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Chapter 7

Epidemiology of Needlestick and Sharps Injuries in Veterinary Medicine

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Abstract

Needlestick injuries (NSIs) are a serious concern for veterinary practitioners as well as other healthcare personnel. During practice, veterinarians are exposed to various risky situations in which NSI and sharps injuries seem to be a common occupational hazard. Studies on prevalence and occurrence of NSI in veterinary medicine are scarce and probably underreported. One important consequence is the physical trauma. However, other factors related to their economic or psychiatric impact should also be considered. The studies available about NSI in veterinarians reported different prevalence, ranging from 1 % to 86.7 %, although their comparison is difficult since prevalence is calculated from different data sources. Various risk factors of NSI (such as years as veterinarians, number of work hours, poor quality of restraint of animals, poor needle handling practices, among others) have been described. However, information regarding risk factors in veterinary medicine is scarce. In order to understand the epidemiology of NSI in veterinarians, a review of the literature published in the last four decades (1980–2016) is presented. Thus, the current chapter will address several characteristics of NSI in veterinary medicine as occurrence, prevalence and incidence risk factors, consequences and preventive measures.

Keywords: needlestick, sharps, injury, epidemiology, risk factor, prevalence

1. Introduction

Occupational health problems in veterinary medicine are very frequent, and veterinarians are considered to be members of a high-risk group for occupational hazards [1].

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A needlestick injury (NSI) can be defined as an inadvertent (accidental) penetrating wound from a needle that may result in exposure to the blood or other body fluids. A sharps injury includes needles or other sharp objects, such as scalpels, lancets, razor blade, scissors, nose tongs for cattle, halters, calf pulling equipment and metal cattle chutes [2, 3]. These types of injuries are considered a major occupational health problem and of serious concern for veterinarians and other healthcare workers [4]. NSI injuries usually occur during activities such as taking blood and body fluid specimens and processing, needle disposal, waste collection and transferring blood from a syringe into another vessel [5].

Awareness of the transmissibility of bloodborne infectious agents in human medicine, including human immunodeficiency virus (HIV), hepatitis B virus and hepatitis C virus, has led to the identification of percutaneous sharps injury resulting in exposure to bloodborne pathogens as an important occupational health risk for people employed in the healthcare industry [6]. It is estimated that more than 2 million healthcare workers experience an NSI or sharps injury with a contaminated sharp instrument every year [7]. Injuries associated with NSI are associated with the potential exposure to infectious agents and syringe contents [8]. Injuries due to contact with contaminated needles may also have serious physical and psychological consequences [9].

There has been less concern regarding NSI and sharps injuries in veterinary practice, and only a few epidemiological studies have been conducted in this area. On the other hand, methodological aspects are not comparable with different design approaches [8]. The analysis of NSI is essential to identifying areas of improvement.

In order to understand the epidemiology of NSI in veterinarians over the last four decades, in this chapter we review the literature, focusing on the epidemiology of NSI and sharps injuries in veterinary practice.

2. Epidemiology of needlestick and sharps injuries

Epidemiologic data on NSI and sharps injuries are essential for targeting and assessing interventions [10]. However, a few studies have looked at the epidemiology of NSI and sharps injuries in veterinary practice. Despite significant effort for reduction, NSI and sharps injuries continue to pose a significant risk in human medicine [11], and a similar risk occurs in veterinary medicine. Reports carried out in small and large-animal practice show a large variability in the prevalence and incidence.

2.1. Biological risk and bloodborne infections

Bloodborne infections are recognized for a long time, and they are the main risk to the health of workers exposed to blood and other biological materials. However, it was only after the discovery of HIV that occupational injuries with potentially contaminated biological material were treated as a public health problem [12]. Infection control guidelines in human medicine put emphasis on protection against bloodborne pathogens. In veterinary medicine few serious

zoonotic infections are currently considered to be bloodborne which reduces concern in the veterinary community [13]. HIV and hepatitis viruses are of potential concerns in human medicine but are absent in veterinary medicine [2]. However, veterinarians, by maintaining direct contact with animals, are often exposed to biological agents found in the blood and body fluids. In veterinary hospitals and clinics, occupational risk by biological agents is universally distributed; the risks are proportional to the amount of contacts with patients and blood, secretions and other body fluids [14, 15].

The risk of transmission of infectious agents after the injury with biological material depends on several factors such as host susceptibility and resistance, virulence of the agent, the route of exposure and amount of the infectious agent. As such, the greater the manipulation of sharp objects, blood and other body fluids, the greater the exposure and risk of acquiring infectious diseases [16].

The few recognized bloodborne pathogens that can be transmitted between animals and humans probably are the reason for the less concern regarding NSI and sharps in veterinary practice [17]. The most important bloodborne pathogens in veterinary work are *Staphylococcus* spp.; *Pseudomonas* spp. (inoculated from the animal skin); pathogens from fine-needle aspirates *Blastomyces*, *Pasteurella* spp., *Staphylococcus* spp. and *Streptococcus* spp. (from fine-needle aspirates); certain arboviruses or modified live vaccines [2]. *Bartonella* spp. appear to be a zoonotic pathogen [18]. There are two reports in the literature about accidental needlestick transmission of *Bartonella* to veterinarians. One study reported a suspected needlestick transmission of *Bartonella vinsonii* subspecies *berkhofii* to a veterinarian [19], and another reports a veterinarian with *Bartonella henselae* after a needle puncture [20]. Disease associated with NSI occurrence was addressed in one study [21] where injury during *Brucella* vaccine administration was found to be a risk factor for occupational brucellosis. More reports in veterinary practice that NSI and sharps injuries resulted in a zoonotic disease are of a 26-year-old veterinary technician who became infected with B virus following a needlestick injury [22] and blastomycosis developed in a veterinarian after an NSI following a fine-needle aspiration [23]. No cases of other biological agents have been reported after NSI in small or large-animal practice in the literature review. Exotic zoonotic pathogens are hypothetically transmitted through contact with the blood, and the risk of emerging bloodborne pathogens should be seriously considered by all veterinary practitioners [13, 24, 25].

2.2. Prevalence and incidence of NSI and sharps injuries in veterinarians

Approximately 1.2 million occupational NSI and sharps injuries occur in the European Union (EU) each year [26]. It is very difficult to conduct studies in prevalence or incidence (per time per person) or exposure rate of NSI and sharps injuries in veterinary medicine, but these studies are important to determine the risk factors associated with occurrence of injuries [1]. Another problem is that the rate of underreporting of NSI and sharps events is very high [27], and the quality of available data is variable [2].

The studies available about NSI and sharps injuries in veterinary medicine reported different prevalence, ranging from 1% to 86.7%. However, their comparison is difficult since prevalence

is calculated from different data sources. In one study conducted in veterinarians in Wisconsin, the incidence of NSI and sharps exposures to Johne's bacterin during vaccination against paratuberculosis was 5.5/100 person-years [28]. A survey conducted in female veterinarians reported 63.9% of one or more needlesticks after graduation from veterinary college. The incidence of NSI was 9.3/100 person-years [27]. The prevalence of NSI and sharps injuries in American zoo veterinarians was 86.7% [29]. The overall exposure rate reported by Australian veterinarians was 75.3%, but those reported suffering from at least one contaminated NSI in the previous year were 58.9% [30]. A survey of veterinary technicians reported that 93% had at least one NSI over the course of their career and 74% had experienced a needlestick injury during the previous 12 months of the study [8]. In another study, veterinarians that reported at least one unintentional NSI were 74.2 in the previous year of the study [31]. A survey of veterinarians from Uganda reported a NSI prevalence of 15.0% [32]. In a study performed in Portugal, 78.5% of veterinarians enrolled in the study reported having had at least one NSI during their careers [33]. The prevalence of NSI in Japanese veterinarians during containment measures of foot-and-mouth diseases was 1%, and NSI accounted for 18% of all reported injuries in all veterinarians [34].

Rates observed in veterinary medicine are variable, but in some epidemiological studies, values are much higher than the prevalence rates described for human medicine [35, 36].

2.2.1. Reporting

Accurate reporting of NSI and sharps injuries is essential, to ensure that incidents are appropriately managed [37]. An accident with a needlestick or a sharp should be reported immediately to the supervisor, which supports the workers in administrative and legal terms if they develop a disease resulting from an accident [38]. Surveillance in NSI and sharps injuries should be activated in every healthcare setting to monitor injuries and contaminations and identify the need for corrective interventions [39]. It is difficult to provide accurate statistics on the incidence of NSI or sharps injuries because even in developed countries in human medicine, all cases are not reported [40]. Reasons for underreporting in human medicine include the lack of necessity of reporting with a presumption that the risk of bloodborne pathogens transmission is low and lack of knowledge of systems [37]. There is no single reporting system for injuries or disease in veterinarians, and reported cases of NSI and sharps may greatly underestimate the real number of occurrences [1]. Recall bias and deterioration of memory with the passage of time are other problems associated with the rates of prevalence reported. The true incidence may be underreported owing to the incapacity of busy professionals to remember and write down the details [27].

2.3. Risk factors of NSI and sharps injuries in veterinarians

Identification of risk factors of NSI and sharps has been reported in few epidemiological studies involving veterinarians. As a consequence, little information is available concerning the risk factors for NSI and sharps injuries. Some risk factors associated with NSI and sharps have been referred to in the literature as presented in **Table 1**.

Factors described	Reference
Poor quality of restraint	[30]
Inadequate access to sharps containers	[49]
Poor needle handling practices by veterinarians	[13, 29, 52]
Female gender	[30]
Working in small-animal practice	[30]
Working with large animals	[46, 47]
Veterinarians working with dogs	[33]
Less experienced veterinarians (years as veterinarian)	[30, 41]
Veterinarians with more than 10 years of practice	[33]
Seeing excessive numbers of patients per week	[30]
Working longer than normal hours per week	[30]
Number of patients treated per week	[30]
Household bovines and sheep during childhood	[33]

Table 1. Factors described as contributing to the risk of NSI and sharps injuries in veterinarians.

2.3.1. Demographic and workplace items

The influence of sex in the prevalence of NSI and sharps injuries has been studied. Female veterinarians presented higher odds of injury than male veterinarians [30].

Years as veterinarians have been described as risk factors. Less experienced veterinarians [30, 41] were more likely to report injuries, which is consistent with that observed in human medicine where the probability of injuries by sharp devices among new personnel or healthcare students is superior when compared to healthcare workers with more years of experience [42]. Clinical experience may have provided expertise and techniques for handling needles and sharp devices, reducing the risk of occupational injuries [43]. However, other studies of veterinarians are contradictory and showed that the proportion of veterinarians who experienced NSI increases with years of practice [33]. This is probably because younger veterinarians may apply the knowledge in infection control acquired in the university and put safety procedures into practice, while practitioners with experience have familiarity with needles and sharp instruments and pay less attention to risks and have lower compliance with biosafety measures [44].

In human medicine, increased risk of injury incidents is positively associated with time constraints and rushing to complete procedures, nervousness, tiredness and loss of concentration. The predisposition to increased risk was also noted to be associated with high workload, working hastily, a crowded work environment, times when personnel are fatigued, do not have a patient's collaboration or when the medical team was not fully present [12, 45]. In veterinary medicine there are no studies that associate time constraints with NSI and sharps

injuries, but these injuries were directly connected with working longer hours per week and number of patients treated per week [30].

Household association with cattle during childhood has previously been identified as a risk factor. Interaction with animals in infancy could lead to a sense of security in the handling of animals. This can give rise to overconfidence and generate negligent safety behaviours [33].

2.3.2. Type of practice

There is no consensus about the link between the type of practice and the occurrence of accidents that cause injuries. Working in small or mixed animal practice was associated with a significantly higher exposure rate for contaminated NSI in one study [30]. In another study, working with dogs was a risk factor for NSI occurrence, probably, because these animals are extremely mobile animals that are seldom fully restrained during the course of veterinary care and they are often treated with parenteral drugs [33]. According to another study, people working with large animals were more likely to report injuries [46] suggesting that the treating of large animals is more hazardous than the treating of small animals [47]. Animal handling and environmental problems probably influence the occurrence, such as working in semi-dark settings, confinement in closed spaces and high animal densities. However, in a Minnesota and Wisconsin survey, the type of practice did not affect the exposure rate to NSI and sharps injuries, although large animals caused more severe injuries—which is not surprising [48].

Veterinary occupational injury can increase with prior injuries, participation in sports, current smoking and six or fewer hours of sleep [49]. Neglected management of occupational health and a failure to comply with simple proactive measures are risk factors for NSI events [38].

2.3.3. Working conditions

2.3.3.1. Poor quality of restraint

Poor quality of restraint caused by lack of adequate personnel or inadequate assistance with restraint of animals is considered as a risk factor for an NSI event. Animals are far less obedient than human patients, and movement of the animal at the time of needle puncture is more common if the animal patient is not well restrained [30]. It is probable that the large-animal veterinarians may experience a lower rate of needlestick puncture wounds because they are more likely to restrain their large-animal patients compared to the small-animal clinicians [27, 50]. Poor restraint can compromise not only the person inoculating but also other healthcare workers and animal owners who may be helping [2].

2.3.3.2. Inadequate access to sharps containers

No sharps boxes present increased rates to injuries [49]. Sharps should be disposed of immediately after use directly into a container (i.e. not left bare on any surface) [17]. These sharps containers need to be in close proximity so that the staff can place the sharps into the appropriate containers immediately after use [51]. Pocketing of needles poses a risk for NSI to other staff whilst doing unrelated tasks such as in the laundry [2, 8]. Poor needle handling practices,

such as not firmly recapping needles or not bothering to recap them at all, is an important risk factor [13, 29, 52]. But it is likely that this behaviour is improving. In a study performed in small-animal veterinary practices, 89% of practices dispose of sharps directly, rather than recapping them, though a few even indicated a preference for careful recapping [53]. If an appropriate disposal container is not in proximity and available, recapping should be done using some procedures and techniques such as the one-handed 'scoop' or using a device to handle the needle cap [54, 55].

2.4. Procedures associated with NSI and sharps injuries

Needlestick and sharps injuries most often occur before disposal of a needle or sharp device, during the use of a sharp device, after a procedure and after improper disposal (leaving needles in a laboratory coat with subsequent needlestick injury to laundry personnel) [2]. There are many possible mechanisms of injury. Some circumstances associated with NSI and sharps have been referred to in the literature.

Regarding the circumstances in which incidents of NSI and injuries by sharp instruments occurred, it is possible to observe that injury can occur during vaccination and other procedures, in which veterinarians are frequently accidentally 'self-inoculated' or suffer other self-inflicted wounds [20, 31, 32, 56, 57]!

2.4.1. Vaccine administration

Concerning veterinary activity at time of injury, it has been demonstrated that vaccine administration is an activity that accounts for a lot of accidents. Within the studies reviewed which evaluated substances involved, two studies refer to injury during *Brucella* vaccine administration, RB51 [58] and S19 strain [21]. Vaccine administration in chickens against infectious bursal disease (Gumboro) and Newcastle disease was the single most important cause of self-inoculations in practitioners from Uganda [32]. A study of 1347 NSI involving vaccines demonstrated that one-third of the vaccine-related sticks involved rabies and about 11% involved distemper vaccines [27]. Self-inoculation with the vaccine against *Leptospira* was reported by 7.5% of US veterinarians [31]. Accidental injection of an inoculation against (*Mycobacterium avium* subspecies *paratuberculosis*) (bovine Johne's disease) was reported in two studies [28, 56]. Accidental exposures (due to NSI) to vaccines against diseases such as West Nile virus, *Giardia* and *Leptospira* spp. [46] and to live equine vaccination against Equilis StrepE [57] have also been reported in the literature. Erysipelas vaccine and other vaccines was the most commonly cited agent exposure reported by US swine veterinarians in a study of occupational hazards [52].

2.4.2. Animals involved

Procedures involving large animals were reported in more studies [27, 29, 30, 32, 34, 46, 47, 52, 58, 59] of epidemiology occurrence than small animals. Zoo animals were also involved in accidents [29].

2.4.3. Poor infection control practices

Recapping needles is another activity that increased the risk of percutaneous injury. There was an association between recapping needles in small-animal practice and in large-animal practice and NSI and sharps injuries [13, 52]. A study of zoo veterinarians reported that 86.0 % of NSIs involved recapping needles [29]. Uncapping of needles by the mouth can be a relatively common but risky form of behaviour [17]. Another practice of risk for parenteral exposures, especially in large-animal medicine, is the reuse of needles and syringes [13]. Standard precautions for human medicine guidelines recommend never recapping needles [51].

2.4.4. Injury location

There was little information about the most affected anatomical parts of the body injured. There was no agreement between studies with respect to the most frequent site of the involvement. In one study, a veterinarian experienced an NSI in the right index finger [19]; in other two studies, veterinarians experienced an NSI into the right thumb [20, 56]; and in another study, seven veterinarians were said to have experienced an NSI in the upper limb [32].

2.5. Consequences and side effects of NSI and sharps injuries

The consequences of occupational exposure to the blood and other body fluids are not only related to infections but also the psychological trauma, anxiety, relationships and prophylactic drugs [60]. NSI and sharps injuries can produce physical trauma, but it is unlikely that they cause severe injuries alone. Physical trauma such as severe laceration can be significant, especially from large-bore needles, and can result from animal movement during injection or blood collection [2]. Every needlestick and sharps injury carries a risk of trauma or inoculation of harmful substances. While the physical trauma caused by needle or a sharp in the body may often be minor, introduction of hazardous compounds such as chemical or biological contaminants has been associated with severe sequelae, including serious infections and damage to tissue [27]. Side effects of NSI and sharps injuries following accidental exposures were normally characterized as mild or severe and local or systemic. Serious adverse effects, while uncommon, do occur [2]. Local adverse events are characterized by one or more of the following symptoms: pain, erythema, local swelling and superficial abscess [27, 52, 58]. These were frequently reported after an injury. Systemic adverse effects experienced after NSI or sharps injuries included myalgia, fever, arthralgia, headaches, fatigue, sweats, severe allergic reaction, chills, lacerations, psychedelic experience, diarrhoea, vomiting or granuloma [27, 56, 58, 59]. Severe reactions included severe local inflammation, abscess formation, localized necrosis, local nerve damage, disease, severe allergic reaction and miscarriage [2, 23].

Veterinarians experiencing adverse reactions are more likely to report having had a NSI than others [2].

Psychological and psychiatric consequences of NSIs are not yet quantified in veterinary medicine. In human medicine occupational blood exposure can lead to posttraumatic stress, anxiety and depression and is a major contributing factor of time loss from work [60–62].

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2.5.1. Syringes and needle content and side effects

Although many types of sharps injure veterinarians, the most common causative devices associated with a higher rate of injury were syringes and needles [19, 30, 47], needle biopsy [56], scalpel blades [63] and ampoule/vial [30]. Although some accidents occurred with empty or clear needles [27, 52], NSI injuries may involve the risk of self-injecting drugs or other hazardous substances, which can result in mild or severe allergic reactions or other more severe consequences [2, 27].

Agents producing a side effect most often include anthelmintics [27, 52], euthanasia agents and anaesthetics and steroids [27], immobilizing agents [29], hormones, vaccines [20, 21, 28, 29, 31, 32, 46, 56] and antibiotics [29, 30, 32]. Mineral oil adjuvants of veterinary vaccines can produce a chronic granulomatous reaction with sterile abscess formation [64]. Accidental needlestick injuries and conjunctival or open wound exposures of humans involving the RB51 vaccine were associated with both local and systemic adverse events in the United States [58].

Occupational NSI and sharps injuries may also represent a serious human reproductive health hazard, notably the unintentional injection of dinoprost tromethamine, a prostaglandin compound leading to miscarriage in a previous study [27].

In some cases NSI and sharps injuries require medical treatment with hospital admission, in which case medical attention [20, 29, 34, 56, 57] and sometimes surgical intervention are needed [56, 58]. In a study examining zoo veterinarians, 6.5% of veterinarians required medical care after a NSI event [29]. The demand for medical treatment occurs in cases of adverse reactions to injected harmful substances and severe trauma. Self-treatment of injuries was common [48].

2.6. Prevention of needlestick and sharps injuries

Needlestick and sharps injuries are a serious problem in veterinary medicine, but it is often preventable. In human medicine almost 83% of needlestick injuries can be prevented [65]. However, preventive efforts can reduce the risk of exposures, but not eliminate them [66].

In human medicine, time and considerable economic resources have been expended to reduce the incidence of NSI associated with bloodborne agents. Some countries and governments have invested in the need to introduce safety devices, educating healthcare workers on the safe handling and disposal of sharp devices and developing strategies to prevent them [67, 68]. Aggressive educational campaigns concerning NSI prevention are lacking in veterinary medicine. Probably, the factor associated with the lack of this approach is a poorly developed culture of concern about biosafety in veterinary medicine, and only a few bloodborne zoonotic pathogens are recognized in clinically normal animals [2, 8].

2.6.1. Safe practices

Adherence and compliance with the universal precaution recommendations proposed by the Centers for Disease Control and Prevention (CDC) are important factors for the prevention of NSI [69]. Recommended prevention strategies include educational programmes, avoidance of

recapping, better needle disposal systems and careful handling and disposal of sharp devices [12]. Infection control and workplace safety include safe handling of sharps [17]. Avoid recapping needles or use a 'one-handed scooping technique' to recap is a simple infection control procedure which may substantially reduce this form of occupational injury [46]. The CDC recommended the use of gloves and gowns during patient contact that requires handling of blood [69]. Although this equipment does provide a physical barrier to shield the skin and mucous membranes from contact with blood, most protective equipment is easily penetrated by needles [10]. Universal precautions recommended that persons that manipulate needles and other sharps wear gloves and have eye protection and reduce the risk of exposure to needlestick [58]. In previous studies, wearing two pairs of gloves seems to protect because when the outer glove is perforated, the inner glove can protect the hand [70, 71]. Previous studies suggest a low compliance with personal protective equipment in healthcare workers [39]. Discomfort, reduction of agility and decreased sensation of touch were reported to outweigh the benefits afforded by double gloving [72]. The use of personal protective equipment could be affected by availability [51].

The risk of NSI can also be reduced by the use of safety medical devices, which are becoming more commonly used in human healthcare [73] incorporating safety-engineered protection mechanisms (safety-engineered devices, e.g. retractable needles, fixed-needle safety syringes). These modern safety devices minimize the risk and impact of NSI injuries [39, 45]. However some healthcare workers refuse to use such devices [4]. Cost is an obvious concern with needle safety devices, particularly when the benefits are difficult to quantify [2]. And in veterinary medicine, the cost of using the safety-engineered devices can be unaffordable, and cost may be a limiting factor for the use of this kind of device [52].

Risk management prevention is necessary to reduce the likelihood of NSI and sharps injuries [2]. The implementation of legislation into the field can help identify and reduce future risk of these injuries [67, 74]. In Europe, legislation to improve the safety and health of personnel has been in place since 1989 and was published to protect healthcare workers and requires an integrated approach [74]. However, in some countries, this legislation is not adapted to veterinary medicine. Current guidelines to reduce NSI and sharps injuries in veterinary practice are not based on veterinary data, but are modified from studies in human medicine [30]. On the other hand, it is very important that veterinarians understand the reasons to comply with safe procedures, which include good needle and sharp handling practices and correct disposal by veterinarians [39]. Veterinarians should be familiar with the recommendations of the CDC guidelines on universal precautions [51]. Work-practice controls are important in preventing exposures to blood and hazardous substances and include verbal statements when passing sharps, avoiding hand-to-hand passage of sharp instruments [75].

2.6.2. Cost-benefit effectiveness of prevention

Costs are harder to quantify. They include the direct costs associated with the initial and follow-up treatment when necessary [76], the emotional cost associated with fear and anxiety associated with the possible consequences of the injury, direct and indirect costs related with lost productivity and cost of any associated legal action [10, 11]. Occupational hazards in the

work of American veterinarians resulted in an estimated US$ 4 million in losses [77], and the costs of injuries related to sharp contaminated instruments in the USA have been estimated to be around 118–591 million dollars in 2010 [78]. These costs associated with NSI can be reduced and healthcare protected with investment in safety-engineered sharp devices [79].

2.6.3. Education and training

Education plays an important role in decreasing NSI rates as it decreased recapping, unnecessary needle manipulation and improper disposal of used devices [39]. Training should always be provided for new employees and periodically for veterinary clinical personnel, as well as for supporting staff [7]. Educational interventions including videotaping and performance feedback proved effective in the short term; however, long-term adherence was not observed [80]. To encourage constant compliance with good safety standards, educational sessions incorporating regular teaching, practical classes and reminders in the form of posters could be used [51]. Education and training need to be encouraged in older workers who receive less training and have more limited access to new technologies than younger workers [39, 81]. Adequate staffing and personnel training in proper animal restraint are also important, as poor restraint is an important risk factor [50]. To prevent injuries with aggressive animals, it is important to handle those animals with care and to make proper use of restraining devices and protective equipment [47].

3. Conclusions

This chapter describes the epidemiology of NSI and sharps injuries in veterinary medicine and emphasizes the importance of compliance with international standards of infection control practices, of training and of the education of veterinarians. It emphasizes the need for reporting and prevention of NSI and sharps injuries. Increasing awareness of hazards and how to avoid them and establishing better work environments are also crucial. Education regarding the use of personal protective equipment and the importance of reporting accidents should be promoted. There is a need to assess accurately the risk of NSI and sharps hazards in veterinary practice in order to develop effective measures for reducing related incidents. More epidemiological studies in this field are needed to study risk factors, to determine knowledge, attitudes and practices. It is also essential to put a cost-effective and efficient injury and control programme into place.

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