Communicating Predictive Factors Impacting USMLE Step 1 Performance

Robert G. Carroll#, David L. Giles# and Anne C. Carroll*

BSOM Office of Medical Education#, and

Department of Psychology* East Carolina University

BSOM Medical Education Day

Greenville NC
April 2015

Background

- Database construction and analysis allows modeling and projection of medical student performance on the USMLE Step 1 Licensing examination.

- Communicating the results of this projection is difficult, particularly for this hyper-vigilant group of students

- Medical students often have difficulty interpreting data from epidemiological test results.

Risk profile of USMLE Step 1 Low performers (past 4 years)

Failing score (red)

Low Passing score (yellow)

Pass/Fail threshold →

Step 1	Phly	Micr	CBSE	Med	Path
164	45	36		51	
168	37	13			
171	46	35	41	47	40
175	38	43	31	53	
176	55	43	35	54	41
184	56	37	33	50	
185	42	33	28	47	40
186	52	32	35	55	
188	50	43	38	52	42
190	42	39	44	48	43
191	45	37	31	50	44
192	51	48	39	54	48
192	51	34	29	52	
194	44	53	35	69	
194	48	41	27	52	
195	50	41	43	56	
197	46	25	13	57	
198	39	40	38	58	
199	37	44	44	56	
199	44	35	38	58	
199	47	35	29	51	38
199	50	37	38	55	
200	39	43	38	62	
200	44	36	26	47	
200	45	43		52	50
200	45	25	37	61	

3
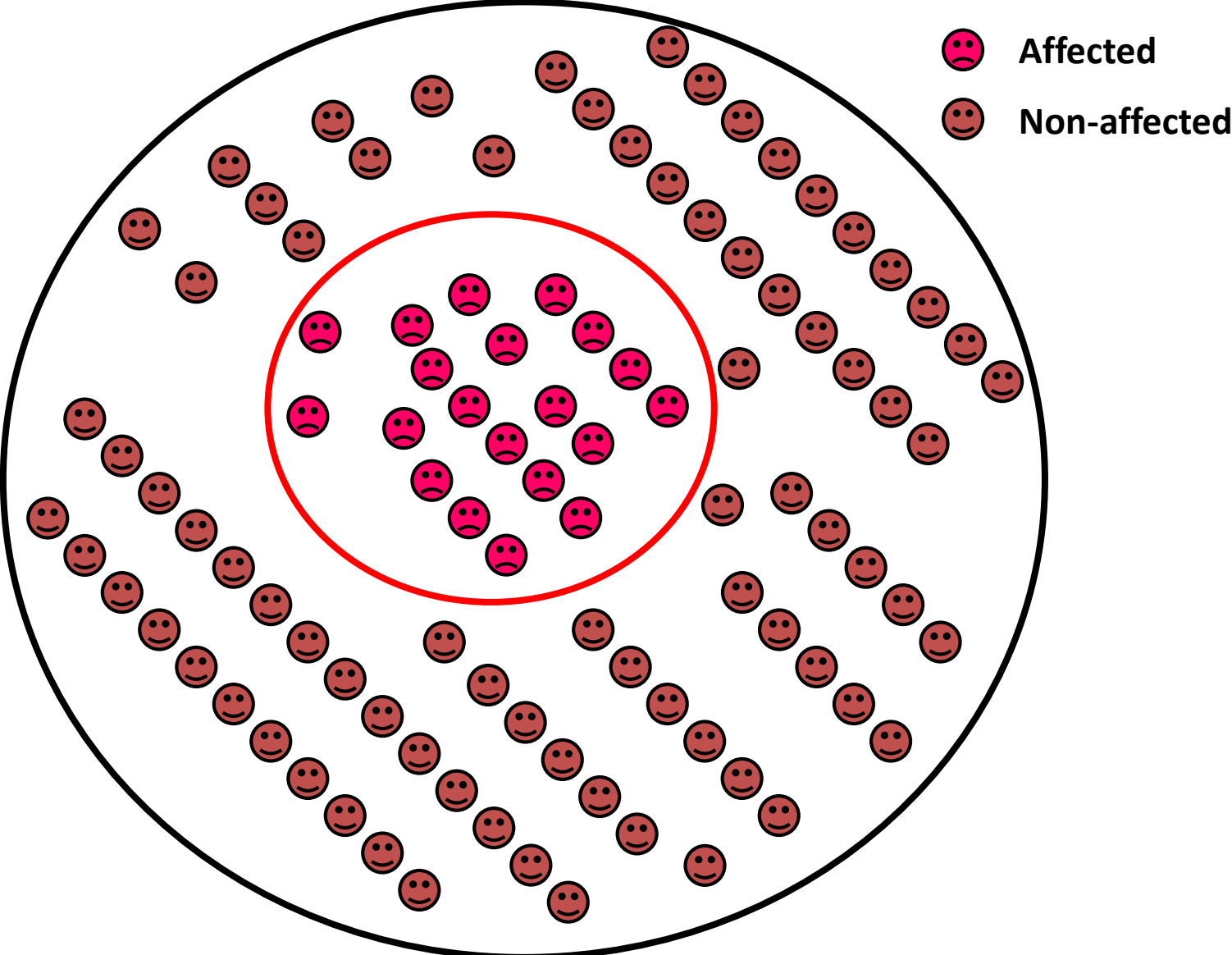
Sorted by Physiology NBME subject exam Performance

Correlation OK, but not very predictive of poor performance….

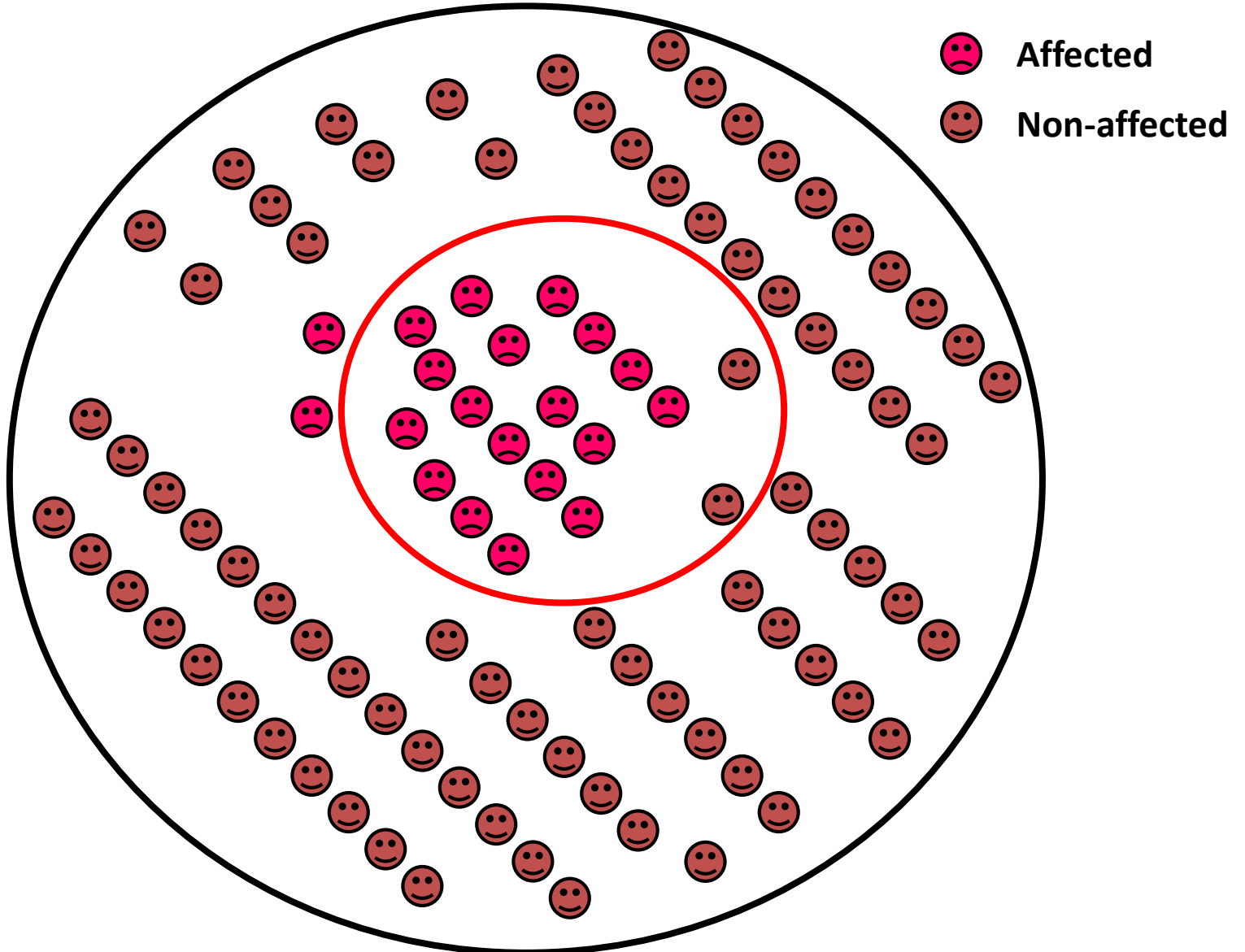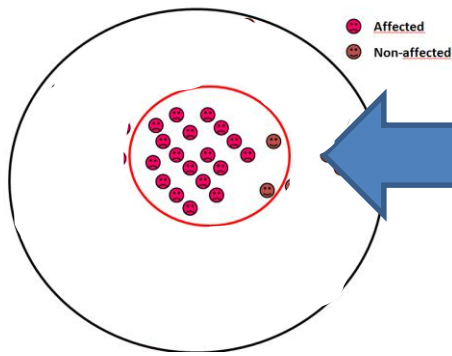| Step 1	Phly	Micr	CBSE	Med	Path
202	38	41	33	50	33
211	35	45	43	56	
211	36	43	33	50	
225	36	57	40	64	
168	37	13			
199	37	44	44	56	
175	38	43	31	53	
198	39	40	38	58	
200	39	43	38	62	
205	39	45	46	52	43
209	39	49	52	59	
212	41	29	36	50	
185	42	33	28	47	40
190	42	39	44	48	43
204	42	39	6	58	
208	42	45	51	60	
213	42	41		54	
218	42	42	44	64	
222	42	50	49	58	
232	42	54	50	59	59
194	44	53	35	69	
199	44	35	38	58	
200	44	36	26	47	
212	44	54	48	59	
213	44	47	50	65	
219	44	50	46	51	47
222	44	55	48	79	52
235	44	56	52	62	
164	45	36		51	
191	45	37	31	50	44

Problem

- Can a diagnostic test model of Sensitivity Specificity and Threshold be adapted to more clearly communicate the results of predictive modeling of medical student performance on the USMLE Step 1 examination?

- Can identification of students at risk for Step 1 low performance in early May allow time for effective intervention?

A perfect diagnostic test identifies the affected individuals only

Affected

Non-affected

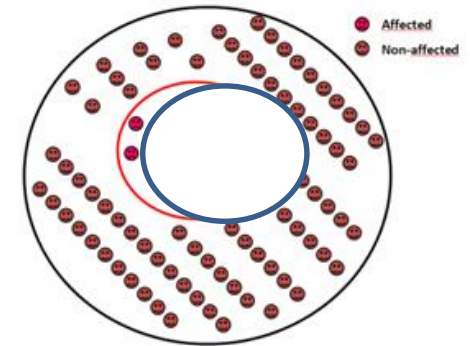# In reality, tests are not perfect

Affected

Non-affected

Sensitivity of a test

The sensitivity of a test is the ability of the test to identify correctly the affected individuals

Proportion of persons testing positive among affected individuals

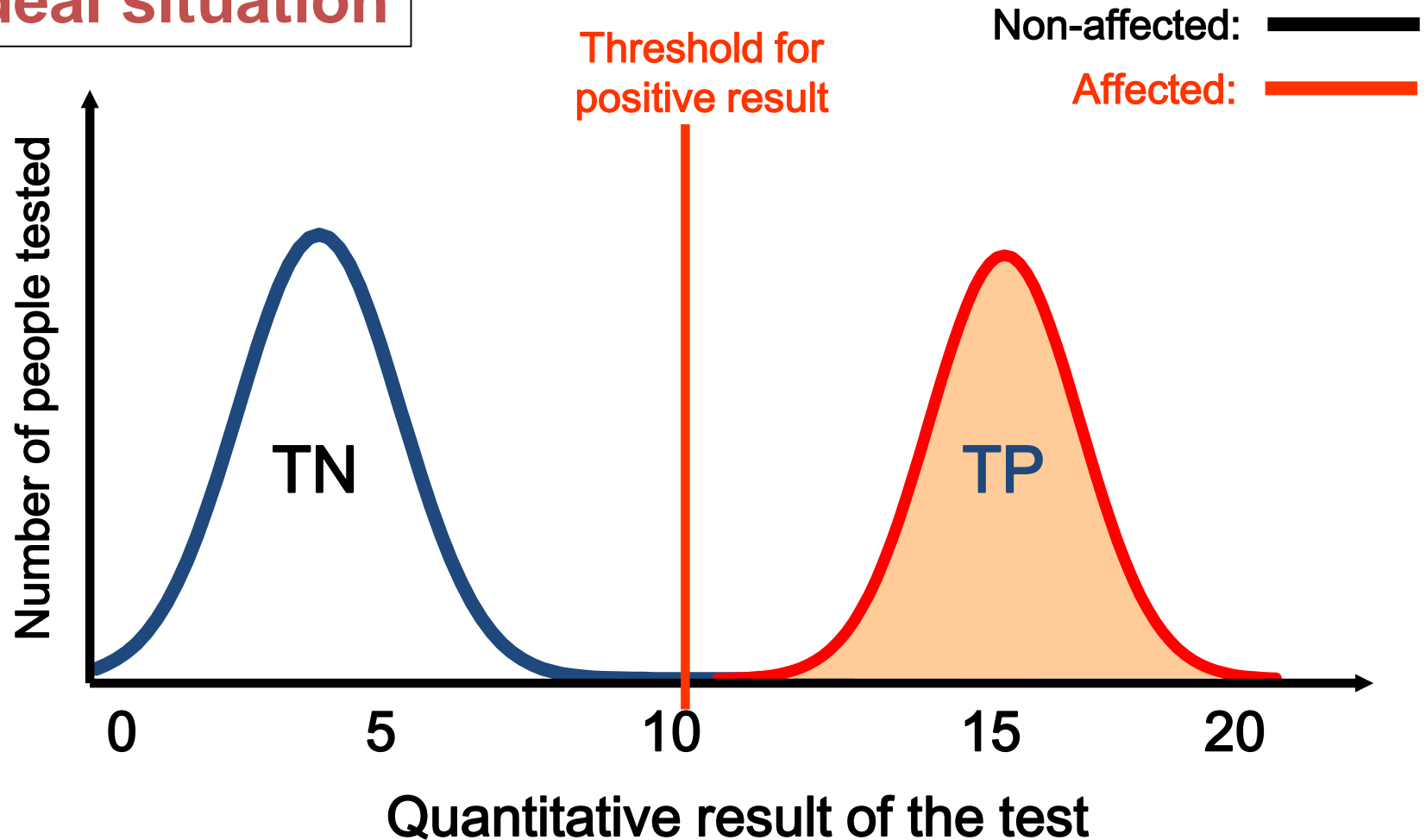# Specificity of a test

The specificity of a test is the ability of the test to identify correctly non-affected individuals

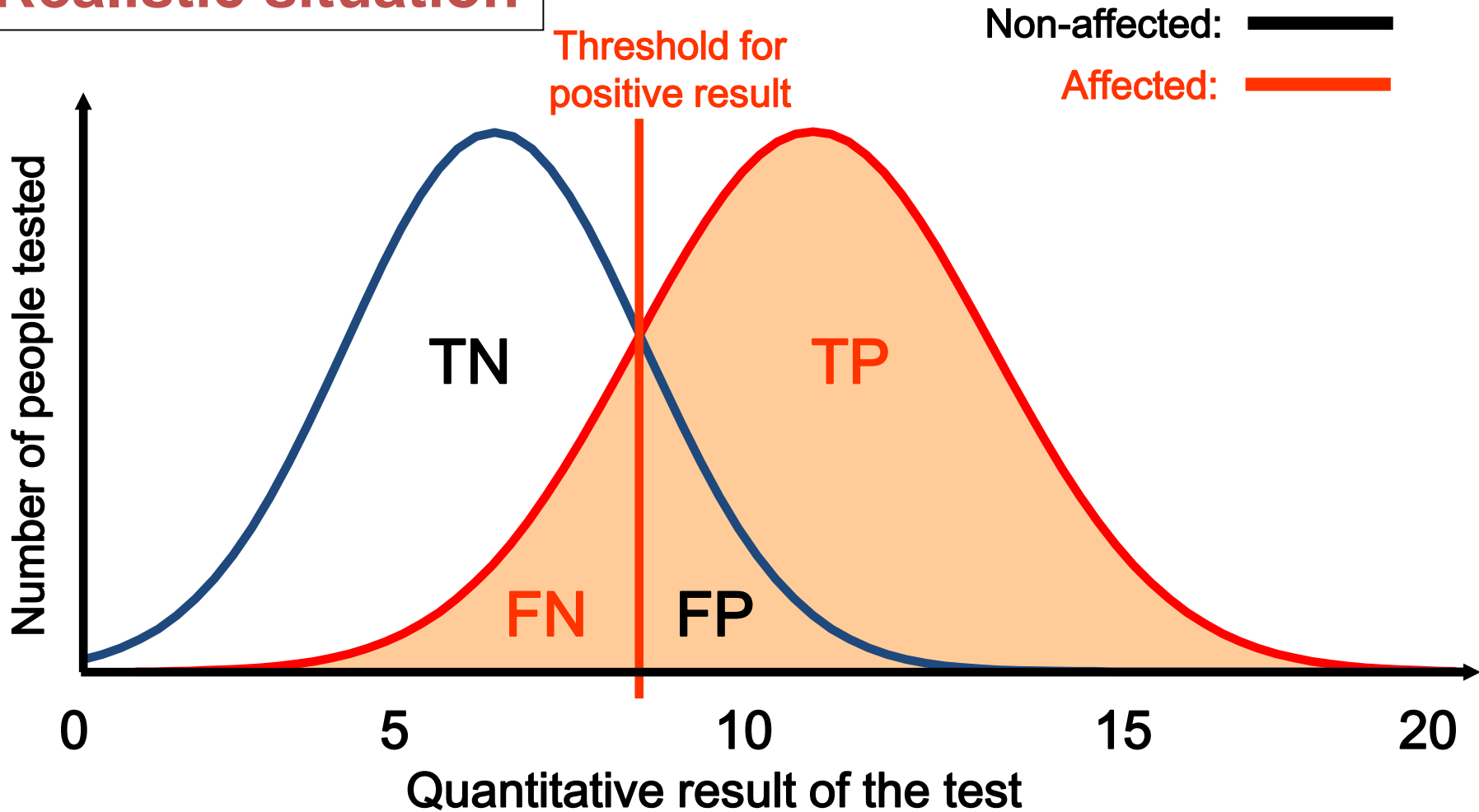**Proportion of persons testing negative among non-affected individuals**

Distribution of quantitative test results among affected and non-affected people

Distribution of quantitative results among affected and non-affected people

Realistic situation
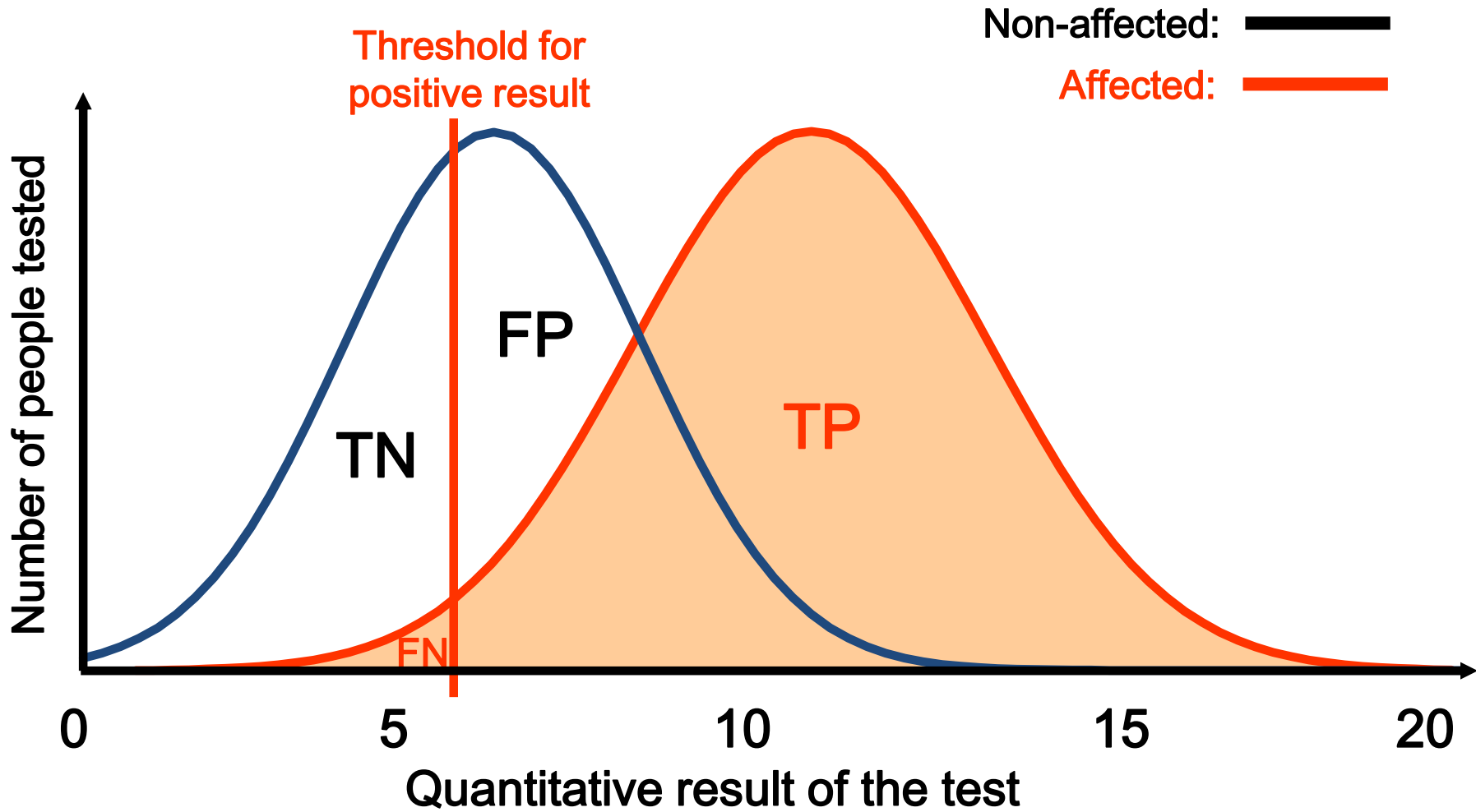
Non-affected: ——
Affected: ——

Threshold for positive result

Number of people tested

TN

TP

FN FP

Quantitative result of the test

0 5 10 15 20

Really low Path subject exam score

		Disease (fail Step 1)		
		Present	Absent	total
Path Risk Factor 1	Positive	3	2	5
	Negative	3	62	65
	total	6	64	70
	Sensitivity	3 / 6 = 50%		
	Specificity	62 / 64 = 97%		

Effect of Decreasing the Threshold

Threshold for positive result

Non-affected:
Affected:

Number of people tested

FP

TN

TP

FN

Quantitative result of the test

0   5   10   15   20

12

Sort of low Path subject exam score

		Disease (fail Step 1)		
		Present	Absent	
Path Risk Factor 2	Positive	6	4	10
	Negative	0	60	60
	total	6	64	70
	Sensitivity	6 / 6 = 100%		
	Specificity	60/64 = 94%		

202	38	41	33	50	33
199	47	35	29	51	38
185	42	33	28	47	40
171	46	35	41	47	40
176	55	43	35	54	41
188	50	43	38	52	42
208	51	44	32	60	42
205	39	45	46	52	43
190	42	39	44	48	43
191	45	37	31	50	44
227	57	41	49	66	46
219	44	50	46	51	47
202	47	29	41	52	48
192	51	48	39	54	48
216	46	51	6	57	49
224	50	28	44	46	49
220	55	41	41	47	49

Conclusion and Next Steps

- Concepts of Sensitivity, Specificity and Threshold of a diagnostic test allows clear communication of Step 1 predictive data.

- Students who perform poorly on the May 2015 NBME Pathology subject exam will be offered additional help for USMLE Step 1 preparation.