Evidence Based Dentistry

Appraising Diagnostic Tests

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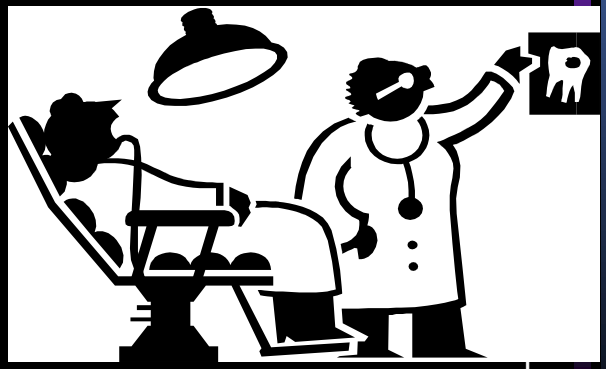
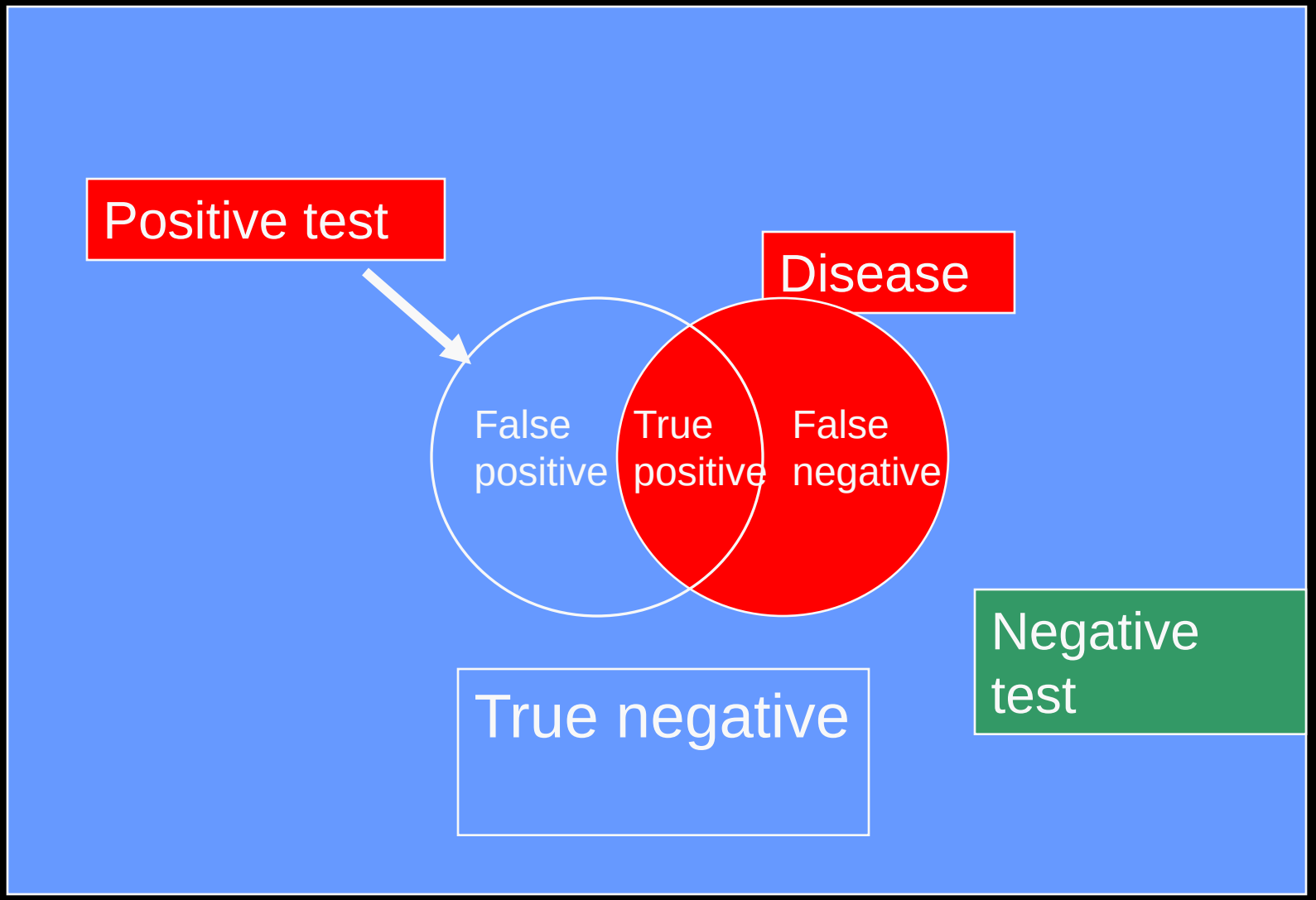


Diagnostic Tests

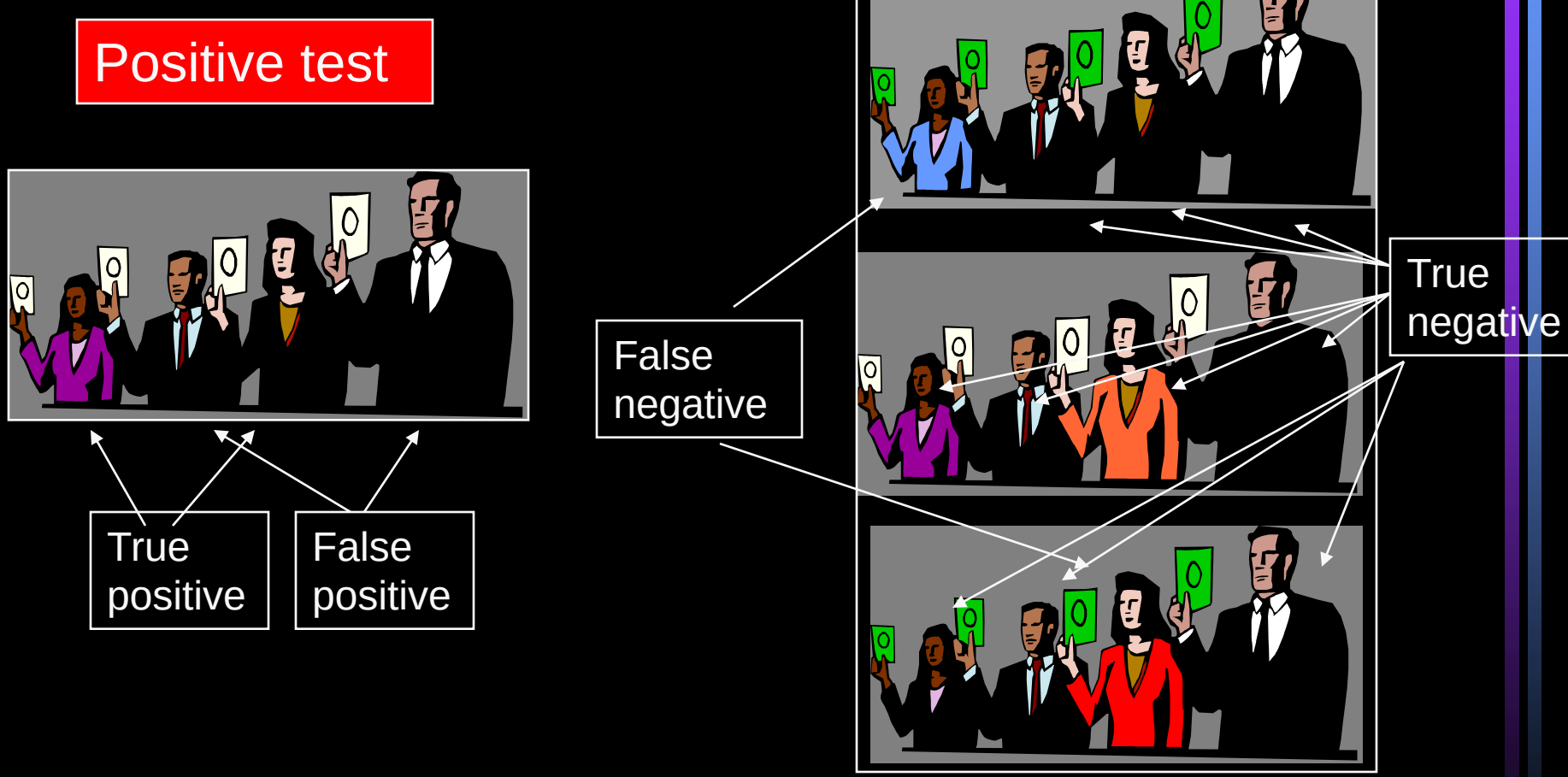
Why gather diagnostic data ?

- To make a diagnosis
- To judge severity
- To predict clinical course and prognosis
- To estimate response to therapy
- To determine actual response to therapy

The diagnostic universe



The diagnostic universe



Types of diagnostic tests used in clinical practice

- **Predictive tests**
  - Identify individuals at risk/ not at risk of developing a specific disease.
  - Only useful if techniques exist for preventing the development or transmission of the condition.
- **Screening tests**
  - Identify individuals with a disease or category of disease.
  - Screening tests cannot replace the patient history and physical examination.

Types of diagnostic tests used in clinical practice

- **Discriminatory tests**

  For differential diagnosis

  Of little use if the result does not influence treatment or outcome.

- **Monitoring tests**

  To describe changes in the disease underlying pathology or primary symptom.

  Variable measured should dosely reflect the change in the process and/or effects of therapy.

Is the trial on diagnostic test valid?

- Did the study address a clearly focussed issue?
  - population
  - test
  - outcomes
- Was there an independent, blind comparison with a reference standard?
  - was an appropriate reference test used
  - was there independent or blind assessment of the result

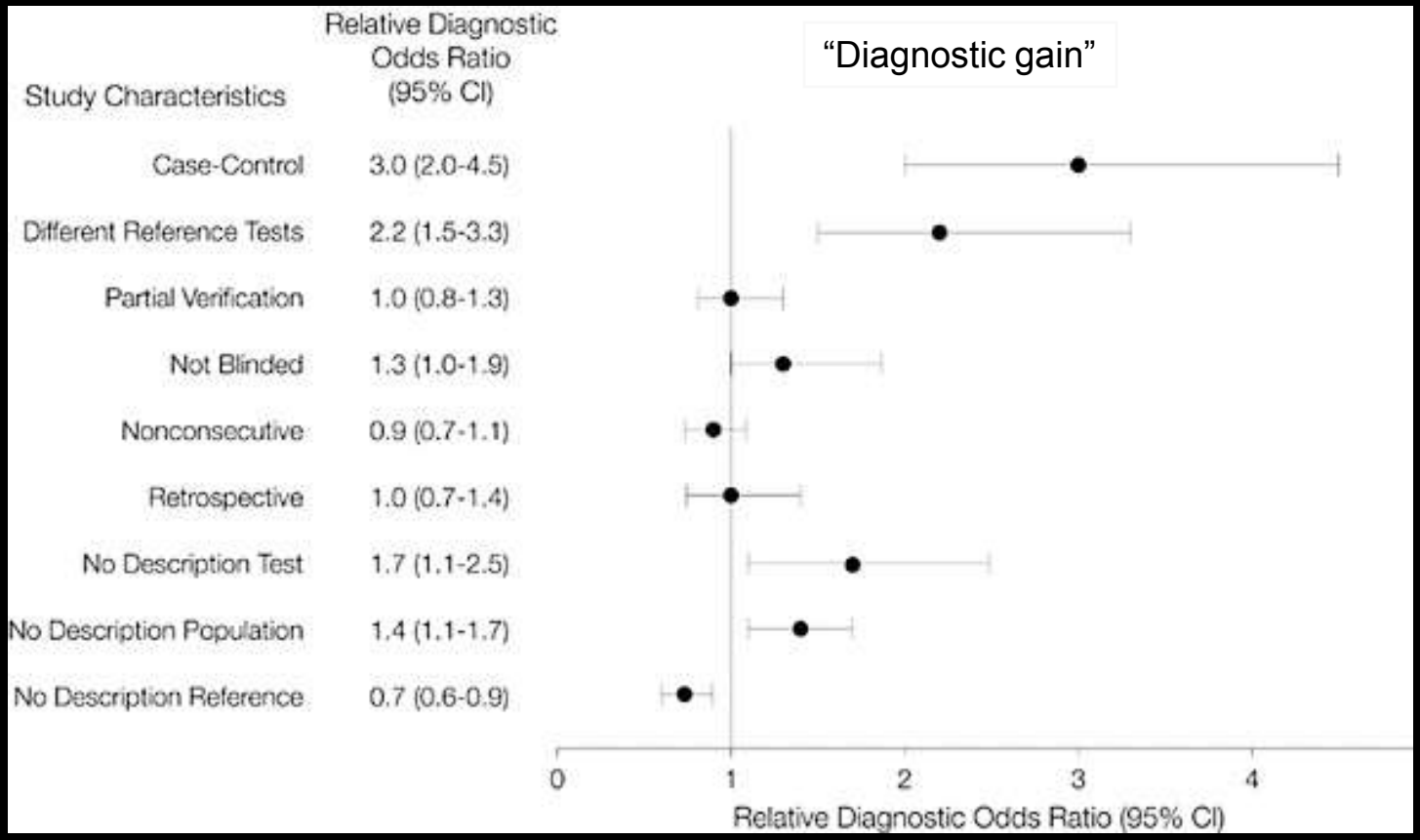
Is the trial on diagnostic test valid?

- Did the patient sample include an appropriate spectrum of patients
  - Consider, age, sex and severity of disease

Is the trial on diagnostic test valid?

- Did the results of the test being evaluated influence the decision to perform the reference standard.
  - Was the reference test performed on all patients?
- Were the methods for performing the test described in enough detail to permit replication.
  - Look for details of patient preparation, test technique, and analysis and interpretation of the result

Effect of study methodology on validity



Studies of lower methodological quality, particularly those including non-representative patients or applying different reference standards, tend to overestimate the diagnostic performance of a test. Lijmer et al. JAMA, 1999; 282: 15.

What are the results?

- Are likelihood ratios given or can they be calculated from the data?
  - Look for
    - Sensitivity and Specificity
    - Positive and negative predictive values

Assessment of the efficacy of a diagnostic test

Parameter	Description
Sensitivity	Ability to identify patients in a patient population
Specificity	Ability to identify non-patients in an asymptomatic population
Positive predictive value	Ability of a diagnostic test to identify a patient correctly, given that the test is positive
Negative predictive value	Ability of a diagnostic test to identify a non-patient correctly, given that the test is negative
Measurement validity	The accuracy of a measurement technique when compared with a known standard
Measurement reliability	The variability of the measurements over time and in different enviroruments
Diagnostic validity	The ability to separate those with the disease from those without the disease

Sensitivity and Specificity

- Sensitivity
  - Probability that a subject with the disease will screen positive
- Specificity
  - Probability that a subject who is disease free will screen negative

2 x 2 Tables

	Disease Present	Disease Absent	
Test Positive	a	b	a+b
Test Negative	c	d	c+d
	a+c	b+d	a+b+c+d

Sensitivity

	Disease Present	Disease Absent	
Test Positive	215	16	231
Test Negative	15	114	129
	230	130	

$$\frac{215}{230} = 93\%$$

Sensitivity = $\frac{a}{a+c}$

Specificity

	Disease Present	Disease Absent	
Test Positive	215	16	231
Test Negative	15	114	129
	230	130	

Specificity = $\frac{d}{b+d}$

$\frac{114}{130}$ = 87%

Positive and Negative Predictive Values

- Positive Predictive Value
  - probability of those testing/screening positive actually having the disease
- Negative Predictive Value
  - probability of those testing/screening negative NOT actually having the disease

<u>Relevant when you know the prevalence of the disease in the population.</u>

Positive Predictive Value

	Disease Present	Disease Absent	
Test Positive	215	16	231
Test Negative	15	114	129
	230	130	

$$\frac{215}{231} = 93\%$$

Positive predictive value = a / a+b

Negative Predictive Value

	Disease Present	Disease Absent	
Test Positive	215	16	231
Test Negative	15	114	129
	230	130	

$$\frac{114}{129} = 88\%$$

Negative predictive value = d/b+d

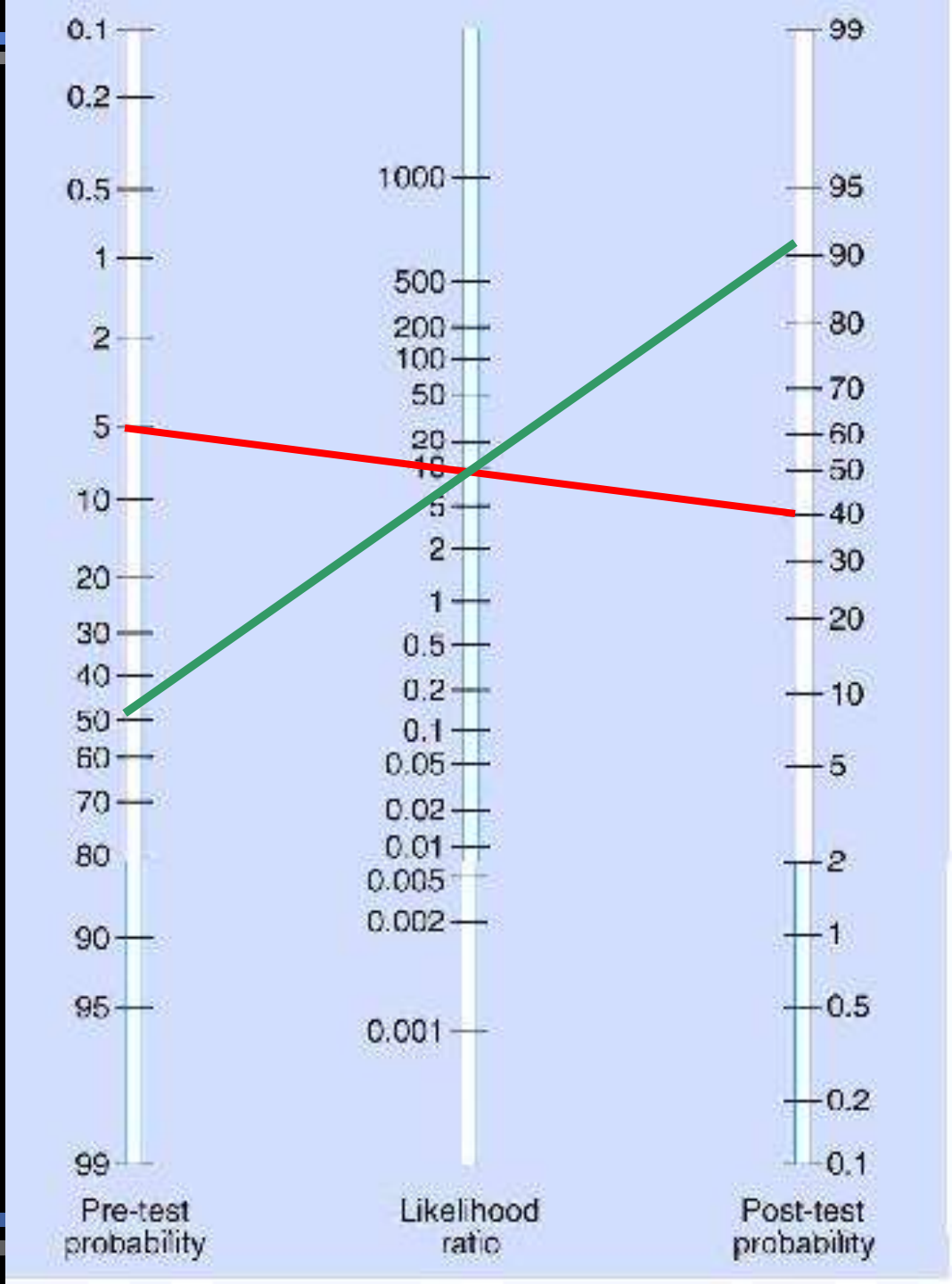
Likelihood Ratio

Indicates the value of the test for increasing certainty about a positive diagnosis

$$\frac{\text{Sensitivity}}{1 - \text{Specificity}}$$

$$= \frac{215/230}{1 - 114/130} = 8$$

Likelihood ratio nomogram



Is this trial of a diagnostic test relevant for me?

- Will the reproducibility and interpretability of the test be satisfactory locally?
  - Consider:
    - How the test is carried out
    - Interpretation of the result
- Can the results be applied to the local population?
  - Is the disease severity similar?
  - Are the results generalisable?

Is this trial of a diagnostic test relevant for me?

Will the results change my management?

Are the benefits worth the harms and costs?