Physician probability thresholds for ruling out and initiating treatment for common clinical conditions

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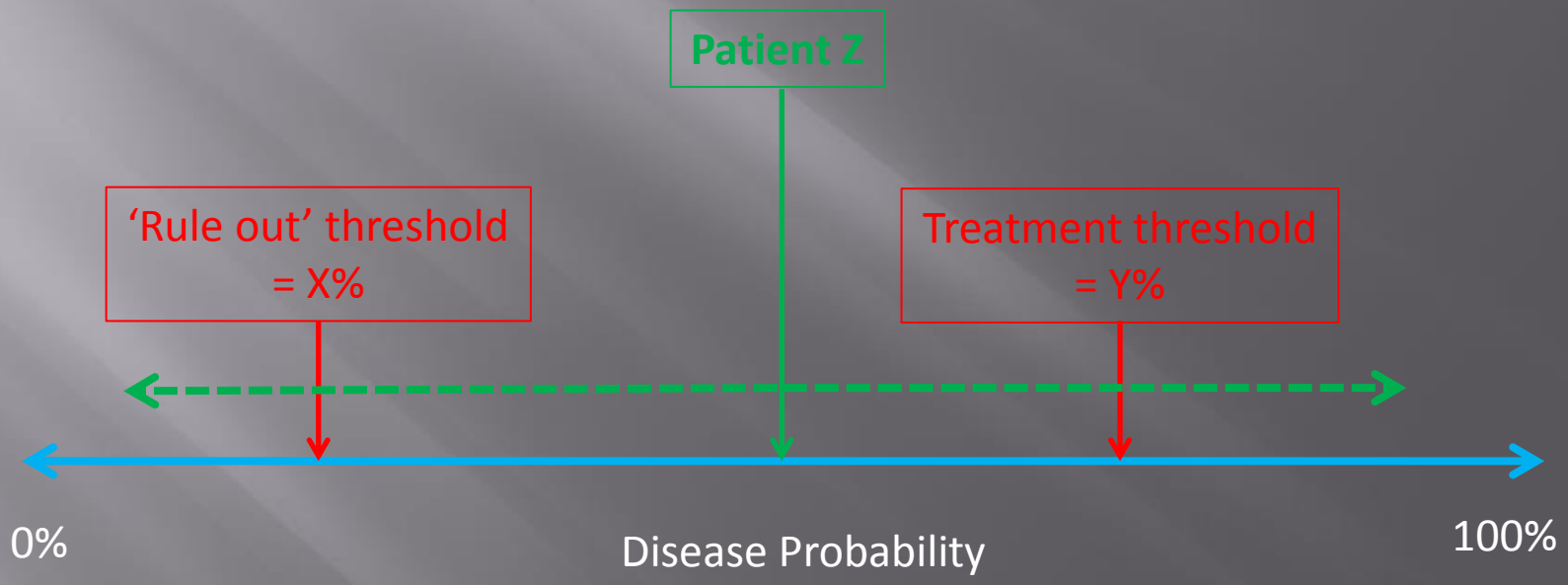
Background

How does the physician think of these thresholds?



*Sox HC, Blatt, MA, Higgins MC, Marton KI. *Medical Decision Making.* Woburn, MA: Butterworth-Heinemann, 1988.

Aims

- To gather and present quantitative physician thresholds for ‘ruling out’ and ‘treating’ specific diseases
  - Strep pharyngitis
  - Pulmonary Embolism
  - Pediatric appendicitis
  - Meningitis
  - Influenza (<48 hours of symptoms)
- To determine the variance of these physician thresholds
- To compare physician thresholds for ‘ruling out’ strep throat vs. pulmonary embolism
- Use the physician defined thresholds for strep pharyngitis to determine when diagnostic testing is useful

Methods

- Residents and Faculty at a Family Medicine residency program in Westminster, CO were surveyed
- 'Rule out' and 'treatment' thresholds for each disease were calculated (mean and SD)
- Statistical comparison of 'rule out' thresholds for strep and pulmonary embolism were performed using Student's T-test and Wilcoxon signed-rank test

Results

Rule OUT Thresholds (%)					
n=34	Strep	PE	appy	meningitis	flu
Mean	34.29	20.68	22.27	19.24	37.94
Standard Deviation	29.53	32.91	33.89	31.94	25.62

Treatment Thresholds (%)					
n=34	Strep	PE	appy	meningitis	flu
Mean	69.85	70.97	73.03	66.15	71.74
Standard Deviation	21.65	25.78	22.93	26.65	23.73

Results

Expected example	strep	PE	appy	meningitis	flu
Rule out	10	3	5	2	20
Treatment	60	70	65	50	75

Outlier Type 1 (n=4)	strep	PE	appy	meningitis	flu
Rule out	90	97	95	98	80
Treatment	60	70	65	50	75

Outlier Type 2 (n=5)	strep	PE	appy	meningitis	flu
Rule out	90	5	50	25	80
Treatment	60	50	50	50	75

Results

Rule OUT Thresholds (%) (correcting/eliminating outliers)					
n=29	Strep	PE	appy	meningitis	flu
Mean	19.86	4.82	7.31	4.45	29.83
Standard Deviation	13.98	4.86	13.46	5.16	20.51

Treatment Thresholds (%) (correcting/eliminating outliers)					
n=29	Strep	PE	appy	meningitis	flu
Mean	72.93	77.17	78.03	70.31	76.52
Standard Deviation	14.85	19.40	17.41	23.56	16.43

Results

Strep vs PE rule out thresholds

Comparing rule out thresholds	Strep	PE	Student 's T test P value	Wilcoxon signed-rank P value
Mean (± SD)	34.29 (± 29.53)	20.68 (± 32.91)	0.000596	0.00026
Kolmogorov Smirnov Test (normal distribution?)	p=0.00	p=0.00		

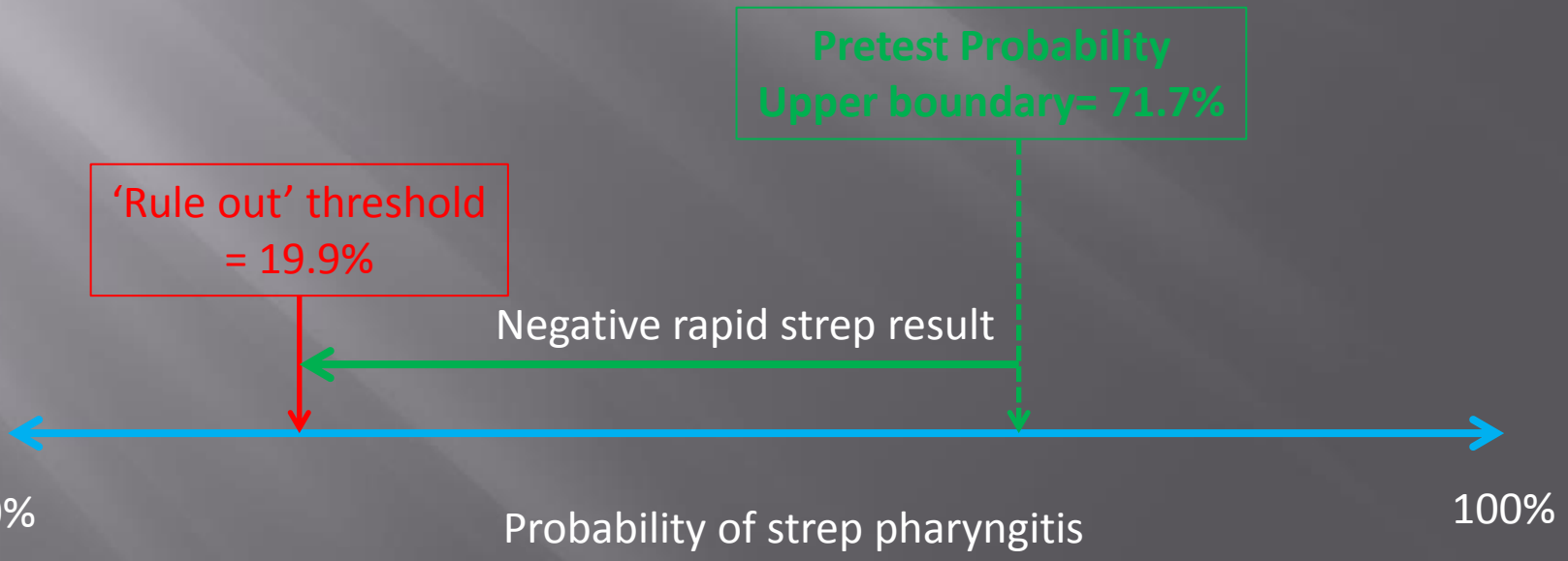
The physician threshold to rule out PE is significantly lower than their threshold to rule out strep pharyngitis.

Results
Strep Pharyngitis Data

	Disease +	Disease -
Test +	2012	70
Test -	199	801 → Negative predictive value = 19.9%
	2211	871 → Pretest probability = 2211/3082 = 71.7%

*Sensitivity = 91%
Specificity = 92%

For a pretest probability > 71.7%, a negative rapid strep result will not move the posttest probability below the 'rule out' threshold of 19.9%



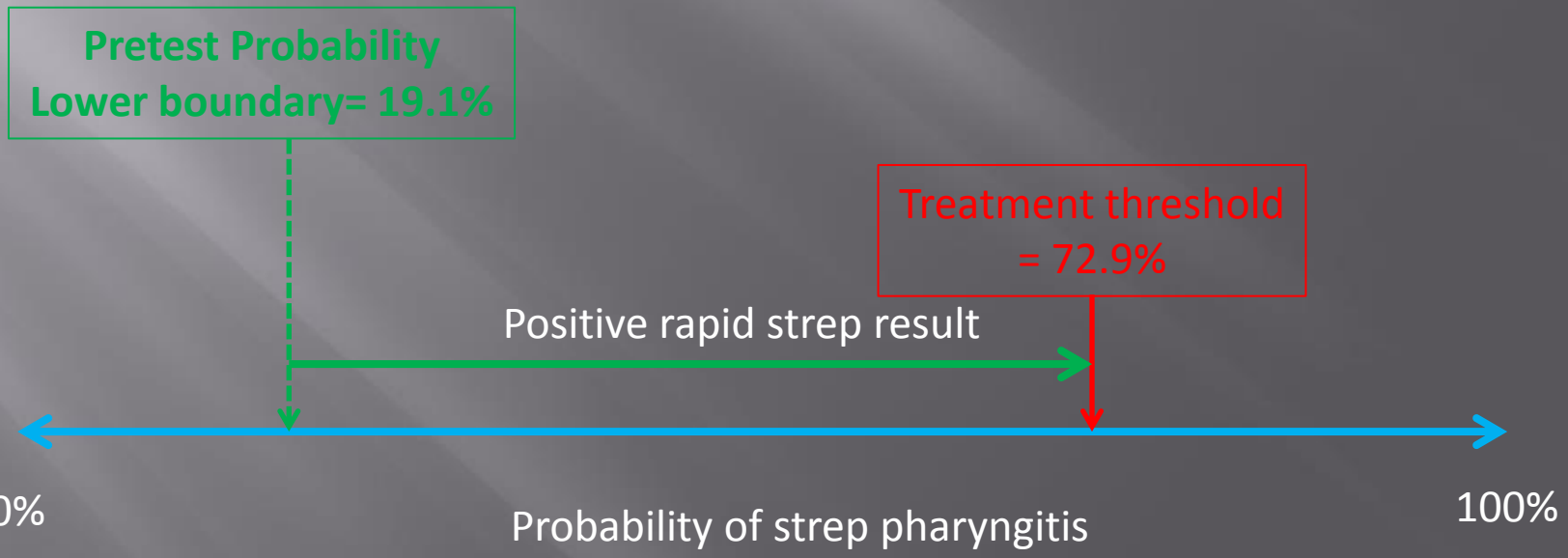
Acceava strep A Test Procedure Card. Alere San Diego, Inc. 2013.

Results
Strep Pharyngitis Data

*Sensitivity = 91%
Specificity = 92%

For a pretest probability < 19.1%, a positive rapid strep result will not move the posttest probability above the treatment threshold of 72.9%

	Disease +	Disease -	
Test +	729	271	1000 → Positive predictive value = 72.9%
Test -	72	3117	
	801	3388	→ Pretest probability = 801/4189 = 19.1%



Limitations

- Clumsy survey
- Outliers may not have understood the survey questions
- Small sample size
- Round number bias
- Survey answers biased by other questions on the survey

Bottom Line

- Amongst physicians there exists substantial variability in their 'rule out' thresholds for common diseases.
- Amongst physicians there exists substantial variability in their treatment thresholds for common diseases.
- Physician thresholds for 'ruling out' pulmonary embolism is significantly lower than their threshold for 'ruling out' strep pharyngitis.
- Estimating 'rule out' thresholds and treatment thresholds in terms of probability may help guide physician decisions and interpretation of diagnostic testing (strep pharyngitis example).