



Research article

Animal care professionals' practice towards zoonotic disease management and infection control practice in selected districts of Wolaita zone, Southern Ethiopia

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ABSTRACT

Veterinary practices or activities expose professionals to occupational hazards, including infection with zoonotic diseases, during contact with animals. To assess animal care professionals' practice towards zoonotic disease management and infection control practices (ICPs) in selected areas of the Wolaita zone, a cross-sectional survey was conducted using a structured questionnaire survey. A total of 287 animal care professionals were registered by the Wolaita zone livestock and fishery office and working in nine different districts of the Wolaita zone. Of these, 135 animal care professionals working across nine different districts of the Wolaita zone were interviewed in the current study. The survey showed that about 55% (74/135) of respondents were animal health assistants, and about 84% (114/135) of the professionals were males. In terms of utilization of ICP, about 72% of professionals routinely wash their hands before eating and drinking in their workplace. However, approximately 7% of professionals sometimes eat or drink at the workplace. Additionally, almost 32% of the professionals always wash their hands between patient contacts. In the survey, approximately 49% of veterinarians said they sterilized and reused disposable needles. When dealing with an animal suspected of carrying a zoonotic infection, nearly 25% of experts isolate or quarantine diseased animals, and only about 25% of the experts remove their personal protective equipment (PPE) before interacting with other animals. Approximately 62% of responders said they used outwear (PPE) when carrying out surgery and 28% when performing a necropsy. Nearly 39% of veterinarians reported using gloves and gowns when assisting with parturition or handling conception products, and around 36% of practitioners utilized proper PPE when handling blood samples. Our findings show that the veterinary community in the Wolaita Zone's selected sites needs to be educated about ICPs regularly. A better understanding of the risk of zoonotic disease exposure, as well as alternatives for reducing this risk and liability problems, may encourage the use of infection control measures. Successful partnerships across multiple professional sectors should use a One Health approach that includes stakeholders from the human, animal, and environmental categories.

1. Introduction

Zoonotic diseases are diseases that are transmissible between animals (domestic and wildlife) and humans (World Health Organization, 2006). Zoonoses can be caused by viral, bacterial, rickettsial, fungal, parasitic, and prion agents (Bansal et al., 2016; M'ikanatha et al., 2008) and are transmitted through direct contact with infected individuals and an inanimate object such as in rabies and anthrax or indirectly via vectors, food, water, and the environment, as in the case of bovine tuberculosis, brucellosis, leptospirosis, and echinococcosis (World Health Organization, 2006). There are two types of zoonoses: those that produce chronic

infections with long-term social and economic effects and those that generate acute outbreaks with significant morbidity and death.

Ethiopia, an agropastoral society, is vulnerable to zoonotic diseases because a segment of the population lives in close proximity to animals frequently in unsanitary conditions with limited access to healthcare (Desta, 2015; Habib and Alshehhi, 2021; Kloos and Berhane, 2006). A committee utilizing the one health approach prioritized rabies, echinococcus, anthrax, brucellosis, and leptospirosis as the top five zoonotic diseases of interest for Ethiopia (Pieracci et al., 2016). One retrospective study conducted in northern Ethiopia estimated that 4.2% of all human diseases were caused by five zoonotic diseases (Menghistu et al., 2018).

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The latest prevalence rates for the northern region were schistosomiasis (30.3%), extrapulmonary TB (26.6%), rabies (23.3%), pulmonary TB (14.4%), and visceral leishmaniasis (5.3%) (Menghistu et al., 2021). This surveillance did not collect data on some diseases of interest, such as anthrax or brucellosis, so it is likely an underestimate (Menghistu et al., 2018). Other studies have reported that the human anthrax prevalence in Ethiopia is 1.3%, animal brucellosis is 2.4%, and human brucellosis is estimated to be 2.6% among individuals working with livestock (Bahiru et al., 2016; Pereira et al., 2020).

The veterinary field includes diverse professionals engaged in animal health and husbandry practice who are at higher risk of exposure to occupational hazards (physical, chemical, and biological hazards) and zoonotic infections (Abdulhameed et al., 2018; Adebowale et al., 2020; Harb et al., 2019). Veterinary understanding of zoonotic disease prevention and suspected case care is critical because these providers can serve as a point of entry for zoonotic diseases and play a critical role in the defense against the spread of zoonoses to humans (Harb et al., 2019). Although a majority of animal care professionals in Ethiopia are familiar with the transmission, management, and prevention of zoonotic disease, they have limited experience with identifying zoonotic diseases in humans. Furthermore, they have not participated in community efforts to mitigate transmission due to a lack of coordination. Medical professionals' knowledge of zoonoses is equally lacking in Ethiopia due to a lack of awareness and clinical practice in diagnosing certain zoonotic diseases (Desta, 2016; Gebremichael et al., 2013).

One health is a collaborative multisectoral approach designed to tackle the transmission of zoonotic diseases between humans and animals by bringing together physicians, veterinarians, epidemiologists, and other experts to understand the ecology of each emerging zoonotic disease. In Ethiopia, a joint zoonotic disease surveillance approach has been practiced for the past few years and is necessary to tackle the complexities of preventing zoonotic diseases. However, its full-scale application was limited by several factors, such as multiple disease challenges, unmotivated One Health workforce, remoteness, lack of appropriate working tools/infrastructure, and low budget. These factors often lead to the emergence and spread of zoonotic diseases (Gemedo et al., 2016).

For the realization of the joint zoonotic disease surveillance approach, health care providers in the human and animal health sectors play a crucial role (Gemedo et al., 2016; World Health Organization, 2020). In Ethiopia, one health approach was employed to convene a committee, which examined available literature and prioritized zoonotic diseases. From this risk assessment, the top five zoonotic diseases that the country would focus on building capacity for surveillance, laboratory identification, prevention, and outbreak response were identified (Kelly et al., 2017; Mackenzie and Jeggo, 2019).

Surveying human zoonotic diseases using national and regional health state data has progressed. Several studies revealed that zoonotic diseases such as bovine tuberculosis (5.8%) were reported in Ethiopia by (Sibhata et al., 2017), and (Menghistu et al., 2018) also reported other zoonotic diseases, such as helminthiasis (51,192), TB (2,085), rabies (227), schistosomiasis (105) and visceral leishmaniasis (7), from selected districts of southern Tigray, the northern Wollo zone of the Amhara region and the Ab'Ala district of the Afar region (Tadesse, 2016). reported a varied prevalence of brucellosis in people in pastoral (160 per 100,000) and sedentary systems (28 per 100,000) in Ethiopia. Animal data are still lagging due to inadequate resource allocation in the Department of Veterinary Services for critical activities such as surveillance and reporting of animal diseases and laboratory diagnosis. Operationalizing and executing the goals outlined in one health approach has been challenging due to competing resources and a shortage of qualified professionals who can dedicate time to these efforts (Pieracci et al., 2016).

Understanding veterinary providers' perceived risk of zoonotic diseases and the precautions they take to protect themselves is an important first step toward the prevention of occupational and nosocomial infections. Important zoonotic diseases have been described in several studies in East Africa, including Ethiopia (Cavalerie et al., 2021; Kemunto

et al., 2018; Laes-Kushner, 2020; World Health Organization, 2017). According to a review of the available literature, no study has been done on the awareness and adoption of infection control methods by animal health professionals in Ethiopia. Therefore, this study aimed to assess veterinary practitioners' practice toward zoonotic disease management and infection control practice in the Wolaita zone.

2. Materials and methods

2.1. Study area

The research was carried out in a selected district of the Wolaita zones. The Wolaita Zone comprises sixteen districts with its administrative town and is found in southern Ethiopia (Figure 1), located at 6.40–7.20 North latitude and 37.40–38.20 East longitudes with a total area estimated to be approximately 4,208.64 km² (Central Statistical Agency, 2019). The Wolaita zone receives a total annual rainfall of 1,112.3 mm, an annual mean maximum and minimum temperature of 25.4 °C and 14.5 °C, respectively, and the average annual humidity ranges from 60.9–63.5% (WZFEDD, 2020).

2.2. Study subjects

The study population included in the study was animal care professionals working at nine selected governmental and private veterinary clinics as well as regional laboratories of the Wolaita Zone who were engaged in handling different infectious diseases, disorders, and injuries of large ruminants, small ruminants, equines, and poultry. A total of 287 animal health professionals were registered by the Wolaita zone livestock and fishery office in 2021 and working in sixteen different districts of the Wolaita zone. Out of the 287 veterinarians, 135 animal health professionals working in the selected sites voluntarily participated in the current survey.

2.3. Study design

A cross-sectional questionnaire-based survey was employed from May 2021 to August 2021 to assess the attitude and practice of animal care professionals towards zoonotic disease and infection control practices (ICPs) in selected areas of the Wolaita zone.

2.4. Data collection method

2.4.1. Questionnaire survey

A structured questionnaire was designed, and a total of 135 animal care professionals were included from the nine selected districts in a face-to-face scheduled interview. The questionnaire was subdivided into three different parts. The first part included the respondent's sociodemographic characteristics, whereas the second part included hygienic behavior in the workplace. The third part addresses the utilization of personal protective equipment (PPE) to protect against infection in the workplace, including handling animals with different infectious diseases, handling different samples, and performing different minor and major surgical procedures (Supplementary file 1). The aim of the study was briefly described and written and verbal consent was obtained from animal care professionals before performing the survey. The survey protocol of the study was approved by the Research Ethics and Review Committee of Wolaita Sodo University with the reference number WSU 41/22/2242/2021. The questionnaire used to assess animal health professionals' practice toward zoonotic disease management and infection control practices in selected districts of the Wolaita Zone, southern Ethiopia, was adapted from the previous work of (Dowd et al., 2013) and (Wright et al., 2008).

Animal care professionals' responses to their sanitary conduct at work and the actions followed by professionals when an animal is suspected or has a zoonotic disease were evaluated using a five-point scale (never,

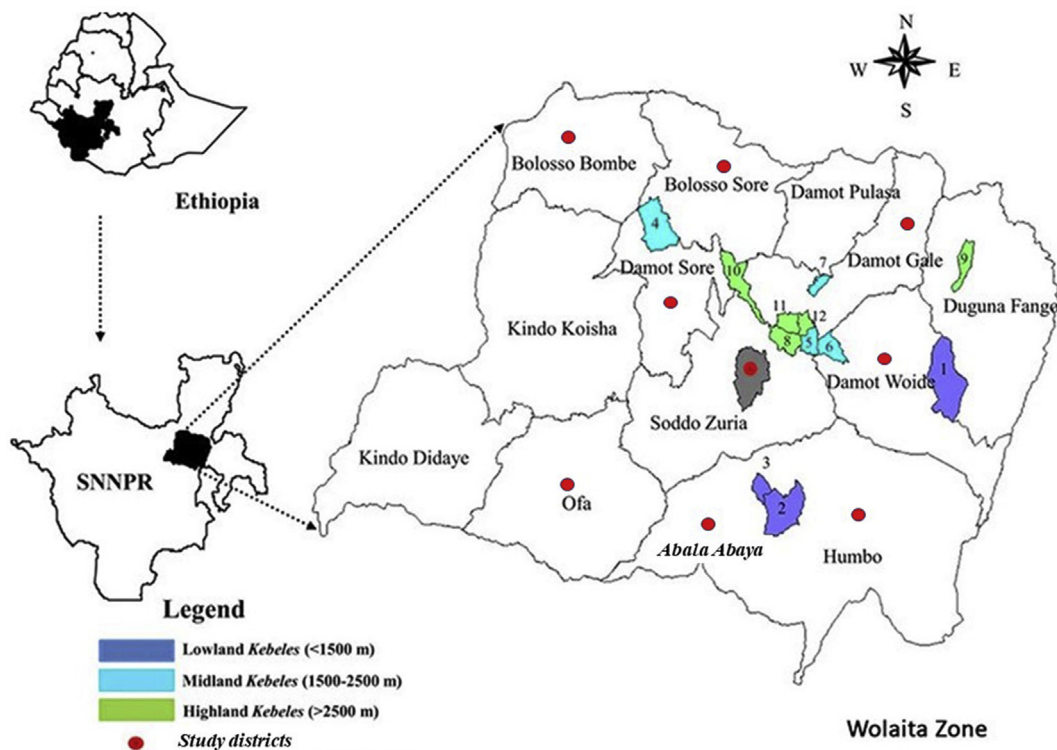


Figure 1. Map of the study sites.

seldom, sometimes, mostly, and always). Respondents were asked to pick one of four categorical answers to represent their choice of personal protective equipment in particular animal handling circumstances in regard to PPE compliance: (1) no special precautions are taken, (2) protective clothes or gloves, (3) protective cloth and gloves, (4) gloves, protective and cloth, and mask or face shield (Williams et al., 2015; Wright et al., 2008).

2.5. Sample size determination and sampling design

The sample size for this study was calculated using the formula described by (Yamane, 1967), which takes into account a 5% standard error and a 95% confidence interval.

$$n = N/[1 + N*(e)^2]$$

where n -sample size, N-population size = 287 Total number of (reference), e-acceptable sampling error.

Accordingly, the calculated sample size is approximately 167. However, only a total of 135 animal care professionals voluntarily participated in the interview during the study period from the selected districts.

In the present study, a convenience sampling technique was used to select the study sites. Thus, a total of nine districts, namely, Soddo Zuria, Humbo, Abala Abaya, Damote Gale, Damote Woyde, Damote Sore, Bolosso Sore, and Offa districts, were selected for conducting the current questionnaire survey. The accessibility of a relatively large number of animal care professionals in those districts, distance from the capital city of Soddo town, and road connection with each district were considered during the study site selection to save time and cost.

2.6. Data analysis

All survey data were recorded into a Microsoft Excel 2019 spreadsheet and then transferred to STATA Version 13.0 for statistical analysis. For each survey question, descriptive statistics (frequency and

percentages) were used to present the results. Using a systematic Likert point system, each respondent was allocated a precaution awareness (PA) score based on questionnaire replies that represented the stringency of his or her ICPs. Each response was granted a score ranging from 0 to 4, with higher values being assigned if respondents indicated behaviors more likely to safeguard against zoonotic disease transmission or the usage of extra PPE while handling animals or engaging in certain activities. Each person's scores were summed (PA score). Respondents were classified within each practice type depending on whether their PA scores were in the top 25% or bottom 75% of their summed scores (designated as high or low PA rankings, respectively) (Wright et al., 2008) (Supplementary file 2). A low PA score corresponded to less than ideal ICPs. Pearson's chi-square test was used to detect the existence of an association between work type and ICP variables (high vs. low PA score). A statistically significant association was considered at a p-value of less than 0.05.

3. Results

3.1. Animal care professionals' sociodemographic characteristics

In the current study, 135 animal care professionals completed the questionnaire survey and were included in the study. Among these, the majority of the respondents 74 (55%) were animal health assistants, followed by graduates of Doctor of Veterinary Medicine (DVM) 46 (34%), and artificial insemination technicians 15 (11%). About 84% (114/135) of the respondents were males, while approximately 16% (21/135) were females. In addition, almost 91% (123/135) of professionals were between 25-35 years old, and about 9% (12/135) of the respondents were between 36-50 years old. Furthermore, approximately 55% (74/135) of professionals had 5-10 years of work experience, whereas around 13% (17/135) of the professionals had 10-15 years of work experience, nearly 90% (121/135) of the professionals' work in government veterinary clinics and the remaining 10% (14/135) were working in private clinics (Table 1).

Table 1. Sociodemographic characteristics of respondents (N = 135).

Variable	Category	Frequency (n)	Proportion (%)
Sex	Male	114	84.44
	Female	21	15.56
Age (years)	25–35	123	91.11
	36–50	12	8.91
Work type	AI	15	11.11
	DVM	46	34.07
	Animal health assistant	74	54.81
Marital Status	Married	96	71.11
	Single	39	28.89
Working area	Government clinic	121	89.63
	Private veterinary clinic	14	10.37
Work experience	<5 years	35	25.93
	5–10 years	74	54.81
	10–15 years	17	12.59

3.2. Workplace hygiene

The frequency of behavior related to hand cleanliness, the use and handling of various types of equipment, and isolation measures when suspicious animals have zoonotic infections, as reported by veterinarians, is summarized in [Table 2](#). About 72% of professionals routinely wash their hands before eating and drinking in their workplace. According to [Table 2](#), nearly 7% of professionals sometimes eat or drink in animal handling areas and almost 32% of the professionals always wash their hands between patient contacts.

About 33% of professionals always recap needles before disposal at the workplace; however, nearly 24% of respondents never apply this practice. Additionally, approximately 49% of professionals always sterilize and reuse disposable needles or syringes, whereas nearly 37% of professionals always dispose of needles in an approved sharps container. However, approximately 16% of professionals never sterilize and reuse disposable needles or syringes, and approximately 19% of professionals never dispose of needles in a workplace in an approved sharps receptacle.

In regard to managing a zoonotic disease-affected animal, almost 28% of professionals never limit people's interaction with the sick animal, whereas about 35% of professionals sometimes remove their outerwear, whereas only 19% of professionals always do so before interacting with other animals. Additionally, only 25% of professionals always practice the isolation or quarantine of suspected animals, whereas around 28% of professionals do not restrict the contact of people with the suspected animal ([Table 2](#)).

Table 2. Hygienic practice and measures taken to control animals suspected of zoonotic diseases.

Variables	Frequency, n (%)				
	Never	Seldom	Sometimes	Mostly	Always
Care for Hand Hygiene					
Wash your hands before eating and drinking at the workplace	7 (5.19)	0 (0)	12 (8.89)	19 (14.4)	97 (71.85)
Eat or drink in animal handling areas	121 (89.63)	4 (2.96)	9 (6.67)	1 (0.74)	0 (0)
Wash or sanitize hands between patient contacts	23 (17.04)	5 (3.7)	44 (32.59)	20 (14.81)	43 (31.85)
Handling of Sharp materials					
Recap needles before disposal	33 (24.44)	2 (1.48)	35 (25.93)	20 (14.81)	45 (33.33)
Needles disposal in an authorized sharps container.	25 (18.52)	3 (2.22)	32 (23.70)	25 (18.52)	50 (37.04)
Sterilize and reuse disposable needles or syringes.	21 (15.56)	1 (0.74)	24 (17.78)	23 (17.04)	66 (48.89)
Handling of suspected/infected animals					
Isolate or quarantine the animal	30 (22.22)	8 (5.93)	30 (22.22)	23 (17.04)	34 (25.19)
Limit owners' contact with the suspected animal	38 (28.15)	17 (12.59)	31 (22.96)	29 (21.48)	20 (14.81)
Take off outerwear before approaching other animals	34 (25.19)	6 (4.44)	47 (34.81)	23 (17.04)	25 (18.52)
Sterilize all equip after use on the animal	4 (2.96)	0 (0)	27 (20.00)	30 (22.22)	74 (54.81)

3.3. Utilization of PPE to protect against infection at workplace

3.3.1. Handling of animals with infectious disease

The present study revealed veterinarians' responses to the frequency of use of personal protective equipment related to infection control practices at the workplace. About 39% of professionals used all personal protective equipment when managing an animal that showed indications of respiratory signs followed by managing an animal with neurologic signs (30%), while almost 46% of professionals used both protective clothes and gloves while handling an animal with a dermatological sign. However, approximately 44% of respondents did not use particular precautions to handle healthy animals, whereas approximately 27% of the professionals handled animals with gastrointestinal neurological signs without any precaution ([Table 3](#)).

Standard personal protective equipment (PPE) is equipment worn by animal care professionals to establish a barrier between the person and potential occupational hazards. Rubber boots, splash-proof overalls (gowns) or disposable overalls with impervious or splash-proof aprons, disposable impermeable gloves (nitrile gloves suggested), face shields, or safe eyewear (goggles), a particulate respirator, and masks may all be included. A PPE should be changed often (at least daily) if it is dirty or otherwise contaminated by bodily fluids perceived or known to constitute a risk for pathogen contamination (e.g., feces, blood, nasal exudates, urine, or uterine fluid). Animal care professionals should change out of their hospital PPE before leaving the office, and similar things should not be worn outside of the office. All veterinary hospitals and clinics should provide laundry facilities so that outerwear does not leave the premises ([Weese, 2004](#); [World Health Organization, 2020](#)).

3.3.2. Handling different samples and clinical examinations of animals at the workplace

In the present study, about 34%, 47%, and 41% of the professionals used protective gloves and cloths when handling fecal samples and urine samples as well as performing a rectal examination. However, approximately 17% of professionals do not use special precautions when performing an oral examination, followed by nearly 8% during the collection of a blood sample ([Table 4](#)).

3.3.3. Handling animals and performing surgical procedures

From [Table 5](#), we can see that with the exception of surgery, approximately only 30% of professionals wore optimal PPE for these high-risk activities such as handling products of conception and assisting with parturition, performing necropsy or handling tissues, and handling an animal with a haemorrhage.

Table 3. Handling of animals with infectious disease.

Variables	Frequency, n (%)				
	No special protection (Level 1)	Gloves or a protective cloth (Level 2)	Gloves and a protective cloth (Level 3)	Surgical mask, goggles, boots, protective clothing, & gloves (Level 4)	Level of PPE considered appropriate
Handling Healthy animal	59 (43.70)	45 (33.33)	26 (19.26)	5 (3.70)	1 through 4
Handling a skin (dermatologic signs) diseased animal	8 (5.93)	57 (42.22)	62 (45.93)	8 (5.93)	3 through 4
Handling an animal with respiratory signs	6 (4.44)	44 (32.59)	32 (23.70)	53 (39.26)	3 through 4
Handling an animal with gastrointestinal signs	36 (26.67)	41 (30.37)	43 (31.85)	15 (11.11)	3 through 4
Handling an animal with a neurologic sign	36 (26.67)	28 (20.74)	30 (22.22)	41 (30.37)	3 through 4

Table 4. Handling different samples and clinical examination of animals.

Variables	Frequency, n (%)				
	No special protection (Level 1)	Gloves or a protective cloth (Level 2)	Gloves and a protective cloth (Level 3)	Surgical mask, goggles, and gloves (Level 4)	Level of PPE considered appropriate
Handling faecal samples	9 (6.67)	69 (51.11)	46 (34.07)	11 (8.15)	3 through 4
Handling of urine samples	7 (5.19)	49 (36.30)	63 (46.67)	16 (11.85)	3 through 4
Collection of a blood sample	11 (8.15)	47 (34.81)	49 (36.30)	7 (5.19)	3 through 4
Performing an oral examination	23 (17.04)	56 (41.48)	40 (29.63)	16 (11.85)	3 through 4
Performing rectal examination	7 (5.19)	52 (38.52)	55 (40.74)	21 (15.56)	3 through 4

Table 5. The use of personal protective equipment (PPE) in specific professional situations among animal care professionals in the workplace.

Variables	Frequency, n (%)				
	No special protection (Level 1)	Gloves or a protective cloth (Level 2)	Gloves and a protective cloth (Level 3)	Surgical mask, goggles, boots, protective clothing, & gloves (Level 4)	Level of PPE considered appropriate
Handling an animal with a haemorrhage	7 (5.19)	46 (34.07)	50 (37.04)	32 (23.70)	3 through 4
Handling of products of conception and assisting with parturition	2 (1.48)	39 (28.89)	52 (38.52)	42 (31.11)	Level 4
Performing surgery	1 (0.74)	12 (8.89)	38 (28.15)	84 (62.22)	Level 4
Performing necropsy or handling tissues	18 (13.33)	34 (25.19)	45 (33.33)	38 (28.15)	Level 4

3.4. Comparison of work types with infection control practices (ICPs)

The veterinary practitioners' work types were compared with the various ICPs based on the PA ranking developed by (Wright et al., 2008). In each practice category, data for veterinarians with low PA scores were compared with data for animal care professionals with high PA scores to determine whether certain work types were associated with less stringent ICP. The variables or infection control practices that showed a

statistically significant ($p < 0.05$) effect on zoonosis is presented in Table 6. In the present study, DVM professionals had a higher PA on sterilization and reuse of disposable needles (8%), handling an animal with respiratory disease (19%), handling of products of conception and assisting with parturition (16%), and performing necropsy/tissue handling (16%) than other professionals. On the other hand, animal health assistants (AHAs) have a low PA in sterilization and reuse of disposable needles (50%), handling an animal with respiratory disease

Table 6. Association of work types with infection control practice (ICP).

Variables	Work type, Frequency, n (%)			Chi-square (X^2)	p value
	AI	DVM	AHA		
Sterilize and reuse disposable needles				6.98	0.03
High PA Score	4 (2.9%)	11 (8.1%)	6 (4.4%)		
Low PA Score	11 (8.1%)	35 (25.9%)	68 (50.4%)		
Handling an animal with respiratory				6.69	0.04
High PA Score	5 (3.7%)	25 (18.5%)	23 (17.0%)		
Low PA Score	10 (7.4%)	21 (15.6%)	51 (37.8%)		
Handling of products of conception and assisting with parturition				9.24	0.01
High PA Score	4 (2.9%)	22 (16.3%)	16 (11.9%)		
Low PA Score	11 (8.1%)	24 (17.8%)	58 (42.9%)		
Performing necropsy or handling tissues				10.41	0.005
High PA Score	8 (5.9%)	21 (15.6%)	16 (11.9%)		
Low PA Score	7 (5.2%)	25 (18.5%)	58 (42.9%)		

(38%), handling products of conception, and assisting with parturition (43%), and performing necropsy/tissues (43%) than other professionals. There was a significant association between work type and infection control practice (ICP) (Table 6).

4. Discussion

Each zoonosis's risk of occupational exposure is linked to the disease's incidence in animals in each veterinarian's practice. Veterinary professionals are also susceptible to infectious illnesses such as brucellosis. According to Pieracci and his colleagues, brucellosis is still a major issue in the pastoral community and mixed crop-livestock production systems, where seroprevalence was more highly reported in pastoral communities (17.4%) than sedentary (3.1%) communities (Pieracci et al., 2016). Moreover, Tadesse's (2016) study revealed that rabies, anthrax, brucellosis, leptospirosis, and echinococcosis were identified as priority zoonotic illnesses based on decision tree analysis and subsequent discussion with core decision-making participants composed of human, animal, and environmental health ministries. These diseases were prioritized and chosen from a list of forty-three zoonotic diseases based on criteria developed by the US Centers for Disease Control and Prevention, such as the severity of disease in humans, the proportion of human disease attributed to animal exposure, the burden of animal disease, the availability of interventions, and existing intersectoral collaboration. A collaborative multisectoral One Health approach that focuses on these prioritized Zoonotic diseases should be operationalized to enhance disease surveillance system development in humans and animals that helps to improve prevention and control strategies (Tadesse, 2016).

In Ethiopia, there are limited studies conducive to assessing health professionals' practice towards infection prevention and control practice. According to (Gemedo et al., 2016), 99.7% and 97.5% of health care providers in the Gomma district of Jimma Zone heard about rabies and anthrax, respectively. However, approximately half of health care providers are not aware of the use of wearing protective cloth in preventing anthrax, and 18% of them also do not practice isolation of suspected or infected dogs to prevent rabies. This may be explained by the fact that, unlike other national priority infectious diseases, there are no national zoonotic disease prevention and control programs in the district. Such a significant number of health care providers may not be able to advise on the method of protecting themselves against zoonotic diseases such as rabies and anthrax, which may lead to the persistent occurrence of rabies and anthrax outbreaks in human and animal populations.

On the other hand, from studies conducted in Canada, the most common zoonotic diseases have changed (Epp and Waldner, 2012), and this disease is currently eradicated in this country according to the WHO report. Increased contact with domestic animals is not always a crucial component of the transmission cycle for some zoonoses; nonetheless, veterinarians may be in danger owing to their location or the outside environment in which they work. Giesecke and Barton's research (Giesecke and Barton, 1993) revealed that Australian cattle herds are free of bovine brucellosis; however, in some regions of Australia, it is a frequent zoonotic illness found by veterinarians in wild pigs, and it may still represent a danger to people.

This study examined infection control techniques used by veterinarians and indicated certain elements for improving future safety and biosecurity measures in veterinary practices in selected areas of the Wolaita zone. The findings also reported that hand cleanliness, sharp material management, quarantine or isolation procedures, and personal PPE preferences are practiced by animal care professionals with various frequencies.

Our survey revealed that approximately 72% of respondents wash or sanitize their hands before eating or drinking, and approximately 32% of them wash before and after patient/client contact. Our findings are in contrast to those of a survey conducted in the United States, which found that only 31.1%–55.2% of large and small animal veterinarians wash their hands before eating and drinking at work, whereas approximately

18%–48% of small animal veterinarians wash their hands between patient contacts (Wright et al., 2008). Moreover, approximately 75–80% of practitioners in the United Arab Emirates always wash their hands before eating or drinking in animal handling areas and between patient contacts (Habib and Alshehhi, 2021).

Hand hygiene is the number one way to prevent the transmission of diseases. Hands that have not been cleaned can cause nosocomial infections in veterinary patients, as well as zoonotic disease transmission to humans (Espadale et al., 2018). Adopting infection control policies or procedures requiring handwashing and establishing staff rooms or lunch areas apart from animal handling areas in clinical settings might help to promote more acceptable practices (Anderson and Weese, 2016). The present findings suggest that hand washing compliance at veterinary clinics should be improved, with 32% compliance, as suggested by earlier research in the United States and WHO (Kloos and Berhane, 2006; World Health Organization, 2006; Wright et al., 2008).

When dealing with an animal suspected of having zoonotic disease, approximately 25% of animal care professionals surveyed said they always isolate the patient/client and prevent human access. This value is significantly lower than those reported in similar studies. Isolation of animals requires dedicated isolation space and personal protective equipment, both of which might not always be readily available in the study area. The adoption of infection control measures is impacted by a complex combination of institutional, logistical, social, and psychological factors and may not be straightforward (Dowd et al., 2013).

In our study, we found that almost 49% of professionals always sterilized and reused disposable needles. However, a study by (Habib and Alshehhi, 2021) in the UAE reported that approximately 19% of large and 10% of small animal veterinarians always sterilize and reuse disposable needles. It was also found that just one percent of veterinarians in the United States sterilize and reuse their disposable needles every time, according to a study by Wright and colleagues (Wright et al., 2008). The use of shared needles for subcutaneous vaccination can transmit various types of infection, such as bluetongue virus, mechanically between ruminant hosts since the needles are contaminated with pathogens (Darpel et al., 2016; Reinbold et al., 2010). In regard to blood-borne diseases, single-use needles have been extensively accepted as the standard of care and best infection control practice in human medicine. Veterinarians need to be aware of this, as it can be spread by contact with blood, particularly needle injection (Wernery, 2014). Better education can help improve compliance with workplace safety requirements, such as never recapping needles among human healthcare personnel, and it can also help animal care professionals adopt acceptable infection control practices.

The present study revealed that approximately 33% of animal care professionals always recap needles before disposal at the workplace; however, nearly 24% of respondents never apply this practice. In contrast (Habib and Alshehhi, 2021), reported that 75%–80% of veterinarians in the United Arab Emirates recap needles before disposal. Across the East African region, including Ethiopia, several zoonotic diseases, such as brucellosis, anthrax, rabies, salmonellosis, and bovine tuberculosis, have been reported (Kemunto et al., 2018), and these infections can be an occupational risk for farmers and veterinary professionals. Needle sticks and sharp injuries are occupational dangers for healthcare professionals who may be exposed to lethal blood-borne infections as a result of an unintentional injury with contaminated needles and other sharp items (Assen et al., 2020; Bekele et al., 2015). To lessen the risk of such accidents among healthcare professionals, it is critical to provide training on workplace safety and well-being, make safety instructions available, and avoid recapping the needle after use. Needle recapping was a significant modifiable risk behavior. Health policymakers and veterinarian clinic managers should develop methods to enhance working conditions for healthcare personnel and boost adherence to universal precautions.

From Table 5, we can see that with the exception of surgery, approximately 70% of respondents were not wearing optimal PPE for these high-risk activities, such as handling products of conception or

aiding with parturition. This practice was minimal compared to (Venkat et al., 2019), who reported that 70% of veterinarians in Arizona always use PPE when in contact with animal birthing fluids, urine, or feces. Small droplets or aerosols of biological fluids can be expelled during PPE handling, making PPE ineffective in shielding against newly occurring and re-emerging zoonotic infections (Alhaji et al., 2019).

According to the current study, a statistically significant association was observed between veterinary practitioners' work type and their infection prevention and control practice. In contrast to DVM professionals, animal health assistants have a low PA on sterilization and reuse of disposable needles, handling an animal with respiratory, handling products of conception and assisting with parturition, and performing necropsy/tissue handling. The adoption of safety precautions, such as muzzling, is rare, according to other research (Lucas et al., 2009). Several veterinarians changed the way they operated as a result of adopting avoidance methods or using personal protective measures to avoid the risk of biting and contact with different body fluids such as blood, feces, urine, and saliva (Jeyaretnam et al., 2000; Nienhaus et al., 2005).

Numerous zoonotic diseases that can be transmitted during the diagnosis of client animals were reported by many veterinarians in the survey (Alhaji et al., 2019; Dowd et al., 2013; Epp and Waldner, 2012; Jenni et al., 2019). Similarly, animal care professionals in the selected study sites may be infected with different zoonotic diseases since some of them do not use the appropriate PPE when handling biological samples, handling animals with infectious diseases, and performing high-risk procedures. This could increase the likelihood of becoming infected with the zoonotic disease and transmitting it to humans through professional contact, that the transmission cycle for these zoonoses is successfully prevented by veterinarian-administered preventive measures, or that people have been exposed but never developed a clinical infection.

Close contact with infected or carrier animals increases the potential of transmission of additional zoonoses, putting veterinarians at risk. This was supported by the study of (Nienhaus et al., 2005), who reported that ringworm was the most frequent zoonotic disease in Germany and was spread by direct contact with infected animals (Lucas et al., 2009). It is possible to minimize the zoonotic spread of ringworm and other contact-related diseases by taking simple precautions, such as wearing gowns, and gloves and washing hands frequently while inspecting patients.

We found in our study of infection prevention and control practices that some veterinarians did not take the steps necessary to guard against zoonotic disease transmission. This was in line with the study by (Wright et al., 2008) in the USA (Epp and Waldner, 2012), in Germany, and (Habib and Alshehhi, 2021) in the United Arab Emirates. In this study, all practicing animal care professionals were at risk of experiencing different skin infections since approximately 6% of the animal care professionals did not use any PPE when handling dermatological cases. Similarly (Epp and Waldner, 2012), reported that veterinarians are at risk of getting ringworm, regardless of whether they work with small or large species in Canada. In contrast, the report by (Habib and Alshehhi, 2021) in the United Arab Emirates reported that veterinarians used level 2 and above PPE when handling dermatological cases.

Infections and biological risks can be reduced by using safe animal handling methods. As the chance of contracting zoonotic infections among veterinarians decreases, people may become less cautious about taking precautions. Each veterinarian should be aware of the hazards in their work environment and make every effort to reduce the risk of biological hazards by following infection control procedures (Abdulhameed et al., 2018; Alhaji et al., 2019; Habib and Alshehhi, 2021; Venkat et al., 2019). Animal care professionals who do not consider PPE in their routine work neglect their professional duty to adopt work practices that do not expose themselves, their team, and the community to unnecessary risk of zoonotic infections (Dowd et al., 2013; Lae-s-Kushner, 2020). The recent global coronavirus (COVID-19) pandemic

has greatly affected and improved the use of personal protective equipment (especially face masks and gloves) in the workplace. The use of standard PPE and precautions, such as wearing gloves, masks, Google, rubber boots, and gowns, help to reduce the spread of zoonotic diseases and should be practiced when handling or examining infected animals, different types of samples, and contaminated equipment (Venkat et al., 2019; World Health Organization, 2020).

5. Conclusion

In the current study, animal care professionals did not take the necessary infection prevention and control measures to prevent the spread of zoonotic diseases. In addition, animal care professionals did not use the appropriate PPE while handling cases and samples and performing surgery and necropsy. In conclusion, veterinarians should be given a greater understanding of the danger of zoonotic disease exposure, as well as strategies for managing this risk and liability concerns. A targeted training program for practicing veterinarians in the Wolaita zone regarding zoonotic disease hazards, as well as a widespread campaign to raise awareness among veterinarians is required. There should be a national and local development of infection prevention and control guidelines. The guidance for the Wolaita zone would include hand hygiene, handling of potentially infectious animals, specimens, equipment and needles, and personal protective equipment use. Groundwork toward addressing zoonotic diseases using the one-health approach has been established in Ethiopia, but infrastructural gaps and other challenges have interfered with implementation and collaboration.

6. Ethics approval and consent to participate

Ethical clearance was obtained from the Research Ethics and Review Committee of Wolaita Sodo University. Informed consent was obtained from the participants through both written and verbal consent forms, and the survey protocol of the study was approved by the Research Ethics and Review Committee of Wolaita Sodo University with the reference number WSU 41/22/2242/2021. Confidentiality was maintained at all levels of the study by avoiding identifiers such as any personal identifying characteristics; images and videos of study participants were kept anonymously. Participants' involvement in the study was voluntary; participants who were unwilling to participate in the study and those who wished to quit their participation were informed to do so without any restriction.

Declarations

Author contribution statement

Haben Fesseha: Conceived and designed the experiments; Performed the experiments; Analyzed and interpreted the data; Wrote the paper.

Tasew Kefelegn: Conceived and designed the experiments; Performed the experiments; Wrote the paper.

Mesfin Mathewos: Conceived and designed the experiments; Analyzed and interpreted the data; Contributed reagents, materials, analysis tools or data.

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Data included in article/supplementary material/referenced in article.

Declaration of interests statement

The authors declare no conflict of interest.

Additional information

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