Risk Factors for *Bartonella* Seropositivity Among Veterinary Professionals in Washington State

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ABSTRACT

Exposure to zoonotic disease is a significant occupational risk in veterinary medicine. In this study, we characterized PPE use, injury frequency, and *Bartonella* seropositivity in Washington State veterinary workers. Using a job exposure matrix (JEM) and multiple logistic regression, we explored determinants of risk for Bartonella seropositivity. Depending on the seroreactivity cutoff used, *Bartonella* seropositivity was between 24.0% and 55.2%. No significant predictors of seropositivity were found, though the relationship between high-risk status and increased seropositivity for some *Bartonella* species approached significance. Further research is needed to clarify this relationship.

BACKGROUND

Veterinarians and other veterinary care workers face occupational exposure to zoonotic pathogens daily. Despite this risk, surveys have reported generally low use of personal protective equipment (PPE) and lack of comprehensive infection prevention and control planning in veterinary workplaces.[1,2,3] As a result, veterinary workers remain vulnerable to emerging and reemerging zoonotic diseases.

Bartonella (Figure 1) is a zoonotic pathogen that has been associated with occupational veterinary exposures.

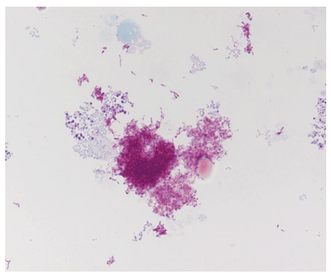

Figure 1. *B. henselae* in biopsy (Angelakis et al., 2010)[4]

In humans, Bartonella infection can cause illness with a wide range of severity (Figure 2). Because of the expanding number of Bartonella species, the spectrum of disease they can cause, and their presence in companion animals and livestock, Bartonella has been proposed as a serious reemerging threat, particularly to veterinarians.

Figure 2. Axillary lymphadenitis in a patient with bartonellosis (Giladi et al., 2005)[5]

In this study, we measured seropositivity for Bartonella henselae, kohlerae, and vinsonii in a sample of 96 veterinarians from Washington State. Using a JEM developed from an accompanying survey, we estimated occupational risk of factors for exposure to Bartonella to explore determinants of risk for Bartonella seropositivity.

METHODS

Survey administered to 96 veterinary professionals at a 2019 Washington veterinary medicine conference of veterinary practice (Figure 3), included:

- Characteristics
- Work practices
- Exposure to infectious materials
- Injuries
- Health outcomes

Blood samples collected, analyzed by immunofluorescence assay for antibodies specific to *Bartonella henselae, B. kohlerae,* and *B. vinsonii*.

Figure 3. Survey administration (Center for One Health Research, 2019)

We created a JEM for occupational exposure risk by combining measures of reported PPE use and reported animal-related injury from the survey. The two category scores were summed to create the overall risk score, generating low, moderate, and high overall risk categories. We generated a logistic regression model including total risk level, career length, cat ownership, and dog ownership as possible predictors of overall bartonella seropositivity at the 1:128 cut-off:

$$\text{Logit}(p) = \beta_0 + \beta_1 X_{\text{risk level}} + \beta_3 X_{\text{career length}} + \beta_4 X_{\text{pet cat}} + \beta_4 X_{\text{pet dog}}$$

The same model was used also used for the outcomes B. henselae seropositivity, B. kohlerae seropositivity, and B. vinsonii seropositivity.

RESULTS

At the 1:64 seroreactive titer cutoff, 55.2% of participants were positive for at least one Bartonella species (32.3% for henselae, 36.5% for kohlerae, and 24.0% for vinsonii). At the 1:128 cutoff, 24.0% of participants were positive for at least one Bartonella species (11.5% for henselae, 15.6% for kohlerae, and 8.3% for vinsonii). No significant predictors of seropositivity were found using the initial logistic regression model, likely because of the small sample size, the lack of variability in risk factors, and the limited sensitivity of Bartonella IFA. In a model using high-risk status instead of total risk category score, values approaching significance were found for the relationship between high-risk status and general Bartonella seropositivity as well as B. kohlerae seropositivity (Table 1).

Table 1. Association between high total risk status and Bartonella status.

Species	OR	95% CI	P-value
All *Bartonella*	2.95	0.99-8.79	**0.052**
B. henselae	2.03	0.49-8.32	0.33
B. kohlerae	3.35	1.01-11.18	**0.049**
B. vinsonii	2.00	0.41-9.84	0.39

Conclusions

The results of this study confirm past research on the use of PPE and infection prevention and control in veterinary workplaces while highlighting the high prevalence of *Bartonella* seropositivity in veterinary workers. Identifying specific risk factors for *Bartonella* seropositivity will require further research. Future research using larger sample sizes and greater variability in risk factors is needed to help clarify these relationships.

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