

**Title:** Social and environmental risk factors for canine leptospirosis: A scoping review protocol.

**Authors:** Carys Vyn<sup>1</sup>, Kellie Libera<sup>2</sup>, Lauren Grant<sup>1</sup>, Olaf Berke<sup>1</sup>, Scott Weese<sup>2</sup>, Claire Jardine<sup>2</sup>

<sup>1</sup>Department of Population Medicine, Ontario Veterinary College, University of Guelph, Guelph, ON, Canada.

<sup>2</sup>Department of Pathobiology, Ontario Veterinary College, University of Guelph, Guelph, ON, Canada.

### **Author contributions**

The protocol was drafted by CV with input from KL, LG, OB, SW, and CJ.

### **Funding**

This project is funded by the Ontario Veterinary College.

### **Protocol Registration**

This protocol will be archived in the University of Guelph's institutional repository (<https://atrium.lib.uoguelph.ca>) and The Open Science Framework (<https://osf.io>). This scoping review will be reported following the PRISMA guidelines proposed by Arskey & O'Malley (2005).

### **Rationale**

Leptospirosis is a ubiquitous, climate-sensitive bacterial zoonoses and a growing One Health problem (Goarant, 2015; Shearer et al., 2014). Leptospirosis is an underrecognized cause of morbidity and mortality in most mammalian species, including wildlife, livestock, companion animals, and humans. Animals can become infected with *Leptospira* bacteria through direct exposure to urine from infected wildlife and other animals, or through indirect exposure to urine-contaminated food, water, or soil (Goarant, 2015). Dogs play an important role in the transmission of leptospirosis to humans and other animals due to their frequent interactions with the natural environment and humans. Despite this, canine leptospirosis is poorly understood.

Prevalence of canine leptospirosis is widespread and is expected to continue to increase, in part due to changing climatic conditions that support increased disease spread (Lau et al., 2010). Risk factors for canine leptospirosis are not well understood. Some studies have identified wet environmental conditions (Goarant, 2016; Smith et al., 2019), temperature (Goarant, 2016; Smith et al., 2019), rurality (Goarant, 2016; Taylor et al., 2021), sex/neuter status (Smith et al., 2019; Taylor et al., 2021), and breed (Smith et al., 2019; Taylor et al., 2021) as risk factors. However, conflicting evidence for the role of sex/neuter status, breed, and temperature exists (Goarant, 2016; Smith et al., 2019; Taylor et al., 2021). A large knowledge gap exists with respect to broader environmental risk factors for canine leptospirosis. Given the paucity of evidence, increasing prevalence, and sensitivity to climate change, conducting a scoping review will summarize important upstream social and environmental risk factors for canine leptospirosis that have been described in peer-reviewed and grey literature. Identifying these factors will assist with future research initiatives.

**Research Question**

What is the current state of the literature on the upstream social and environmental risk factors\* for canine leptospirosis\*\*?

\*Risk factors will not include dog-specific factors such as age, breed, or sex.

\*\*Canine leptospirosis includes dogs infected with *leptospira* or *leptospira* antibodies

**Objectives**

The objectives of this review are to 1) summarize social and environmental risk factors for canine leptospirosis that have been identified across peer-reviewed in grey literature, and 2) identify global and regional trends associated with identified risk factors.

**Eligibility Criteria**

The following criteria (Table 1) will be used to determine which studies will be included in the final scoping review.

Table 1: Inclusion and exclusion criteria for the screening of articles.

Inclusion Criteria	Exclusion Criteria
<ul style="list-style-type: none"> <li>• <i>Leptospira</i> infection in dogs is an outcome of interest</li> <li>• Identifies social and/or environmental risk factors using measures of association/effect and/or other formal statistical tests (eg. chi squared test, fischer’s test)</li> <li>• Epidemiological study design (experimental or observational)</li> <li>• Test confirmation via validated tests (PCR, MAT, ELISA, IFR)</li> <li>• Written in English</li> </ul>	<ul style="list-style-type: none"> <li>• Mixed animal populations where dog specific effects are not provided.</li> <li>• Only describes dog-specific risk factors (e.g., age, sex, breed)</li> <li>• Clinical diagnosis</li> <li>• Other knowledge synthesis papers (i.e., reviews, meta-analysis)</li> <li>• Full-text citation is not available</li> <li>• Duplicates</li> </ul>

**Search Strategy**

The following databases will be used to search the literature: Web of Science, MEDLINE via Ovid, and ScienceDirect. ProQuest will be used to search for theses/dissertations. Select websites from official disease focused organizations (eg. CDC, WHO, FAO, etc.) will be searched for additional risk factor evidence. The search terms listed in Table 2 will be applied to the databases, with minor adjustments to follow search guidelines for each database.

Table 2: Search terms that will be applied to each database.

Major Category	Keywords
Dogs	Canine\$ OR dog\$ OR “canis familiaris” OR “canis lupus familiaris”
Leptospirosis	Leptospir* OR “canicola fever” OR “weil’s disease” OR “weil disease”

## **Data Management**

Search results from databases will be imported to Covidence, which will be used for de-duplication, screening, and data extraction. Information related to the selection process (number of articles found, duplicated removed, articles excluded, etc.), will be presented in a flow diagram in the final scoping review.

## **Selection Process**

Level 1 screening includes title/abstract screening. It will be completed independently by CV and LG. Regular meetings will be held to resolve conflicts. A consensus between reviewers will be required to include/exclude articles from the scoping review.

The following questions will be used for primary screening of articles:

1. Is the title/abstract in English?
2. Does the title/abstract describe primary research utilizing primary or secondary data?
3. Does the title/abstract mention dogs with *Leptospira* infection as an outcome of interest?
4. Does the title/abstract mention upstream risk factors related to *leptospira* infection in dogs?

Level 2 screening includes full-text screening. It will be completed independently by CV and KL.

The following questions will be used to determine article eligibility:

1. Is the full text in English?
2. Does the study use an experimental or observational epidemiological study design?
3. Are the methods used for diagnosing leptospira infection appropriate?
4. Does the full text describe social and environmental risk factors for dogs using appropriate statistical tests?

## **Data Extraction**

The following information will be extracted.

- 1) Study characteristics: publication year, publication type, purpose/objective of study, country where research was conducted, study design, statistical methods used, confounding control.
- 2) Population characteristics: sample size, location of population, methods to detect leptospira, ownership status, dog specific factors (age, sex, breed).
- 3) Social risk factors described with a measure of association and/or measure of effect (including statistical significance).
- 4) Environmental risk factors described with a measure of association and/or measure of effect (including statistical significance).
- 5) Serovars detected, if any (including percent), and prevalence.
- 6) Type(s) of statistical tests used.
- 7) Notes of other significant findings.

## Results Strategy

The extracted data from each study will be presented using a descriptive summary with supporting figures and tables.

## Critical appraisal of sources

Articles included in the scoping review will not be critically appraised.

## Limitations

It is possible this review does not identify all the available literature regarding social and environmental risk factors for canine leptospirosis.

## References

- Arksey, H., & O'Malley, L. (2005). Scoping studies: Towards a methodological framework. *International Journal of Social Research Methodology*, 8(1), 19–32. <https://doi.org/10.1080/1364557032000119616>
- Goarant, C. (2015). *Leptospira and Leptospirosis* [Text]. Global Water Pathogen Project; Michigan State University, UNESCO. <https://www.waterpathogens.org/book/leptospira-and-leptospirosis>
- Goarant, C. (2016). Leptospirosis: Risk factors and management challenges in developing countries. *Research and Reports in Tropical Medicine*, 7, 49–62. <https://doi.org/10.2147/RRTM.S102543>
- Lau, C. L., Smythe, L. D., Craig, S. B., & Weinstein, P. (2010). Climate change, flooding, urbanisation and leptospirosis: Fuelling the fire? *Transactions of The Royal Society of Tropical Medicine and Hygiene*, 104(10), 631–638. <https://doi.org/10.1016/j.trstmh.2010.07.002>
- Shearer, K. E., Harte, M. J., Ojkic, D., DeLay, J., & Campbell, D. (2014). Detection of *Leptospira* spp. In wildlife reservoir hosts in Ontario through comparison of immunohistochemical and polymerase chain reaction genotyping methods. *The Canadian Veterinary Journal*, 55(3), 240–248.
- Smith, A. M., Arruda, A. G., Evason, M. D., Weese, J. S., Wittum, T. E., Szlosek, D., & Stull, J. W. (2019). A cross-sectional study of environmental, dog, and human-related risk factors for positive canine leptospirosis PCR test results in the United States, 2009 to 2016. *BMC Veterinary Research*, 15(1), 412. <https://doi.org/10.1186/s12917-019-2148-6>
- Taylor, C., O'Neill, D. G., Catchpole, B., & Brodbelt, D. C. (2021). Incidence and demographic risk factors for leptospirosis in dogs in the UK. *Veterinary Record*, n/a(n/a), 512. <https://doi.org/10.1002/vetr.512>