

## Original Research

# Zoonoses in rural veterinarians in the central region of Argentina

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### Abstract

**Objective:** To estimate the frequency of zoonoses in rural veterinarians and to search for risk factors.

**Design:** Cross-sectional study based on an anonymously answered structured questionnaire.

**Setting:** The interviewees participated in mandatory continuing education classes scheduled throughout the province by the College of Veterinary Surgeons.

**Participants:** Overall, 741 professionals were surveyed, and 75.8% (n = 562) of them completed the structured questionnaire.

**Main outcome measures:** Cumulative incidence (CIR) and incidence density (IDR) rates, standardised rates,  $\chi^2$ , Student's t-test, Pearson's correlation coefficient and logistic regression.

**Results:** The CIR for all zoonoses was 34.1% (brucellosis, 29.1%; toxoplasmosis, 2.1%; leptospirosis, 0.6%; tuberculosis, 0.6%; anthrax, 0.6%; ringworm, 0.4%; other, 0.6%). The IDR for the period 1964–2008 was estimated to be 20.7% (19.5% for brucellosis). The brucellosis IDR decreased between 1964 and 2008 and was higher during early post-graduation. The risk of brucellosis was associated with the number of years of practice and the geographical area. Sixty-nine respondents had at least one day of absence from work (24.0 ± 27.8 days).

**Conclusions:** A high frequency of zoonoses was reported by veterinarians with a large animal practice. Although the rate of zoonoses may be decreasing, further studies are needed to confirm this finding. A joint effort of all institutions is needed to prevent zoonoses among private practitioners.

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**KEY WORDS:** occupational injury, risk factor, safety practice, veterinary practice.

### Introduction

Handling of animals raised for food is related to many zoonotic such as brucellosis, tuberculosis, echinococcosis and leptospirosis.<sup>1–5</sup> Farm animal medicine requires direct contact with animals, their secretions, excretions, products and by-products, pesticides, solvents, disinfectants, antimicrobials, hormones and radiation.<sup>6–12</sup> Recent studies in the western region of Santa Fe Province (Argentina) have shown a high frequency of zoonoses (mainly brucellosis) among veterinarians working in general practices.<sup>13</sup> Although self-inoculation with *Brucella abortus* strain 19 in Argentina may be increasing,<sup>1,14</sup> many veterinarians do not think that this accident is a serious incident.<sup>13</sup>

The objective of this study was to estimate the frequency of zoonoses among rural veterinarians and to identify possible risk factors.

### Materials and methods

A self-recall study on zoonoses in veterinarians working in large animal practices in Santa Fe Province, Argentina was conducted. The study had a cross-sectional design; the unit of interest was the veterinarian, and the target population was the rural veterinarians in this province. The interviewees participated in mandatory continuing education classes scheduled throughout the province by the College of Veterinary Surgeons. Seven hundred forty-one professionals were surveyed, and 75.8% (n = 562) of them completed a structured questionnaire that was divided into two sections: (i) demographic characteristics of the interviewee and (ii) quantification

**What is already known on this subject:**

- Farm animal medicine is related to many zoonotic diseases.
- A high proportion of veterinarians in Argentina have been affected by zoonoses.
- In general, veterinarians are a population at greater risk for zoonoses than rural workers.

and characterisation of their zoonoses. The purpose and importance of the survey was previously explained, emphasising that responses should be anonymous, since the interest was not the experience of any particular colleague but the frequency of events at the population level.

A case was defined as a respondent who had suffered a zoonosis during a given period. Only laboratory-confirmed cases diagnosed after graduation were considered in this study. Information needed to calculate the zoonosis incidence rate was collected according to Silman and MacFarlane.<sup>15</sup> The incidence density rate (IDR) was estimated as suggested by Bendixen.<sup>16</sup> The numerator was the number of new cases and the denominator the number of years free of disease that each individual contributed in the study population (individual-years at risk). The periods under study were the following: (i) number of years since graduation for each respondent; (ii) five-year periods beginning at the earliest graduation date as year zero for all respondents (1964); and (iii) five-year periods beginning at the year of graduation as year zero for each respondent. The cumulative incidence rate (CIR) was calculated as the proportion of individuals who had developed a zoonosis. The numerator was the number of new cases and the denominator the number of respondents at risk. The periods under study were: (i) the number of years since graduation for each respondent and (ii) five-year periods beginning at the earlier graduation date as year zero for all respondents (1964). The numerator was the number of new cases and the denominator the population at risk during the central year (third year) of the five-year period minus all of the individuals who developed the disease in the previous periods. These periods were extended to 10 years for the exploration of risk factors. Work absence due to zoonoses was computed as the frequency of respondents with at least one day of absence and the average number of days of absence.

## Demographic variables

Four demographic characteristics were examined for associations with the occurrence of zoonoses: age, years

**What this study adds:**

- Veterinarians with a large animal practice presented a high frequency of zoonoses, mainly brucellosis.
- The rate of brucellosis appears to be high among recent graduates and professionals who work in areas with high incidence of the disease.
- Veterinarians underestimate the impact of zoonoses and may have a passive attitude regarding their own health.

since graduation, sex and geographic region of professional practice. The first two characteristics were transformed into ordinal variables. Geographical region was divided according to the official bovine brucellosis program.<sup>17</sup> This program divided the Province of Santa Fe into three zones according to the prevalence of brucellosis and the main farming activity: zone 1, characterised by a low prevalence of brucellosis and extensive production of cattle for beef; zone 2, a high prevalence of brucellosis and milk farms; and zone 3, a high prevalence of brucellosis and specialised in agriculture and few milk farms.

Statistical analyses included  $\chi^2$ , Student's *t*-test, Pearson's correlation coefficient and logistic regression. To quantify the risk associated with the diagnosis of brucellosis (positive/negative), the analysis was performed in two stages. First, all of the demographic variables were compared with the dependent variable using  $\chi^2$ . Second, logistic regression was performed. The estimation method was the maximum likelihood with a convergence criterion of 0.01 to a maximum of 10 iterations. Only the variables associated with the dependent variable after the  $\chi^2$  test ( $P < 0.20$ ) were included in the model.<sup>18</sup>

## Results

On average, the respondents were  $42.2 \pm 10.1$  years old and had developed their professional careers over  $16.2 \pm 11.1$  years. Ninety-three per cent were males. The women were significantly younger and had graduated more recently than the men ( $P < 0.0001$ ). Geographical region was not significantly associated with any of the other demographic variables. Eight respondents had suffered from zoonoses prior to graduation: brucellosis ( $n = 4$ ), toxoplasmosis ( $n = 3$ ) and both diseases ( $n = 1$ ). The CIR for all zoonoses was 34.1% and was strongly influenced by the frequency of brucellosis (Fig. 1). The category 'Other' included: Chagas disease (0.2%),

FIGURE 1: Cumulative Incidence Rate (CIR) of zoonoses in rural veterinarians, Santa Fe, 1964–2008.

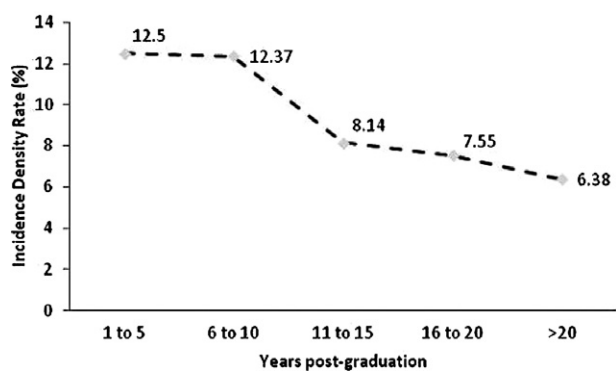
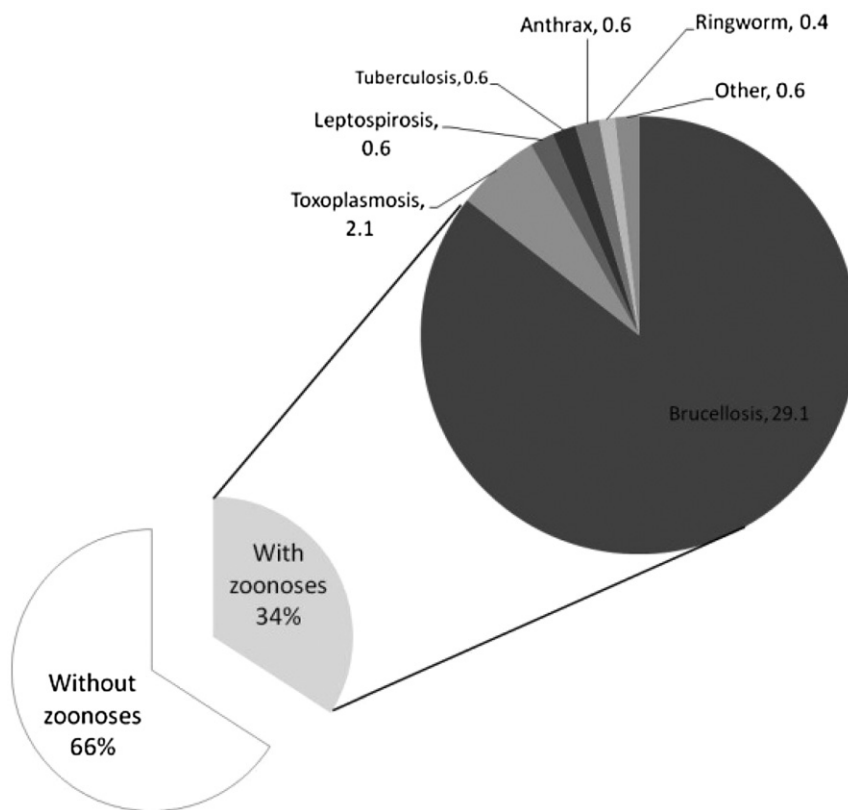


FIGURE 2: Incidence Density Rate (IDR) of brucellosis post-graduation in rural veterinarians, Santa Fe, 1964–2008.

Salmonella (0.2%) and choriomeningitis (0.2%). Twelve respondents had suffered more than one zoonosis (two,  $n = 11$ ; three,  $n = 1$ ), while 13.5% of the respondents had at least one day of absence from work, averaging  $24.4 \pm 27.8$  days. The IDR (1964–2008) for all zoonoses (20.7%) was only slightly higher than the IDR for brucellosis (19.5%). The latter rate decreased over the years studied (Fig. 2) and was higher during the early post-graduation period than the later period (Fig. 3). The brucellosis CIR was 4.5% among those who had less than five years of professional practice, 10.7% among those with 6–10 years, 20.0% among

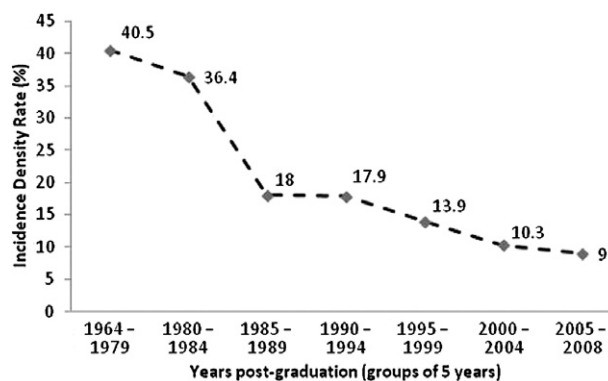


FIGURE 3: Incidence Density Rate (IDR) of brucellosis in rural veterinarians standardised by years since graduation, Santa Fe, 1964–2008.

those with 11–15 years, 38.6% among those with 16–20 years and 41.1% among those with over 20 years. The sex-specific CIRs were 10% for women and 24.7% for men, but these differences were minimised following standardisation by the number of years since graduation (26.0% and 25.6%, respectively). The brucellosis CIRs were different among the regions (zone 1, 19.0%; zone 2, 25.4%; zone 3, 29.2%;  $P < 0.01$ ), and those differences persisted even after standardising for the same variable (Fig. 4).

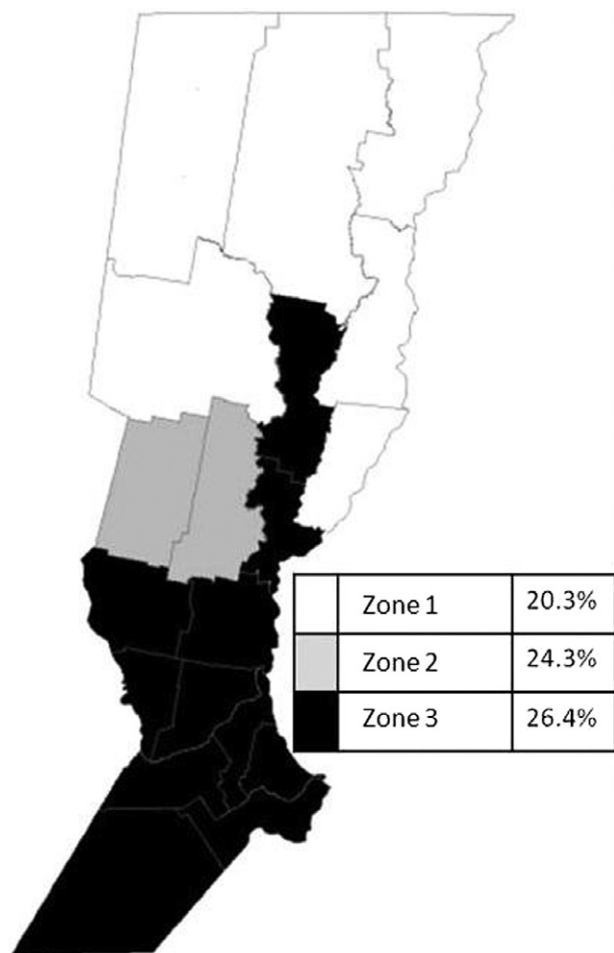


FIGURE 4: Cumulative Incidence Rate (CIR) of brucellosis standardised by geographical area of professional practice, Santa Fe, 1964–2008.

Given the high correlation between age and years of practice ( $r = 0.97$ ,  $P < 0.0001$ ), only the latter variable was included as a risk factor. All of the factors met the inclusion criteria for the multivariate analysis (sex,

$P = 0.0796$ ; region,  $P = 0.0099$ ; years since graduation,  $P < 0.0001$ ). The respondents who graduated one or more decades prior to the study had a higher risk of brucellosis than those who graduated within the last 10 years (Table 1). Meanwhile, the professionals working in zone 3 were 2.08 times more likely to become ill than those in zone 1. The convergence criterion of 0.01 was achieved after four iterations, suggesting an acceptable goodness of fit.

## Discussion

The frequency of veterinarians who suffered from zoonoses was in concordance with previous reports in the Santa Fe Province.<sup>13</sup> However, at least three systematic errors may have had an impact on the final results: selection, classification and memory bias.<sup>19</sup> In terms of selection bias, the present study was not conducted based on a census, rather it was based on an opportunistic sample, and the respondents' participation was voluntary. In this context, the respondents who suffered illnesses may have had a greater interest in responding to the questionnaire than those who did not. Nevertheless, this bias is unlikely because the respondents' age, number of years after graduation and sex were very similar to those reported in a random sample of veterinarians drawn from the western region of the Province one year prior to the present survey.<sup>13</sup> Classification bias may have occurred because the respondents did not regularly undergo laboratory analysis for all zoonoses. Because we included only laboratory-confirmed cases, the calculated frequencies may have been underestimated. As for memory bias, this study used data derived from a cross-sectional study to estimate the disease incidence rates. These estimates are accurate when the disease has an onset that can be clearly remembered by the subject or makes a major impact on his or her memory even after a prolonged period of time.<sup>15</sup> Both

TABLE 1: Logistic regression of risk factors associated with brucellosis in rural veterinarians, Santa Fe, 2008

Predictive variables		B	SE	P	OR	OR CI 95%
Constant		3.25	0.69	0.0001	–	–
Sex		0.28	0.66	0.6751	1.32	0.36–4.85
Area	Zone 2	0.44	0.31	0.1633	1.55	0.84–2.86
	Zone 3	0.73	0.28	0.0099	2.08	1.19–3.62
Years post-graduation	11–20 years	1.57	0.38	0.0001	4.79	2.29–10.01
	>20 years	2.13	0.34	0.0001	8.40	4.28–16.48

Deviance: 430.84,  $P: 0.6763$ . Reference populations: Female, zone 1, years post-graduation  $\leq 10$  years.; B, Beta coefficient; CI, confidence interval; OR, odds ratio; SE, standard error.

possibilities are highly likely among veterinarians who suffered zoonotic diseases. Moreover, we only estimated the incidence rates to project trends. In time periods of at least five years, memory errors in the initial onset of disease may have little impact on the outcome.

Cross-sectional studies do not allow inferences about causality, and their greatest usefulness is not to provide answers but rather to generate new hypotheses. When the objective is to study a disease, these studies are only valid if the disease of interest does not cause an abandonment of the work exposure,<sup>20</sup> an unlikely event in the present study. Moreover, the hypothesis that risk factors, the probability of risks and adverse events can be defined and measured is a valid starting point to quantify the associations between different variables and for the purposes of health promotion.<sup>21</sup>

As previously reported,<sup>13,22</sup> a large proportion of veterinarians had been affected by zoonoses. In Argentina, occupational diseases constitute only 1% of reported claims among cattle workers.<sup>23</sup> This small percentage indicates that veterinarians are a population at greater risk than rural workers and/or possible underreporting among the latter population. Brucellosis seems to be an important disease of major concern.<sup>1,3,13</sup> The true incidence of brucellosis has decreased, coinciding with the control and eradication scheme of bovine brucellosis in the province of Santa Fe.<sup>24–26</sup> This disease rate tended to be higher during the early years after graduation. At least three hypotheses may explain this observation: (i) new graduates are oftentimes already affected by brucellosis but only begin their serological controls after graduation; (ii) newer graduates undergo such controls more promptly and frequently than older graduates; and (iii) the probability of disease is greatest in the first years of professional activity. The first hypothesis is unlikely because the frequency of students testing positive for brucellosis published in the country does not exceed 2%.<sup>27,28</sup> Although the second hypothesis cannot be rejected, the fact that the IDR continues to decline even a decade after graduation gives credit to the third hypothesis.

Obviously, the probability of illness (CIR) increases with the number of years since graduation: the greater the number of years at risk, the greater the likelihood of illness. This variable was the most important risk factor in the logistic regression model. The second most important risk factor was the geographical area of professional practice. The veterinarians working in zones 2 and 3 were almost two times more likely to become ill than those working in zone 1. Zones 2 and 3 are the most important dairy cattle areas of Argentina, while the latter zone specialises in beef production,<sup>24</sup> where direct contact with parturitions and abortions is rare.

## Conclusions

A high frequency of zoonoses, mainly brucellosis, in veterinarians with large animal practices was observed. Although the rate of zoonoses may be decreasing, further studies are needed to confirm this finding. The impact of the zoonoses appears to be highest among recent graduates. The veterinarian is essential for the health and safety of pets, animals raised for food and public health. However, their importance is underestimated in developing countries, and the professionals may have a passive attitude regarding their own health. A joint effort of all institutions is needed to prevent zoonoses among private practitioners.

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