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Knowledge, attitudes, and practices relevant to zoonotic disease reporting and infection prevention practices among veterinarians — Arizona, 2015

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Abstract

Veterinarians play a crucial role in zoonotic disease detection in animals and prevention of disease transmission; reporting these zoonoses to public health officials is an important first step to protect human and animal health. Evidence suggests veterinarians and their staff are at higher risk for exposure to zoonoses because of possible interactions with infected animals. We examined the knowledge, attitudes, and practices of veterinarians regarding zoonotic disease reporting to public health agencies and associated infection prevention (IP) practices such as personal protective equipment (PPE) use, and the need for targeted education and outreach for veterinarians in Arizona. An online questionnaire was developed and distributed by email in September 2015 and was available through November 2015 to all 1,100 members of the Arizona Veterinary Medical Association. Chi-square and logistic regression analyses were performed. In total, 298 (27%) veterinarians from all 15 Arizona counties completed the survey; the majority (70%) were female, practiced small animal medicine (84%), and reported practicing veterinary medicine for ≥10 years (75%). Only 57% reported they knew when to report a suspected zoonotic disease and 60% reported they knew how to make that type of report. The majority said they would report rabies (97%), plague (96%), and highly pathogenic avian influenza (91%) to a state agency. Most respondents reported using PPE (e.g., masks, face shields, and gloves) when performing a surgical procedure (96%) or necropsy (94%), although fewer reported using PPE for handling clinically ill animals (37%) or healthy animals (17%). Approximately 70% reported always using PPE when in contact with animal birthing fluids, urine, or feces, and 47% for contact with animal blood, saliva, or other body fluids. Veterinarians who agreed that they knew the appropriate actions to protect themselves from zoonotic disease exposures were more likely to report always washing their hands before eating or drinking at work (OR = 3.81, 95% confidence interval (CI) [1.97–7.35], $P <$

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0.01). Responses for when to make a report and how to report were not significantly different by gender, years of practice, or holding additional degrees, but did differ by practice type, age, and number of veterinarians in the practice. Small animal veterinarians were less likely to report knowing when to make a report compared to other veterinarians ($P < 0.01$). Respondents demonstrated suboptimal zoonotic disease reporting and IP practices, including PPE use. Public health agencies should improve outreach and education to veterinarians to facilitate better zoonotic disease prevention practices and reporting.

Keywords

Zoonotic disease; Reporting; Infection prevention; Veterinary public health; Zoonoses

1. Introduction

Zoonoses such as rabies, brucellosis, and leptospirosis represent an important human and animal health threat globally; approximately 75% of emerging diseases have an animal origin (Kahn, 2006). Veterinarians in clinical practice play an integral role in promoting and protecting population health through the identification, control, and prevention of zoonotic diseases (Kahn, 2006). Veterinarians are often a trusted source of information for pet owners and can educate clients about preventing zoonotic disease spread (Shanko et al., 2015). Additionally, veterinarians can be among the first people to provide education and guidance for zoonotic disease prevention to clients and staff. Veterinarians and their staff are often the first to encounter animals with potential zoonotic infections, and are also at increased risk for exposure to these agents. Zoonotic disease infection rates among veterinarians and their staff were found to be 30%–40% in two cross-sectional studies of cohorts in Illinois and Washington and 60%–65% in two other cross-sectional studies performed in the United Kingdom and South Africa (Schnurrenberger et al., 1978; Constable and Harrington, 1982; Gummow, 2003; Lipton et al., 2008). Zoonotic disease infection rates in the general population are estimated to be much lower; the Centers for Disease Control and Prevention (CDC) estimates that < 5% of Americans will get sick from zoonotic diseases every year (Centers for Disease Control and Prevention, 2018).

Veterinary and medical communities are encouraged to work closely with local and state public health agencies when zoonoses are suspected (Shanko et al., 2015). State agencies such as departments of agriculture or departments of health rely on veterinarians to identify and report notifiable zoonotic diseases in animals; veterinarians often report disease events and trends to these state public health and regulatory agencies, as well as collaborate with physicians on zoonotic diseases, and advise local health boards (Noah and Ostrowski, 2016). Veterinary knowledge of zoonotic disease prevention, and the notification pathways to report suspected cases of concern to the appropriate government agencies, is crucial. In the United States, there have been several studies regarding awareness of zoonotic disease risks and infection prevention (IP) practices among veterinary professionals. These studies found that the majority of respondents did not frequently engage in protective behaviors to reduce zoonotic disease transmission (Dowd et al., 2013; Wright et al., 2008).

However, there have been no studies published to discern veterinary professionals' understanding of their role in reporting suspected zoonoses in animals to public health. According to the Arizona Administrative Code (Title 9 Chapter 6, 2013 and R3-2-402), there are 25 vector-borne and zoonotic diseases reportable to the Arizona Department of Agriculture by veterinarians, including anthrax, avian influenza, tuberculosis, West Nile virus, rabies, brucellosis, and leptospirosis, among others. Arizona is also at potential risk for imported diseases across land borders from frequent travel of people and both domestic and wild animals; additionally, the state contains several major airports, further facilitating importation of animals from other countries. Identification and reporting of zoonoses in animals to public health officials is crucial to take actions to protect human and animal health. To explore the knowledge, attitudes, and practices of veterinary professionals regarding zoonotic disease reporting and IP practices in Arizona, we developed and disseminated an online survey to Arizona veterinarians, and assessed the need for education and outreach to veterinary professionals.

2. Materials and methods

2.1. Study design

This study was designed as a cross-sectional survey of practicing veterinarians registered as members of the Arizona Veterinary Medical Association (AzVMA). A practicing veterinarian was defined as a licensed veterinarian who treats diseases, disorders, and injuries in animals in a clinical setting. At the time of survey distribution in September 2015, there were 1,100 veterinarians registered as members in AzVMA, most in small animal clinical practice. Sample size calculations were performed using Epi Info 7 with power set at 95% and error set at 5% for a population of 1,100. The resulting sample size calculated was 285. The survey link was distributed by email through the AzVMA listserv a total of three times during September–November 2015. Information about the online survey was also included in the August 2015 print issue of the AzVMA newsletter.

The survey was anonymous, with only basic demographic information collected. An incentive (fitness tracker watch, e-reader, or tablet computer) was provided to five randomly selected participants to encourage participation. CDC reviewed this study for human subjects protection and deemed the work to be non-research.

2.2. Survey description

Qualtrics© LLC survey software (co-headquarters in Provo, Utah, and Seattle, Washington) was used for the online survey; survey content regarding IP practices was based on the reviewed literature and previous similar surveys (Dowd et al., 2013; Lipton et al., 2008; Wright et al., 2008). The survey included 46 questions divided into four sections, including demographics, education, knowledge and attitudes about zoonotic diseases and reporting, and IP practices. Zoonotic disease knowledge, attitudes, and practices were assessed by asking the respondent the extent to which they agreed or disagreed with specific statements, such as if they knew when to report and which agency to contact to report a suspected zoonotic disease in an animal. Veterinarians were asked about their experience diagnosing zoonotic diseases within the last five years and to list those specific zoonotic diseases in an

open text format. To assess respondent knowledge of reportable diseases in Arizona, we provided a list of zoonotic or animal-related diseases for which reporting was required, recommended, or not recommended (nonreportable) and asked respondents to select which ones they would report. Regarding IP practices, respondents were asked how often they use any type of personal protective equipment (PPE) in their work setting for different types of exposures, handwashing at work, and other practices. We also assessed what sources respondents used to learn about zoonotic disease prevention, and what type of educational preferences and resources would be most useful. A comment section was included at the end of the survey to capture additional input. The survey took an estimated 10 min to complete, and was piloted with 10 veterinarians before distribution. A copy of the survey is available from the corresponding author upon request.

2.3. Data management and analysis

Data from the survey were exported from Qualtrics© LLC into a Microsoft® Excel® (Microsoft Corporation, Redmond, Washington) database and cleaned to remove incomplete or duplicate responses, as well as responses from non-veterinarians. Descriptive statistics were calculated for respondent characteristics and included sex, age, county of practice, additional degrees, years practicing veterinary medicine, area of veterinary medicine, and number of veterinarians in the practice. Descriptive statistics were also calculated for reported IP practices (the percentage reporting always, most of the time, sometimes, rarely, or never performed); zoonotic disease prevention and reporting perceptions (‘agree’ combined from strongly agree and agree, and ‘disagree’ combined from strongly disagree, disagree, and neutral); whether a selected zoonotic disease would be reported as required, recommended, or not reportable; and the use of PPE during different exposure types (‘always’ or ‘not always’ [never, rarely, sometimes, and most of the time]). Univariate logistic regression analysis was performed to determine whether demographic characteristics were associated with knowledge of when and how to report zoonotic disease cases. Significant variables in the univariate analysis ($P < 0.10$) were included in the multivariate model using stepwise backward selection. Characteristics were retained in the final model at values of $P < 0.05$. Chi square test or Fisher’s exact test (if cell frequency fell at five or below) was used to assess if respondents’ attitudes about zoonotic diseases were associated with IP practices.

Data were analyzed using Microsoft Excel® and Epi Info 7; a P-value of < 0.05 was considered statistically significant.

3. Results

3.1. Respondent demographics and characteristics

In total, 343 respondents opened the survey. Twenty-five responses were incomplete and excluded from results; additionally, we excluded 20 responses from persons other than veterinarians (e.g., veterinary students, licensed technicians, or veterinary assistants). We included 298 complete responses from veterinarians practicing in Arizona. The majority of the 298 respondents were female (70%), worked in small animal medicine (84%), and reported practicing veterinary medicine for at least 10 years (75%) (Table 1). Respondents

practiced in all 15 Arizona counties, with the majority (65%) reporting practicing in Maricopa County.

3.2. Beliefs and knowledge about zoonotic disease prevention and reporting

A majority of veterinarians responded that they knew which zoonotic diseases are endemic in Arizona (85%) and believed that there is a risk for zoonotic disease transmission to themselves (98%), other staff (98%), and owners (99%) (Fig. 1). Among 298 respondents, 264 (89%) reported knowing what actions they should take to protect themselves from zoonotic disease exposures, and 92% believed they were knowledgeable about zoonotic diseases. Only 171 (57%) of 298 veterinarians reported that they knew when to report a suspected zoonotic disease in an animal and 178 (60%) knew which agency in Arizona to contact to report (how to report) a suspected zoonotic disease in an animal (Fig. 1). These reporting results were similar among the subset of 274 veterinarians who agreed or strongly agreed that they were knowledgeable about zoonotic diseases; 162 (59%) knew when to report a suspected zoonotic disease in an animal and 168 (61%) knew to which agency to report a suspected zoonotic disease in an animal.

Most respondents said they would report rabies (97%), brucellosis (89%), and tularemia (74%), all of which are required reportable conditions in Arizona. Other required reportable conditions were less likely to have been reported, with only 124 (42%) respondents noting they would report leptospirosis, and 123 (41%) respondents saying they would report psittacosis (Fig. 2). Other conditions, including tick-borne diseases and plague, are not considered required reportable conditions in Arizona, but veterinarians are recommended to report them to public health authorities to facilitate rapid response and prevention activities. Only 35 (12%) respondents noted they would report tick-borne diseases; however, 285 (96%) respondents said they would report plague. Of nonreportable conditions, 39 (13%) respondents said they would report scabies and 11 (4%) respondents said they would report coccidioidomycosis (Valley fever).

3.3. Experience with diagnosing zoonotic diseases

A majority (62%) of respondents reported having diagnosed an animal with a zoonotic disease within the past five years, with 81 (44%) diagnosing ≥10 cases of zoonotic diseases in the past five years. Respondents diagnosed a total of 409 zoonotic disease cases in animals of the following pathogens or diseases in decreasing frequency: ring-worm (120), roundworms (51), giardiasis (36), leptospirosis (34), scabies (34), coccidioidomycosis (24), hookworms (18), general intestinal parasites (17), methicillin-resistant *Staphylococcus aureus* or *S. pseudointermedius* (11), salmonellosis (10), rabies (9), avian chlamydiosis (6), toxoplasmosis (4), tapeworms (4), *Cheyletiella* mites (3), campylobacteriosis (3), brucellosis (3), *Clostridium difficile* (3), tuberculosis (3), *Isospora* (3), Rocky Mountain spotted fever (3), tularemia (2), plague (2), *E. coli* (2), vesicular stomatitis virus (1), trichomoniasis (1), contagious ecthyma/orf (1), and West Nile virus (1). Among 184 respondents who diagnosed a zoonotic disease in an animal, 26 (14%) respondents reported a total of 36 cases to an agency; all 36 were reported to the correct agencies. Among 153 (83%) respondents who said they did not report the diagnoses, 32 diagnoses were required reportable conditions, including leptospirosis (22 cases), avian chlamydiosis (4), brucellosis (2), West Nile virus

(1), tularemia (1), tuberculosis (1), and trichomoniasis (1). The remaining five (3%) veterinarians who reported having diagnosed an animal with a zoonotic disease within the past five years did not know if reporting of the zoonotic disease occurred, but included one diagnosis of brucellosis and one diagnosis of leptospirosis that should have been reported.

When asked if they had ever developed illness from a zoonotic disease while practicing veterinary medicine, 13 (4%) reported having a laboratory-confirmed zoonotic infection. These infections included ringworm, cat scratch fever, brucellosis, campylobacteriosis, giardiasis, scabies, toxoplasmosis, and vibriosis. Seventeen (6%) veterinarians had a suspected zoonotic infection or exposure but lacked laboratory-confirmation, which included ringworm, cryptosporidiosis, scabies, plague, brucellosis, giardiasis, bite from a rabid animal, psittacosis, coccidiosis, and West Nile virus.

3.4. Infection prevention practices

Respondents were asked how frequently and in what settings they used PPE while practicing veterinary medicine. A majority of respondents reported always using PPE when performing a surgical procedure (96%) or necropsies (94%); a smaller proportion reported always using PPE when handling clinically ill animals (37%) or healthy animals (17%) (Fig. 3). Of 298 respondents, 212 (71%) and 202 (68%) veterinarians reported always using PPE when in contact with animal birthing fluids, or animal urine and feces, respectively; whereas, 139 (47%) reported using PPE for contact with animal blood, saliva, or other body fluids.

In assessment of IP protocols, 126 (42%) respondents reported knowledge of a written IP manual or protocol available within their workplace; 181 (61%) respondents had areas where animals were isolated or quarantined and staff access was restricted (Table 2). Most (76%) veterinarians reported always washing their hands before eating or drinking at work, and 89% reported always using soap and water when washing their hands.

3.5. Group comparisons

Responses for when to make a report and how to report a suspected zoonotic disease in an animal were not significantly different by gender, years of practice, or holding additional degrees, but did differ by practice type, age, and number of veterinarians in the practice using univariate logistic regression analysis (Table 3). In the multivariate model, small animal veterinarians (aOR = 0.43; 95% CI 0.21–0.85) and veterinarians aged < 45 years old (aOR = 0.53; 95% CI 0.32–0.89) were less likely to report knowing when to make a zoonotic disease report than other groups. Small animal veterinarians were also less likely to know how to make a report (aOR = 0.31; 95% CI 0.15–0.62) than veterinarians in other areas of practice. In addition, we also assessed how attitudes about zoonotic diseases affected respondents' reported practices. Respondents who agreed that they know the appropriate actions to protect themselves from zoonotic disease exposures were more likely to encourage other staff to use PPE to reduce the risk of zoonotic disease exposure than veterinarians who disagreed (OR = 2.81; 95% CI 1.36–5.81) (Table 4). Veterinarians who agreed they knew the appropriate protective actions were also more likely to report always using PPE when performing a surgical procedure (OR = 2.70; 95% CI 1.11–6.56) and always washing their hands before eating or drinking at work (OR = 81; 95% CI 1.97–7.35).

Veterinarians who agreed that they were concerned about being exposed to a zoonotic disease were also more likely to always isolate or quarantine animals with suspected zoonotic diseases than those who were not concerned (OR = 1.86, 95% CI 1.16–2.98).

3.6. Education

The sources that respondents use to learn about zoonotic disease prevention included the American Veterinary Medical Association (AVMA) (74%), CDC (69%), internet (62%), other peer-reviewed journals (47%), AzVMA newsletter and website (45%), and the Arizona Department of Health Services (ADHS) website (37%). Other sources mentioned by respondents included the Veterinary Information Network online forum, Promed email listserv, other veterinarians, textbooks, news sources, the U.S. Department of Agriculture Animal and Plant Health Inspection Service, conferences or webinars, and the Companion Animal Parasite Council. Among 298 respondents, 254 (85%) agreed or strongly agreed that they would benefit from receiving continuing education or guidelines on zoonotic diseases and IP practices. When asked what type of resources on zoonotic diseases and IP would be helpful, respondents most frequently mentioned information on state websites (77%), presentations (65%), and flyers or brochures (48%). Other potentially valuable resources listed by respondents included email alerts, webinars, and quick reference algorithms. All 298 respondents indicated that additional resources were needed; also, in the comments section, approximately 20 respondents specifically mentioned that having an easily accessible list of reportable diseases and relevant contact information for animal and public health agencies would be beneficial.

4. Discussion

Our survey results demonstrate that only 57% and 60% of respondents knew when and how to report zoonotic diseases in animals, respectively, and that small animal veterinarians were less likely to report knowing when and how to report than veterinarians in other areas of practice. In addition to gaps in reporting, veterinarians did not consistently follow recommended IP practices. Compared with the 2015 AVMA U.S. national averages, more of our survey respondents were female (70%) (nationally, 58%), specialized in small animal medicine (81%) (nationally, 74%), and worked in private practice (82%) (nationally, 79%) (American Veterinary Medication Association, 2015). In our survey, handwashing practices were more frequently reported (75%) when compared to a national study by Wright et al. (2008) (2,133 U.S. respondents), who reported that 36% overall or 48% of small animal veterinarians reported always washing hands between patients. Our results and prior studies indicate that hand washing practices in the veterinary clinic setting needs to improve, with the overall goal of 100%. The National Association of State Public Health Veterinarians (NASPHV) Compendium of Veterinary Standard Precautions for Zoonotic Disease Prevention in Veterinary Personnel (williams et al., 2015Williams et al. (2015) provides guidelines to address correct PPE use and IP practices; however, the breadth and depth of implementation in veterinary practices is unknown.

Encouraging veterinarians to follow NASPHV guidelines for PPE use is important, particularly given zoonotic diseases of concern in Arizona such as leptospirosis (Guagliardo

et al., 2019). A high proportion of respondents reported always using PPE when performing a surgical procedure (96%) or necropsies (94%). Although we did not specify what type of PPE was used, NASPHV recommends that during necropsies, veterinary personnel should wear gloves, facial protection, and impermeable protective outerwear. In addition, eye protection and respiratory tract protection should also be employed when there is a high probability of exposure to a zoonotic pathogen through aerosolization.

A small proportion (10%) of Arizona veterinarians who responded to our survey had developed a confirmed or suspected illness from a zoonotic disease while practicing veterinary medicine. A study of veterinarians in Australia (Dowd et al., 2013) found that 45% of 344 veterinarians reported contracting a zoonotic disease, and that only 40%–60% of these 344 veterinarians perceived a risk for exposure to a zoonotic disease depending on activity type. Unlike our Arizona veterinary population where the majority (91%) felt they had a high knowledge of zoonotic diseases, only 42% of the Australian veterinarians reported high zoonotic disease knowledge. A higher proportion (89%) of veterinarians in our survey agreed or strongly agreed that they know what actions to take to protect themselves against zoonotic diseases, compared with 73% in Dowd's study.

Knowledge about reporting zoonotic diseases in our survey was low; only 57% of respondents indicated that they knew when to report a suspected zoonotic disease in an animal, and there were several reportable diseases that would not commonly be reported such as leptospirosis (42%) and tularemia (74%). Knowing when and how to report a suspected zoonotic disease was significantly lower among respondents who primarily practice small animal medicine; veterinarians aged less than 45 years were also less likely to know when to report. This could possibly be due to differences in the types or number of hours of continuing education obtained by respondents, differences in teaching curricula that respondents experienced during schooling, or other reasons not otherwise captured in our survey. Public health and animal health agencies should evaluate ways to improve reporting and knowledge among veterinarians, particularly younger veterinarians who practice small animal medicine, and identify how methods of communication could be improved between the animal and public health sectors. Importantly, 20 respondents specifically commented that having an easily accessible list of reportable diseases or relevant contact information for animal and public health agencies would be beneficial. Since survey completion, ADHS has made efforts to meet these needs by sending out e-mail alerts with zoonotic disease prevention messages, updating website content, providing frequent continuing education presentations and webinars, and providing zoonotic disease handouts such as flyers or brochures.

In our survey, 99% of respondents reported that there is a risk for zoonotic disease transmission to pet owners, 81% felt confident about providing zoonotic disease education and prevention recommendations to owners, and 94% agreed that they played an important role in promoting zoonotic disease prevention. These findings were similar to survey results from Lipton et al. (2008), which reported that veterinarians recognize their important role in zoonotic disease prevention and suggested that veterinarians would welcome stronger partnerships with public health agencies and other health professionals in this endeavor. This is important for all animal owners, although particularly among immunocompromised

populations who might be at greater risk for infection or severe disease from zoonotic pathogens.

This study has several limitations. First, the survey did not specifically examine or capture the type of PPE used with each activity. However, our results demonstrated there was not always compliance with PPE use as recommended by the NASPHV Compendium of Veterinary Standard Precautions for Zoonotic Disease Prevention in Veterinary Personnel (williams et al., 2015Williams et al. (2015); non-adherence to these recommendations can increase veterinarians' exposure to zoonotic disease. Second, this study did not formally evaluate the barriers to zoonotic disease reporting or PPE use. Additional studies could explore these barriers and help guide effective solutions. Third, this was a convenience sample and data might not be generalizable to all veterinarians in Arizona; the AzVMA represents 58% of the 1,900 active licensed veterinarians practicing in Arizona in 2015. Additionally, a response bias is possible because survey respondents might have a greater interest in zoonotic diseases or IP than veterinarians who did not complete the survey.

5. Conclusions

Our findings suggest the need for improved education to veterinarians about zoonotic disease reporting and IP practices. One in 10 respondents reported contracting a zoonotic disease while practicing veterinary medicine, and less than 60% of veterinarians knew when or how to report a suspected zoonotic disease case in an animal. ADHS and local health departments have increased efforts to regularly alert veterinarians about emerging zoonotic pathogens and outbreaks by using the AzVMA email listserv and newsletter. State and local public health agencies in Arizona have also regularly provided continuing education presentations for veterinarians. Plans to upgrade the ADHS website is an effort in progress as of May 2019; this webpage will include zoonotic disease reporting recommendations and contact information for each appropriate agency to create an easier electronic way for veterinarians to report diseases. Strategies to reach veterinarians who are not registered with AzVMA are also ongoing. Other public health agencies are encouraged to improve outreach and continue to build collaborative partnerships with veterinarians to facilitate better zoonotic disease prevention practices and reporting.

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Abbreviations:

AzVMA	ArizonaVeterinary Medical Association

References

American Veterinary Medication Association, 2015 Market Research Statistics: U.S. Veterinarians (accessed June 22, 2017). https://www.avma.org/KB/Resources/Statistics/Pages/Market-research-statistics-US-veterinarians-2015.aspx.

Arizona Administrative Code, Title 9 Chapter 6, 2013 Department of Health Services — Communicable Diseases and Infestations (accessed June 22, 2017). http://apps.azsos.gov/public_services/Title_09/9-06.pdf.

Centers for Disease Control and Prevention, 2018 Zoonotic Diseases. (accessed June 22, 2018). https://www.cdc.gov/onehealth/basics/zoonotic-diseases.html.

Constable PJ, Harrington JM, 1982 Risks of zoonoses in a veterinary service. Br. Med. J. (Clin. Res. Ed.) 284, 246–248.

Dowd K, Taylor M, Toribio JLML, Hooker C, Dhand NK, 2013 Zoonotic disease risk perceptions and infection control practices of Australian veterinarians: call for change in work culture. Prev. Vet. Med 111, 17–24. [PubMed: 23664739]

Guagliardo SA, Iverson SA, Reynolds L, Yaglom H, et al., 2019 Despite high-risk exposures, no evidence of zoonotic transmission during a canine outbreak of leptospirosis. Zoonoses Public Health.

Gummow B, 2003 A survey of zoonotic diseases contracted by South African veterinarians. J. S. Afr. Vet. Assoc 74, 72–76. [PubMed: 15029950]

Kahn LH, 2006 Confronting zoonoses, linking human and veterinary medicine. Emerg. Infect. Dis 12, 556–561. [PubMed: 16704801]

Lipton BA, Hopkins SG, Koehler JE, DiGiacomo RF, 2008 A survey of veterinarian involvement in zoonotic disease prevention practices. J. Am. Vet. Med. Assoc 233, 1242–1249. [PubMed: 19180714]

Noah D, Ostrowski S, 2016 Role of the Veterinarian in Public Health/One Health Merck Veterinary Manual. Merck & Co., Inc., Kenilworth, New Jersey (accessed June 22, 2018). https://www.merckvetmanual.com/public-health/public-health-primer/role-of-the-veterinarian-in-public-health-one-health.

Schnurrenberger PR, Grigor JK, Walker JF, Martin RJ, 1978 The zoonosis-prone veterinarian. J. Am. Vet. Med. Assoc 173, 373–376. [PubMed: 567636]

Shanko K, Kemal J, Kenea D, 2015 A review on confronting zoonoses: the role of veterinarian and physician. J. Vet. Sci. Technol 6, 1–7.

Williams CJ, Cheftel JM, Elchos BL, Hopkins SG, Levine JF, National Association for State Public Health Veterinarians, 2015 Compendium of veterinary standard precautions for zoonotic disease prevention in veterinary personnel. J. Am. Vet. Med. Assoc 247, 1252–1277. [PubMed: 26594810]

Wright JG, Jung S, Holman RC, Marano NN, McQuiston JH, 2008 Infection control practices and zoonotic disease risks among veterinarians in the United States. J. Am. Vet. Med. Assoc 232, 1863–1872. [PubMed: 18598158]

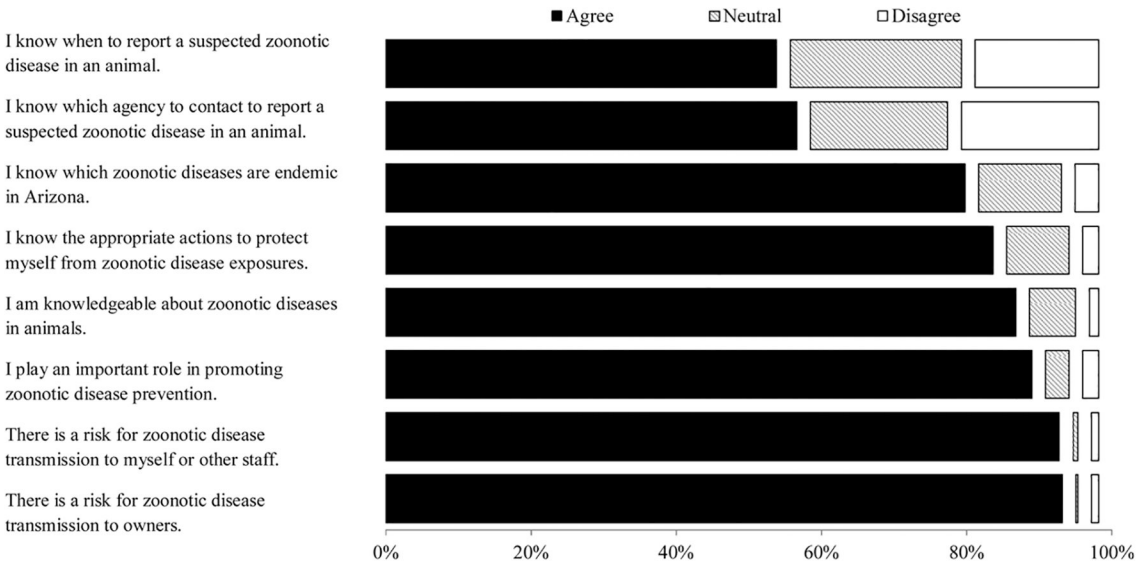

Fig. 1.

Zoonotic disease prevention and reporting perceptions among survey respondents (N = 298) — Arizona, 2015.

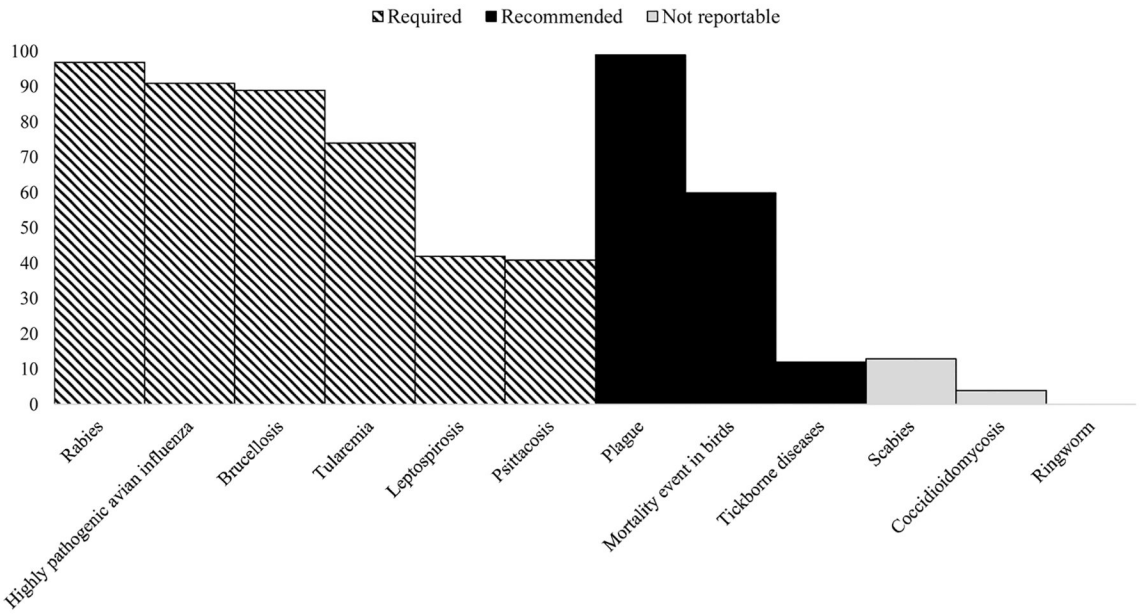

Fig. 2.

Percent of survey participants (N = 298) who responded that they would report the zoonotic disease in an animal to an appropriate public health, agricultural, or wildlife agency, by disease type (required reporting, recommended reporting, or not reportable) — Arizona, 2015.

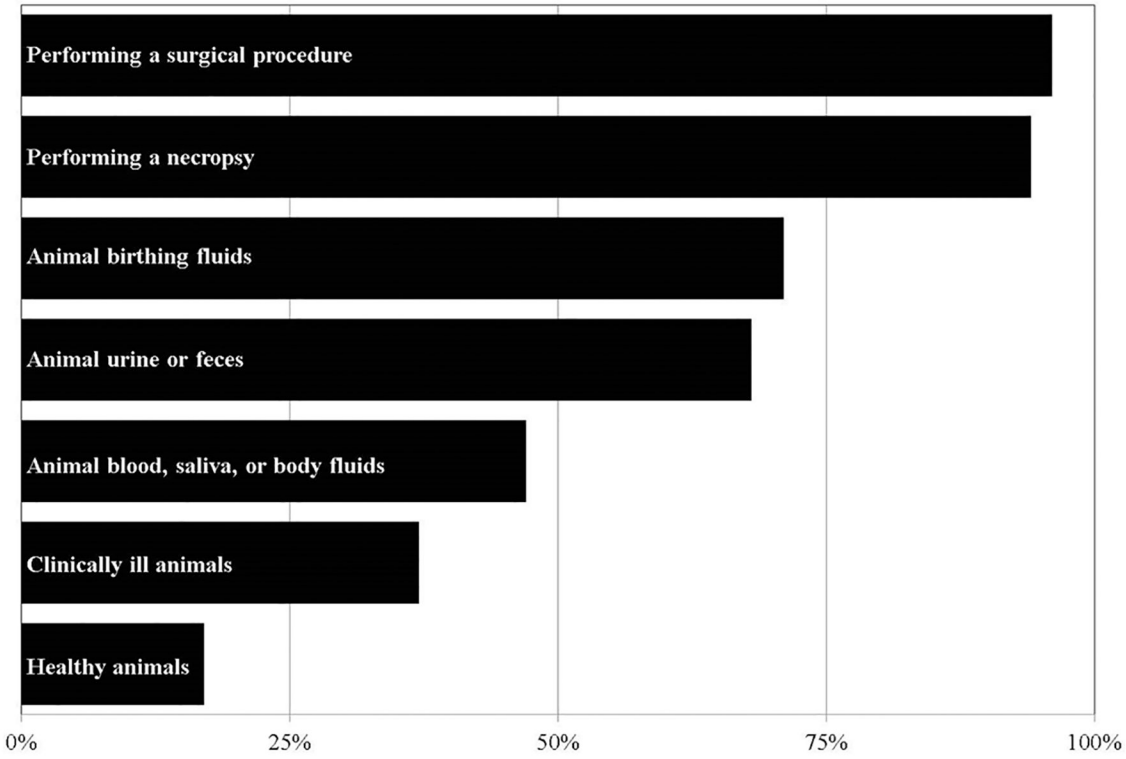

Fig. 3.

Percent of survey respondents (N = 298) who report always wearing personal protective equipment[+] during different exposure types — Arizona, 2015.

[+]Specific types of PPE (e.g. gloves, mask, face shield) were not asked.

Table 1

Veterinary knowledge, attitudes, and practices survey respondent characteristics (N = 298) — Arizona, 2015.

Characteristic	Category	No.	%
Sex	Female	208	70
Age (yrs)			
	< 45	129	43
	≥45	169	57
[a]County of practice			
	Maricopa County	195	65
	Pima County	76	26
	Yavapai County	17	6
	Pinal County	11	4
	Coconino County	10	3
	[b]Ten other Arizona counties	44	15
Additional degrees			
	Master of Science	28	9
	Diplomate or Board Certification	16	5
	Master of Public Health	5	2
	PhD	5	2
Years practicing veterinary medicine			
	<10 years	76	26
	≥10 years	222	74
Area of veterinary medicine			
	Small animal	251	84
	Other, including large animal and equine	47	16
Number of veterinarians in practice			
	1 veterinarian	60	20
	2–5 veterinarians	156	52
	6 or more veterinarians	66	22
	[c]Not applicable	16	5

[a]County of practice could be selected more than one time if the veterinarian practiced in more than one county.

[b]The 10 other Arizona counties had fewer than 10 responses per county, and the results are reported here in aggregate (these counties include, from most to least number of responses, Cochise, Mohave, Gila, Santa Cruz, Navajo, Apache, La Paz, Graham, Greenlee, and Yuma Counties).

[c]Not applicable refers to veterinarians not currently working in clinical practice, but working as a veterinarian in academic, government, public health, or research agencies.

Table 2

Percent of survey respondents (N = 298) who reported certain infection prevention practices — Arizona, 2015.

Questions on infection prevention practice[a]	Always No. (%)	Most No. (%)	Some No. (%)	Rare No. (%)	Never No. (%)
Animals with suspected zoonotic diseases are isolated or quarantined.	170 (57%)	73 (25%)	39 (13%)	11 (4%)	5 (2%)
There is a restriction of staff in areas where animals are isolated or quarantined.	181 (61%)	68 (23%)	27 (9%)	12 (4%)	10 (3%)
I encourage staff to use PPE to reduce risk of disease exposure.	197 (66%)	80 (27%)	17 (6%)	2 (1%)	2 (1%)
I wash my hands between patients and procedures.	223 (75%)	66 (22%)	8 (3%)	1 (0%)	0
I wash my hands before eating or drinking at work.	226 (76%)	64 (21%)	8 (3%)	0	0
I use soap and water when washing my hands.	264 (89%)	29 (10%)	5 (2%)	0	0
I eat or drink in animal handling or treatment areas.	14 (5%)	22 (7%)	105 (35%)	87 (29%)	70 (23%)

[a]Questions were asked as part of the online survey of Arizona veterinarians.

Table 3

Results of logistic regression analyses of demographic and practice characteristics among veterinarians that reported they knew when to make a report and how to make a report (who to contact) of a suspected zoonotic disease in an animal (N = 298) — Arizona, 2015.

Respondent demographics and practice characteristics	Total	N (%) Agree: Know when to make a report of a suspected zoonotic disease in an animal	OR (95% CI), P-value	aOR (95% CI), P-value	N (%) Agree: Know how to make a report (who to contact) of a suspected zoonotic disease in an animal	OR (95% CI), P-value	aOR (95% CI), P-value
Age	129	60 (47%)	0.45 (0.28–0.73), P < 0.001	0.53 (0.32–0.89), P = 0.02	67 (52%)	0.56 (0.35–0.90), P = 0.01*	0.53 (0.40–1.12), P = 0.13
< 45y							
≥45y	169	111 (66%)			111 (66%)		
Gender	90	53 (59%)	1.09 (0.66–1.80), P = 0.41	-	56 (62%)	1.16 (0.70–1.93), P = 0.33	-
Male							
Female	208	118 (57%)			122 (59%)		
Area of veterinary medicine	240	127 (53%)	0.36 (0.19–0.69), P = 0.001	0.43 (0.21–0.85), P = 0.02	131 (55%)	0.28 (0.14–0.57), P < 0.001	0.31 (0.15–0.62), P = 0.001
Small animal							
Other (large, equine, exotic)	58	44 (76%)			47 (81%)		
Years of practice	216	125 (58%)	1.08 (0.64–1.80), P = 0.44	-	133 (62%)	1.32 (0.79–2.20), P = 0.18	-
≥10y							
< 10y	82	46 (56%)			45 (55%)		
No additional degrees	242	133 (55%)	0.58 (0.31–1.07), P = 0.053	0.78 (0.40–1.52), P = 0.46	142 (59%)	0.79 (0.43–1.44), P = 0.27	-
At least one additional degree	56	38 (68%)			36 (64%)		
1 veterinarian in the practice	76	52 (68%)	1.19 (1.08–3.25), P = 0.02	1.32 (0.72–2.41), P = 0.37	53 (70%)	1.79 (1.02–3.12), P = 0.03	1.36 (0.74–2.50), P = 0.33
> 1 veterinarian in the practice	222	119 (54%)			125 (56%)		

OR = Odds Ratio; CI = 95% Confidence Interval; aOR = Adjusted Odds Ratio.

Table 4

Comparison between selected attitudes towards zoonotic disease and related practices among veterinarian respondents (N = 298) — Arizona, 2015.

Attitudes and Practices (selected)	**I am concerned about being exposed to a zoonotic disease.**		**OR (Cl), P-value**	**I know the appropriate actions to protect myself from zoonotic disease exposures.**		**OR (Cl), P-value**
	Agree	**Does not agree**[a]		**Agree**	**Does not agree**[a]	
	n (%)	**n (%)**		**n (%)**	**n (%)**	
	[N = 179]	**[N = 119]**		**[N = 264]**	**[N = 34]**	
Animals with suspected zoonotic diseases are always isolated or quarantined.	113 (63%)	57 (48%)	1.86 (1.16–2.98), P = 0.01	155 (59%)	15 (44%)	1.80 (0.88–3.70), P = 0.11
I always encourage other staff to use PPE to reduce the risk of zoonotic disease exposure.	120 (67%)	77 (65%)	1.11 (0.68–1.81), P = 0.68	182 (69%)	15 (44%)	2.81 (1.36–5.81), P = 0.005
A written infection prevention manual or protocol is always available at my place of work.	83 (46%)	43 (36%)	1.53 (0.95–2.46), P = 0.08	113 (43%)	13 (38%)	1.20 (0.58–2.52), P = 0.61
Always use PPE when handling clinically ill animals	17 (9%)	13 (11%)	0.86 (0.40–1.83), P = 0.69	27 (10%)	3 (9%)	1.17 (0.34–4.11), P = 0.80
Always use PPE when performing a necropsy	151 (84%)	97 (82%)	1.22 (0.66–2.26), P = 0.52	221 (84%)	27 (79%)	1.33 (0.55–3.26), P = 0.53
Always use PPE when performing a surgical procedure	160 (89%)	103 (87%)	1.31 (0.64–2.66), P = 0.46	237 (90%)	26 (76%)	2.70 (1.11–6.56), P = 0.03
Always wash my hands before eating or drinking at work	141 (79%)	87 (73%)	1.36 (0.79–2.34), P = 0.26	205 (78%)	21 (62%)	3.81 (1.97–7.35), P = 0.0001

[a]Does not agree includes: neutral, disagree, or strongly disagree responses OR = Odds Ratio; CI = 95% Confidence Interval, PPE = personal protective equipment.