Matter of pre-test probabilities

Apparently healthy population

Sens = 0.96

Spec = 0.98

True prevalence = 0.02

	Disease+	Disease -	
Test +	192	196	388
Test -	8	9604	9612
	200	**9800**	**10,000**

388 individuals test positive, what is the probability that any single individual is truly positive?

Proportion of true positives that test positive = 0.96 * 200 = 192

Proportion of true negatives that test negative = 0.98 * 9800 = 9604

Matter of pre-test probabilities

Apparently healthy population

Sens = 0.96

Spec = 0.98

True prevalence = 0.02

	Disease+	Disease -	
Test +	192	196	388

388 apparently healthy individuals test positive, what is the probability that any single individual is truly positive?

192 / 388 = 0.50 or 50%

Matter of pre-test probabilities

Clinically sick population

Sens = 0.96

Spec = 0.98

True prevalence = 0.20

	Disease+	Disease -	
Test +	1920	160	2080
Test -	80	7804	7920
	2000	8000	10,000

2080 individuals test positive, what is the probability that any single individual is truly positive?

Matter of pre-test probabilities

Clinically sick population

Sens = 0.96

Spec = 0.98

True prevalence = 0.20

	Disease+	Disease -	
Test +	1920	160	2080

2080 sick individuals test positive, what is the probability that any single individual is truly positive?

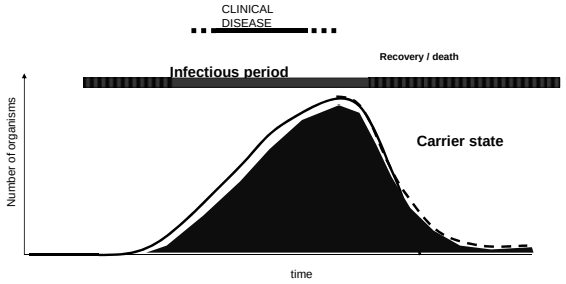
1920 / 2080 = 0.92 or 92%

- Experienced clinicians are good at increasing the prevalence of a condition through identification of clinical signs (physical exam) and history
  - diagnostic tests then have a higher probability of being correct
  - Note: physical exam for clinical signs can be assessed for sensitivity and specificity because they are subjective "diagnostic tests"

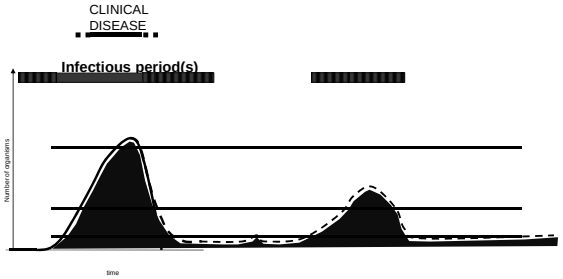
Pathogens: The Host Perspective

- Clinical disease
  - <u>*Externally obvious abnormality*</u> usually leading to decreased probability of surviving or reproducing
    - Direct result of abnormality or indirect (e.g. increased predation)
- Subclinical disease
  - <u>*Abnormality is not externally obvious*</u> (behaviour or lesions absent), but change in probabilities likely
  - Usually reflects our reliance on diagnostic tests for agent or host response to diagnose

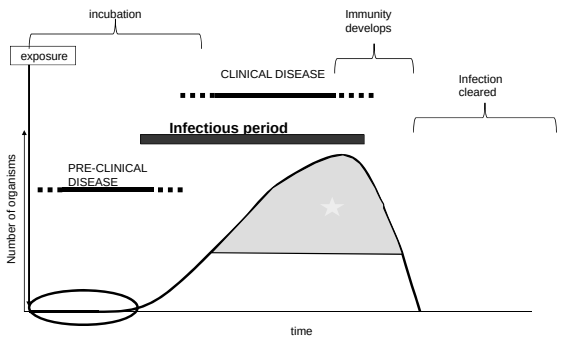
Pathogen replication in host



Diagnostic tests



Surveillance results best applied to animals before they get sick



Detection is affected by many factors

- Disease level in the individual tested
  - Clinical disease is easier to detect
  - Surveillance of 'apparently healthy' individuals is more difficult
- Disease level in the population
  - Which animals are sampled

Depopulation of cage: Does it prevent virus exposure for other cages at site?

Apparent prevalence of different populations (HPR_{ALL}) of Atlantic salmon in New Brunswick farms (2001).

Population	Apparent prevalence (95%CI)	
A^{α}	0.940 (0.887, 0.993)	moribund fish, outbreak cage
B^{β}	0.406 (0.279, 0.533)	healthy fish, outbreak cage
C^{β}	0.286 (0.204, 0.368)	healthy fish, non-outbreak cage, outbreak site
D^{γ}	0.084 (0.009, 0.160)	healthy fish, non-outbreak cage, non-outbreak neighbor site
E^{γ}	0.080 (0.004, 0.156)	healthy fish, non-outbreak cage, distant site

McClure, Hammell, Dohoo, Nerette, Hawkins. 2004. *J Fish Dis 27: 375-383.*

Diagnostic test performance

- What happens when an individual is sick with a virus?
  - When does infection actually occur?
  - When will clinical signs be evident?
  - When does a diagnostic test work best?

Conclusion

- Diagnostic samples must occur in surveillance program
  - Collecting evidence to change our decisions about what is positive and what is negative when fish are sampled *prior* to actual mortality spikes
- Depopulation may be only control measure
  - Costs are high so don't want to decide too early
  - Allowing positive cases to continue can cause entire site and area to continue positive (cost much more!)