PMI 214 Notes - "Epidemiology of Canine Heartworm (*Dirofilaria immitis*)"

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1 Key concepts

- Helminth parasites: endemic, not epidemic
  - Once they're within a host population, there may be fluctuations, but no huge eruptions
- Environmental factors determine potential for transmission
  - climate
  - host presence
  - vector habitat
- Changes in the environment change that potential

2 Why do we care about canine heartworm?

- dogs
  - mild: coughing
  - moderate: difficulty breathing
  - serious: pulmonary hypertension, caval syndrome, RSCHF
- cats
  - rare hosts but poor prognosis

3 lifecycle

- lodged in pulmonary artery
- give birth to microfilaria (not eggs) which circulte in the bloodstream (300 um)
- ingested by mosquito (if lucky)
- mults into invective larvae
- mosquito transmits to definitive host
- mults some more into a reproductive adult

4 At 26°

- 14 - 18 days in the vector
- they chill in the needle of the mosquito and sloppily fall out when mosquito bites a canid host

5 In the canid

- 3-12 days to L4
- larger and larger
- ~180 days to sexual maturity

6 Efficient vectors in CA

-

7 Where do we find heartworm in CA?

- evidence that western tree hole mosquito is the main vector

8 Coyotes are excellent sentinels

- Widespread
- Relatively stationary (as opposed to dogs, which travel with humans)
- prophylaxis
- always outdoors
- high susceptibility

9 two studies

- high-incidence zone
- building and testing a predictive spacial risk model

10 What variavles influence transmission?

- definitive host presense/abundance
- vector presence/abundance
- parasite presence
- temperature

11 Western treehole mosquito

- feed in treeholes where water can gather
- april/may: adults emerge from pupae in tree holes - photoperiod triggered
- females only take 1 blood meal per clutch of eggs
- most females die before taking a second blood meal, approx. 2 weeks later
- some females may have 4 or 5 clutches (and blood meals) before dying at the end of summer
- temperature
  - heartworm larvae requires $> 14°$ to develop

12 Questions

- What limits transmission season?
- how long/variable is the season?
- does transmission intensity vary annually?

13 How to date a transmission event?

- determine heartworm age
  - How? use length as a proxy
- subtract time from sampling date
- arrive at date when the infective L3 entered canine host
  - Most transmission occurs in the span of 1 month
  - transmission starts about 1.5 months after temperature enters desirable zone

14 Transmission, rain, and vector abundance correlated

- Vector abundance correlates with transmission and also rainfull

15 Conclusions

- warming determines onset of transmission
- waning vector abundance ends transmission
- transmission occurs within a month
- precipitation affects vector abundance, which affects transmission

16 How do we make broad spatial predictions?

- (Epi) map parasite occurence and describe and loor for commonalities, or
- (Eco) map parasite prevalence and quantify relationships with variables

17 CA Risk map

- heterogeneous distribution

18 Modeling approach

- Logistic regression
- dependent var: seropositivity (0 or 1)
- independent vars:
  - temp
  - precipitation
  - distance from prime habitat

19 Final model

- HDU (+)
- Precipitation (+)
- distace from dense oak woodland
- HDU*Precipication

20 External Validation Sites

- pro of noting a ton of data - extrenal validation

21 Conclusions

- model confirms varaibles on broad spacial scale
- Locally important vectors, risk factos also matter but are not incorporated in the model
- bottom line: much easier to predict “risky” areas instead of “safe” areas