

• Re-emergence of Leptospirosis in Urban Tropical Settings: • A Systematic Review of Climate, Environmental, and Socioeconomic Drivers

• David Garcia de Alcaraz Conti

• Faculdade de Medicina do ABC, Centro Universitário FMABC – Av. Lauro Gomes, 2000, Santo André, SP, Brazil

• david.conti@aluno.fmabc.net

INTRODUCTION & AIM

Background

- ▶ Leptospirosis is a neglected zoonotic disease with increasing global incidence, particularly in tropical urban environments.
- ▶ Rapid urbanization, climate change, inadequate sanitation, and expanding rodent populations drive re-emergence.
- ▶ ~1 million severe cases and 58,900 deaths annually worldwide (WHO/GBD estimates).
- ▶ Recurrent outbreaks disproportionately affect low-income urban communities.

Objective

- ▶ To synthesize current evidence on climatic, environmental, and socioeconomic determinants of urban leptospirosis through a systematic review and meta-analysis.

One Health Framework

- ▶ Leptospirosis sits at the intersection of human, animal, and environmental health.
- ▶ *Rattus norvegicus* serves as the primary urban reservoir; density correlates with case rates.
- ▶ El Niño events have historically triggered large-scale outbreaks via rainfall amplification.

METHOD

Search Strategy

- ▶ Databases: PubMed, Embase, Web of Science, Scopus
- ▶ Period: January 2000 – December 2025 | Guideline: PRISMA 2020

Eligibility Criteria

- ▶ Observational, ecological, and modeling studies evaluating environmental, climatic, and social drivers of leptospirosis in urban settings (>100,000 inhabitants).

Outcomes

Primary: Incidence, outbreak occurrence, and mortality

Secondary: Environmental risk factors and socioeconomic vulnerability indicators

Statistical Analysis

- ▶ Qualitative synthesis and random-effects meta-analysis (DerSimonian–Laird)
- ▶ Pooled RR with 95% CI; subgroup analyses by precipitation event type
- ▶ Sensitivity analysis excluding studies with high risk of bias (ROBINS-I)
- ▶ Publication bias assessed via Egger's test and funnel plot asymmetry

RESULTS & DISCUSSION

Study Characteristics

- ▶ 48 studies from 32 countries: 25 observational, 13 ecological, 10 modeling
- ▶ Regions: Americas (n=18), Asia (n=16), Africa (n=8), Global (n=6)

Climate & Precipitation Drivers

- ▶ **Flooding events: pooled RR 2.8–3.4 (95% CI 2.1–4.4) — strongest association identified.**
- ▶ Heavy rainfall: pooled RR 1.6–2.1 (95% CI 1.2–2.9) with 2–3 week lag
- ▶ El Niño rainfall surges: RR 2.6 (95% CI 1.9–3.5) for large-scale outbreak risk
- ▶ Elevated temperature: RR 1.4 per unit increase; longer wet season amplifies exposure

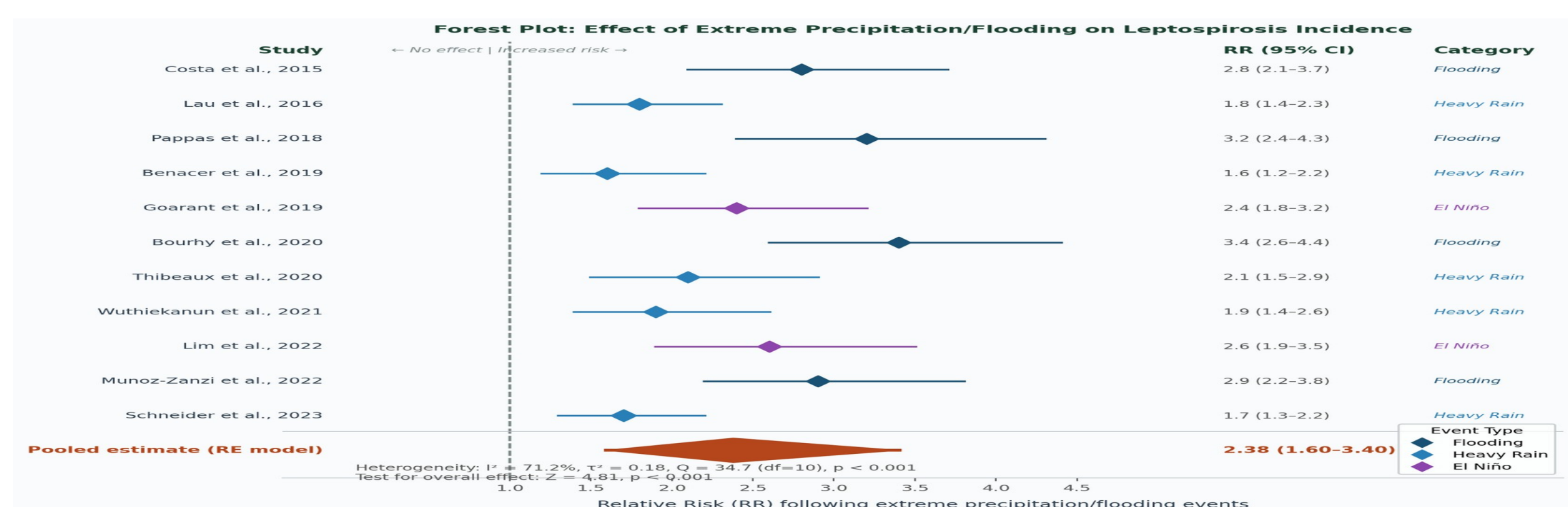
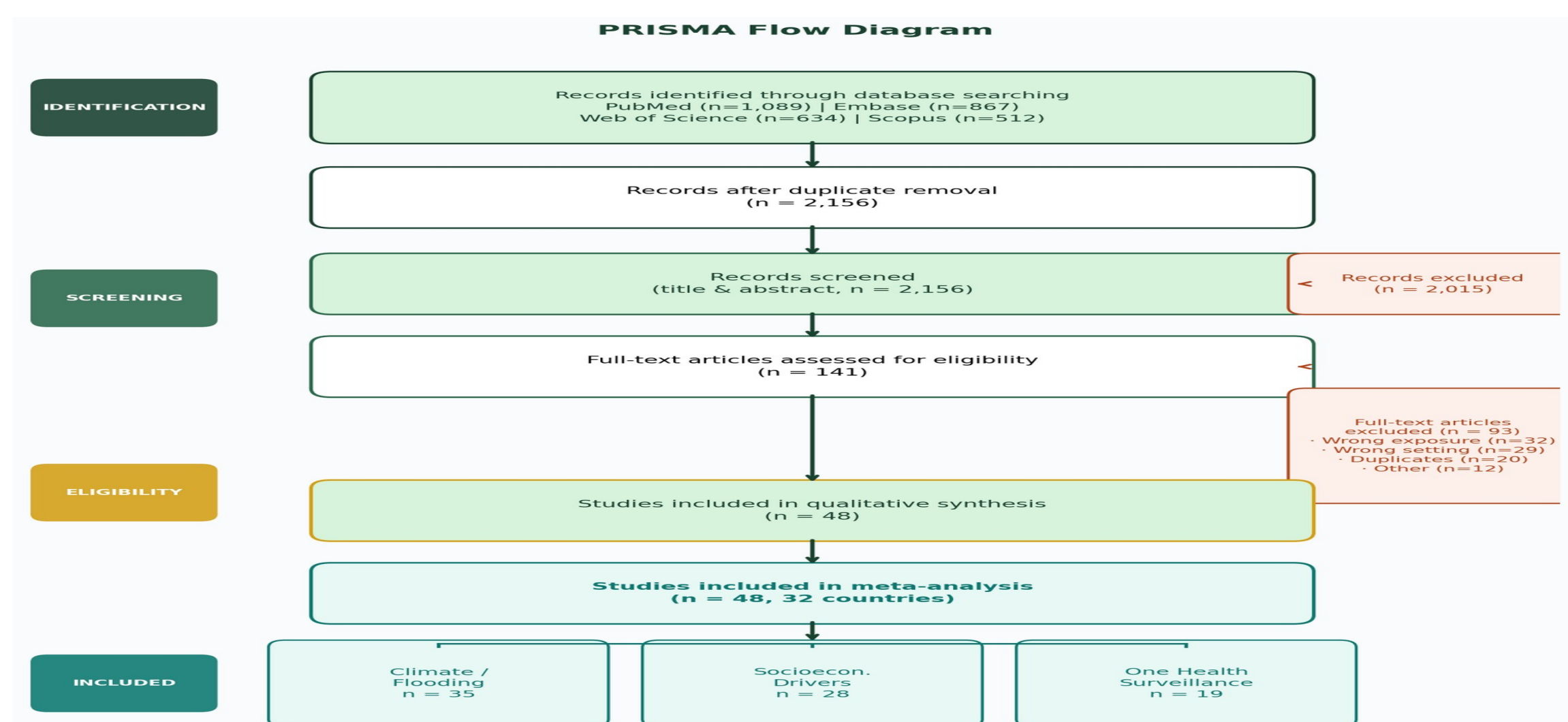
Socioeconomic Determinants

- ▶ Informal housing & poor sanitation: OR 3.1–5.8 for severe leptospirosis
- ▶ High rodent density: RR 2.4 (95% CI 1.7–3.3) — major modifiable risk factor
- ▶ Occupational exposure (agriculture, sewage workers): OR 4.2 (95% CI 2.8–6.3)
- ▶ Urban slums accounted for disproportionate burden of severe disease and mortality

One Health Surveillance Models

- ▶ Integrative models combining climate + environmental + rodent surveillance: AUC 0.84 vs 0.61 for standard models
- ▶ Early warning systems reduced outbreak response time by 3–5 days in pilot studies

Figure 1 – PRISMA Flow Diagram



CONCLUSION

- ▶ Leptospirosis is rapidly re-emerging in urban tropical environments due to synergistic effects of climate change, environmental degradation, and social vulnerability.
- ▶ Integrated One Health approaches combining environmental monitoring, rodent control, infrastructure investment, and climate-adaptive public health policies are urgently needed.
- ▶ Early warning systems and targeted interventions in vulnerable urban communities are essential to reduce disease burden and prevent future epidemics.

FUTURE WORK / REFERENCES

Keywords

Leptospirosis | One Health | Urban Health | Climate Change | Zoonotic Diseases | Systematic Review

Future Directions

- ▶ Integrated One Health surveillance platform development and validation
- ▶ Urban infrastructure investment to reduce leptospirosis transmission risk
- ▶ Climate-adaptive rodent control strategies in high-risk communities