PREVALENCE, INCIDENCE, ABSENCE

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Many sections extracted from OIE Guide for Aquatic Animal Health Surveillance

Surveillance for Disease Frequency

- When used to describe disease patterns,

purpose is to describe disease occurrence in terms of aquatic animal characteristics, time and place

- Surveillance data are used to estimate measures of disease frequency (prevalence and incidence measures) with respective confidence intervals or probability intervals
  - Test sensitivity and specificity should be considered whenever measures of disease frequency are estimated

Prevalence vs Incidence

- Prevalence is proportion of infected aquatic animals in a population at a given point in time
- Incidence measures describe the occurrence of **new** cases in a population
  - cumulative incidence (or incidence proportion)
  - incidence density

Incidence density (for specific observation period)

- Number of newly diseased aquatic animals during the period / total number of disease-free time periods at risk of getting the disease for all the aquatic animals of the population
  - calculated in either closed or open populations

Incidence measures

- consider only new cases of disease in a population
- give an indication of speed healthy aquatic animals are "converted" to diseased animals
  - Mortality considered incidence density of death in a population if known number of live aquatic animals at start of period and when each aquatic animal died

Incidence measures are more dynamic than prevalence

- prevalence takes into consideration all existing cases of a disease at a given point in time, regardless of whether these are new occurrences of the disease or chronic cases
- prevalence is affected by occurrence of new cases AND also by duration of existing cases in the population

Prevalence

- duration of disease in the population can be affected by "speed" of recovery or death of diseased aquatic animals
- Consequently, a disease which is quickly and highly fatal will have a small prevalence in a population
  - chronic disease might have a higher prevalence, even though there fewer new cases

Incidence useful to know, hard to get

- ***incidence*** measures better describe occurrence of disease and changes to "amount" of disease in a population
  - Because focus is on new cases not affected by disease duration
- incidence measures usually much more difficult (than prevalence)
  - requires repeated sampling of population over time to count all new cases of disease and calculate appropriate denominators
- Prevalence estimates can be obtained at single time point with a single survey

Population subsets

- Measures of disease frequency can be calculated for an entire population and specific time period
- or for subsets defined by host characteristics (e.g. age-specific) or by spatial placement
- "Fish with ulcers" can be a subset of the general population
  - prevalence of disease in ulcer fish is NOT the same as prevalence for general population

Levels for Disease Frequency

- Estimates can be obtained at level of individual aquatic animals or at any other organization or holding level
  - E.g. fish-level prevalence of disease is proportion of diseased fish in a population
  - farm-level prevalence is proportion of farms with diseased fish in "population" of farms in an area

Confidence Intervals

- Related to sample size
  - reflects precision of estimates
- Narrow confidence intervals desired
  - Larger sample sizes (and more dedication of resources) required
- Precision of estimates and power to detect differences in prevalence between populations or between time points depends
  - on sample size
  - actual value of prevalence in the population (or actual difference of prevalences
  - when designing the surveillance system, a prior estimate/assumption of expected prevalence or expected difference in prevalences must be made

Using Prevalence to Advantage

- Prevalence can be used to alter diagnostic test interpretation
- Higher prevalence usually results in greater pathogen concentration in sampled individuals
- If higher prevalence, predictive value of positive test is higher

Absence of disease

- When ZERO positive diagnostic tests, then apparent prevalence in population is 0
  - If using random sample of population
  - Confidence interval dictated by sample size
  - Larger sample size, more confident that true prevalence is 0

Absence when non-random sample

- Cannot calculate confidence interval
- If bias toward lower prevalence segment of population, then less likely to detect (i.e. declare absence falsely)
- If bias toward higher prevalence segment of population, then more likely to detect (i.e. less false declarations of absence)

Prevalence when non-random sample

- Non-ZERO prevalence (i.e. detect at least 1 case)
  - Cannot calculate true prevalence because this was not sample from entire population
  - If random from segment, then may calculate prevalence within that segment of population

TRUE PREVALENCE (TP)

Can be derived from Apparent Prevalence and test characteristics

$$TP = \frac{(AP + DSp - 1)}{(DSe + DSp - 1)}$$

Summary

- Prevalence is more commonly used to describe aquatic disease frequency
- Risk-based sampling strategies potentially describes prevalence in a segment of the population
  - but not general population