and Human Services, Centers for Disease Control and Prevention, National Institute for Occupational Safety and Health, DHHS (NIOSH); 2012. Publication No. 2012-150 (June 2012).
27. Veenhuizen MF, Wright TJ, McManus RF, et al. Analysis of reports of human exposure to Micotil 300 (tilmicosin injection). J Am Vet Med Assoc 2006;229(11): 1737–42 [PubMed: 17144818].
28. NIOSH, Couch J, Gibbins J, et al. Health hazard evaluation report: CHEMOTHERAPY drug evaluation at a veterinary teaching hospital–Michigan. Cincinnati (OH): U.S. Department of Health and Human Services, Centers for Disease Control and Prevention, National Institute for Occupational Safety and Health, NIOSH; 2012. HETA No. 2010-0068-3156.