



Part 4

Lecture 3b Diagnostic Accuracy

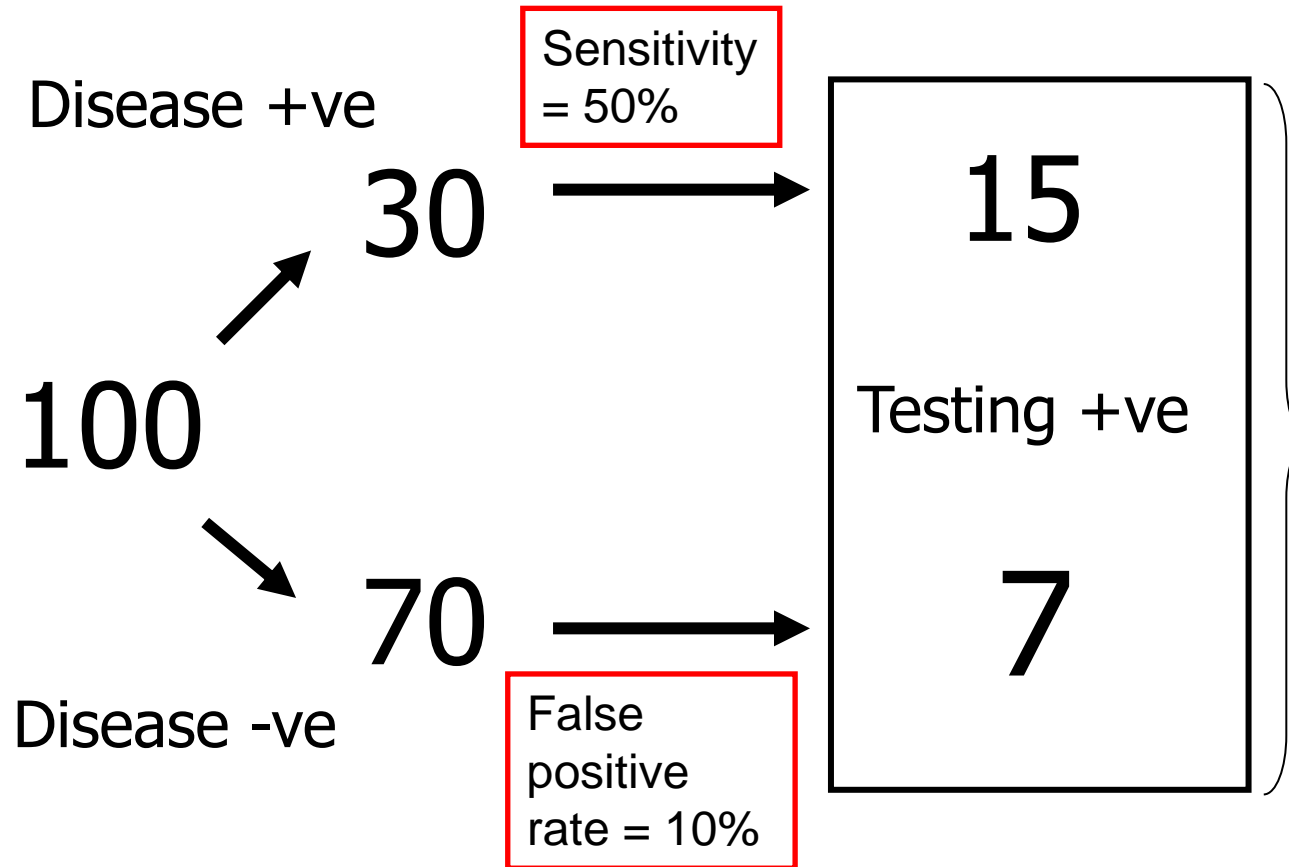
Natural frequencies

- Your father went to his doctor and was told that his test for a disease was positive. He is really worried and comes to ask you for help!
- After doing some reading, you find that for men of his age:
 - The prevalence of the disease is 30%
 - The test has sensitivity of 50% and specificity of 90%

“Son, tell me what’s the chance I have this disease?”



Prevalence of 30%, Sensitivity of 50%, Specificity of 90%



22 people test positive of whom 15 have the disease

So, chance of disease is $15/22$ about 70%

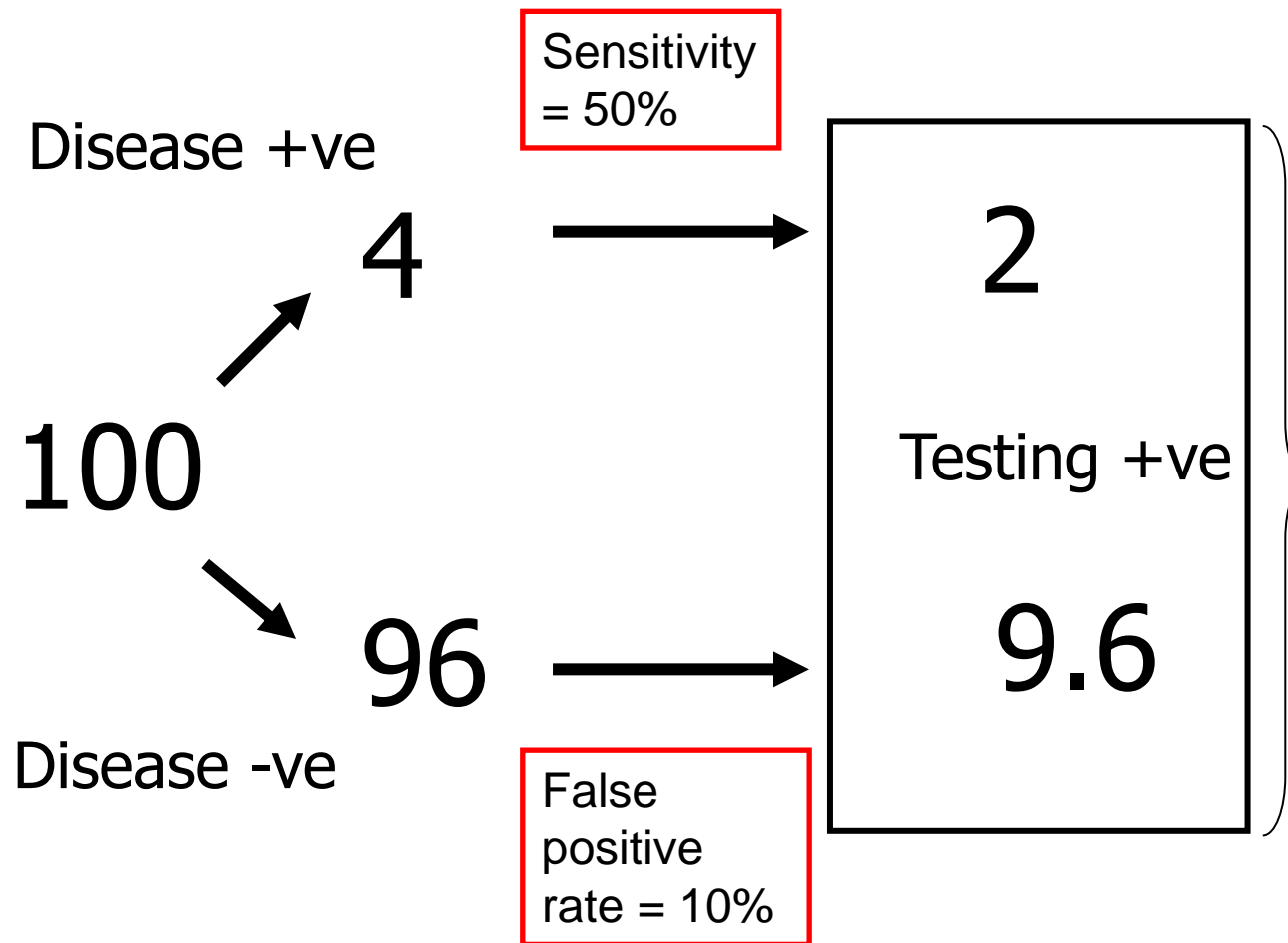


Try it again

- ❑ A disease with a prevalence of 4% must be diagnosed.
- ❑ It has a sensitivity of 50% and a specificity of 90%.
- ❑ If the patient tests positive, what is the chance they have the disease?



Prevalence of 4%, Sensitivity of 50%, Specificity of 90%



11.6 people
test positive
of whom 2
have the
disease

So, chance of
disease is
 $2/11.6$ about
17%

Doctors with an average of 14 yrs experience

....answers ranged from 1% to 99%

....half of them estimating the probability as 50%

Gigerenzer G BMJ 2003;327:741-744

Likelihood ratios

- ❑ Can use in situations with more than 2 test outcomes
- ❑ Direct link from pre-test probabilities to post-test probabilities



Likelihood ratios

Positive likelihood ratio (LR+)

How much more likely is a positive test to be found in a person with the disease than in a person without it?

$$\text{LR+} = \text{sens}/(1-\text{spec})$$

Negative likelihood ratio (LR-)

How much more likely is a negative test to be found in a person without the condition than in a person with it?

$$\text{LR-} = (1-\text{sens})/(\text{spec})$$



2 x 2 table: positive likelihood ratio

		Disease	
		+	-
Test	+	a	b
	-	c	d

$$\text{LR}_+ = a/a+c / b/b+d$$

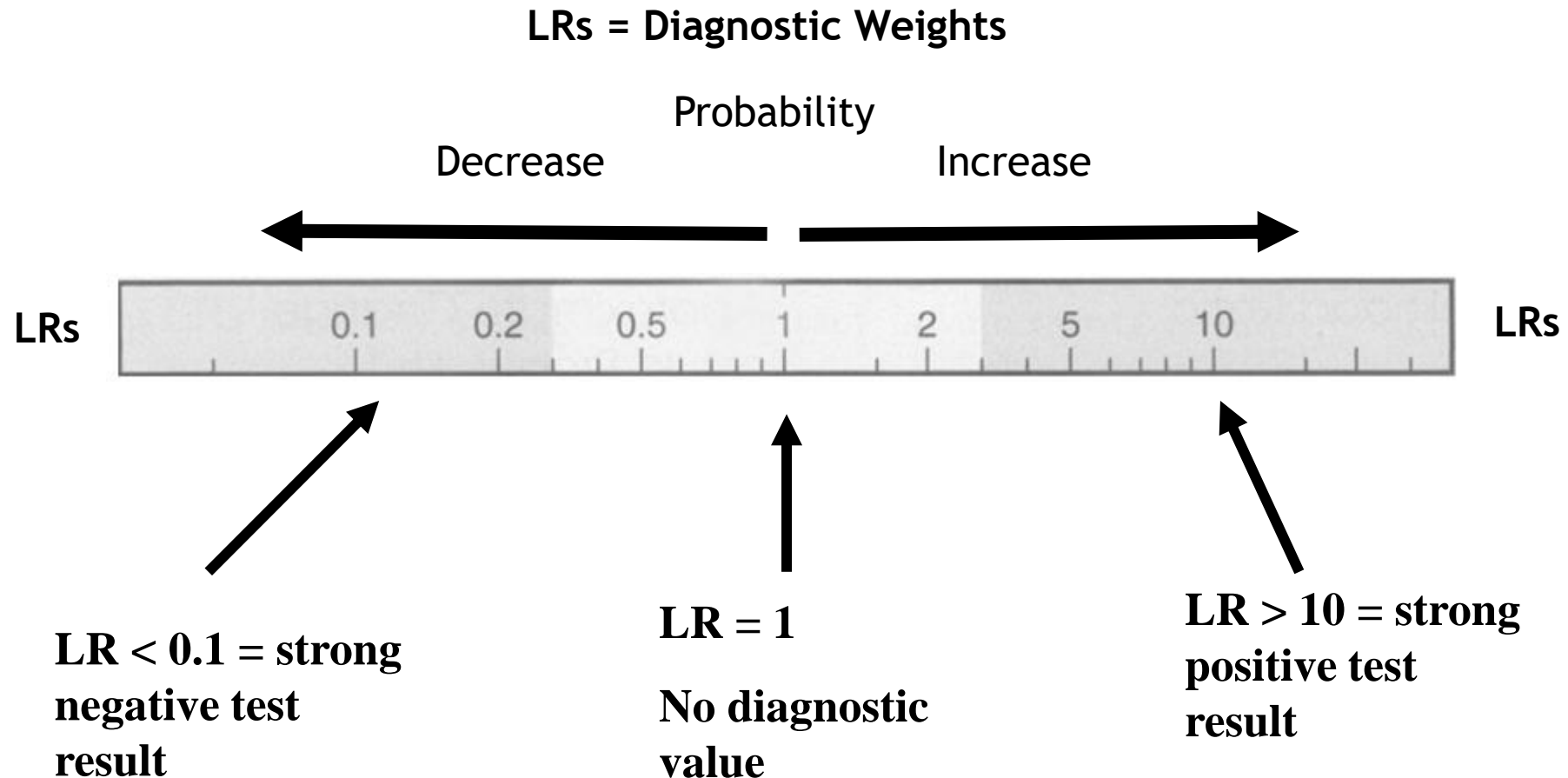
or

$$\text{LR}_+ = \text{sens}/(1-\text{spec})$$

How much more often a positive test occurs in people with compared to those without the disease



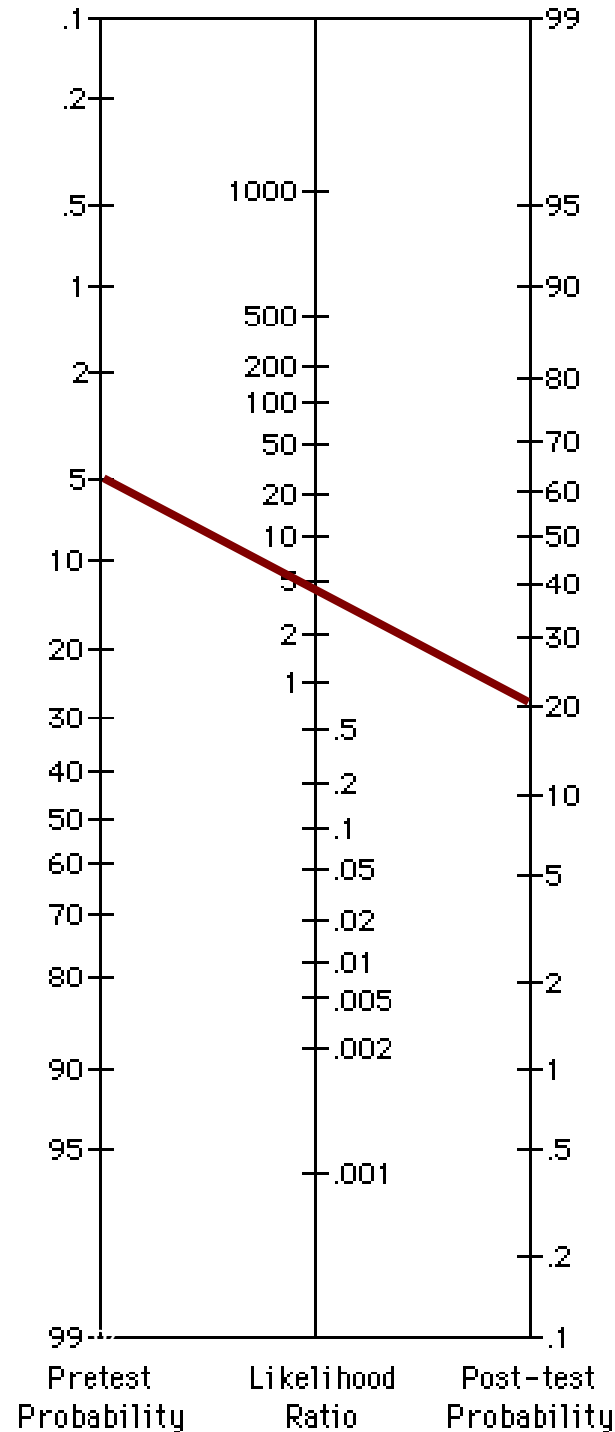
What do likelihood ratios mean?



Bayesian reasoning

Pre-test 5%

? Appendicitis:
McBurney tenderness
LR+ = 3.4



Post test 20%

Fagan nomogram



What's wrong with PPV and NPV?

- Depend on accuracy of the test *and* prevalence of the disease



Summary: diagnostics

- ❑ Clinical decision making
- ❑ All diagnostic studies share a similar structure
- ❑ Appraise in 3 steps:
 - ❑ Are the results valid (do I believe them)?
 - ❑ What are the results (sens/specificity etc)?
 - ❑ Can the test be used in our setting?



End of Lecture 3

Next up in Part 5 Lecture 1: More on Modeling

