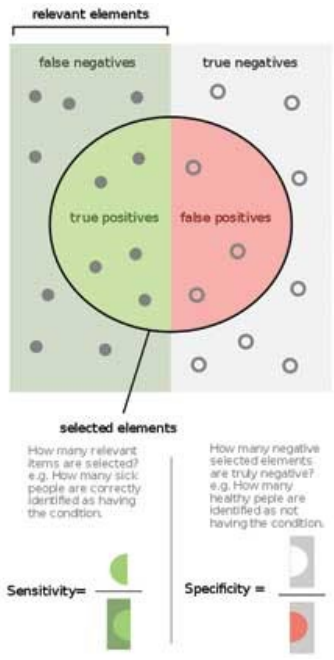
INTRO TO EVIDENCE BASED CLINICAL DECISION MAKING

I. Fundamentals

a. The value of both laboratory and physical examination are only as good as the accuracy of the tests. Traditionally, we are taught to look at the Sensitivity and Specificity to help us understand this.

i. Sensitivity- Proportion of Patient WITH the diagnosis who HAVE a POSTIVIE finding

ii. Specificity- Proportion of patients WITHOUT the diagnosis who LACK the positive finding



Sensitivity and Specificity

$$Sensitivity = \frac{Number\ of\ true\ positives}{(Number\ of\ true\ positives\ +\ Number\ of\ false\ negatives)}$$

$$= \frac{Number\ of\ true\ positives}{Total\ number\ of\ individuals\ with\ the\ illness}$$

$$Specificity = \frac{Number\ of\ true\ negatives}{(Number\ of\ true\ negatives\ +\ number\ of\ false\ positives)}$$

$$= \frac{Number\ of\ true\ negatives}{Total\ number\ of\ individuals\ without\ the\ illness}$$

b. These values can be used to calculate other useful measures, such as likelihood ratios. Likelihood ratios (LR) are divided into Positive and Negative LR, represented by LR+ or LR-

i. (LR+) The probability of a person with disease, having a finding, divided by the probability of the same finding in someone without the disease

ii. (LR-) The inverse, or probability of a person WITH disease, lacking a finding, compared to probability of lack of finding in individuals WITHOUT the disease

c. These values can also be represented as formulas, calculated from the sensitivity and specificity.

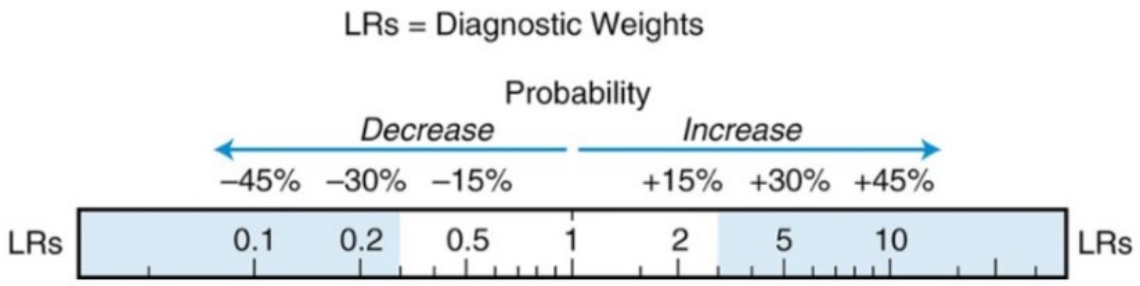
$$LR^{+} = \frac{\text{Probability that test is positive in diseased persons}}{\text{Probability that test is positive in nondiseased persons}}$$

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

$$LR^{-} = \frac{\text{Probability that test is negative in diseased persons}}{\text{Probability that test is negative in nondiseased persons}}$$

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

d. A likelihood ratio of 1, signifies a complete lack of association between the finding and presence or absence of a disease. The farther away the likelihood ratio is from 1, the more significant the association is. Likelihood ratios cannot be negative numbers.
e. Certain likelihood ratios are associated with specific increases in likelihood.
    i. LR of 2, 5, or 10, correspond to an INCREASED likelihood of 15%, 30%, or 45% respectively of the pretest probability.
    ii. LR of 0.5, 0.2, or 0.1 correspond to a DECREASED likelihood of 15%, 30%, or 45% respectively of the pretest probability.
    iii. In the picture below, you can see this represented, the shaded blue area is commonly considered to be a significant value cutoff (0.3 and 3). Where the diagnostic likelihood changes by more than 20-25%. Values closer to 1 can be statistically significant, but are less significant for determining a diagnosis or affecting clinical decision making.



II. Practical Application

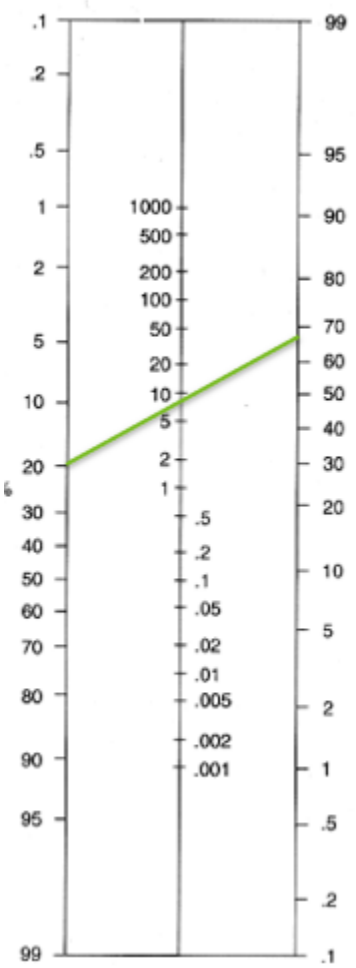
a. The practical use of these statistical models requires two things.

i. **Pre-Test Probability- This is the clinicians estimation of disease probability based on the information they have PRIOR to the test being performed.**

1. Some educators recommend clinicians pick from a specific set of number, such as 20%, 50%, or 80% when picking a pre-test probability. This can be helpful for providers to create a mental model when estimating pre-test probability is new for them but is not necessary. The provider may instead choose any number he feels most accurately represents the likelihood

ii. **Sensitivity and Specificity for the test being performed.** With the statistical information the provider can easily calculate the post test probability using a Fagan Nomogram, or other electronic calculator.

b. Fagan Nomogram- This nomogram composes of three parts.



i. Pretest probability on the far left, here you mark what you think the clinical likelihood of disease is prior to the test

ii. Likelihood Ratio- This is the likelihood ratio for the test being performed; this is in the middle column

iii. Post-Test Probability- This is the column on the right, when a line is drawn from the left column, through the middle column and extended to the right-most column, post-test probability can be found.

To the left is an example of a Fagan nomogram, with pretest probability of 20%, with a positive test who's LR is 7. The post-test probability is determined on the right, and ~65%.

c. Likelihood ratios can be combined in sequence to provide the clinician with additional information if desired.