

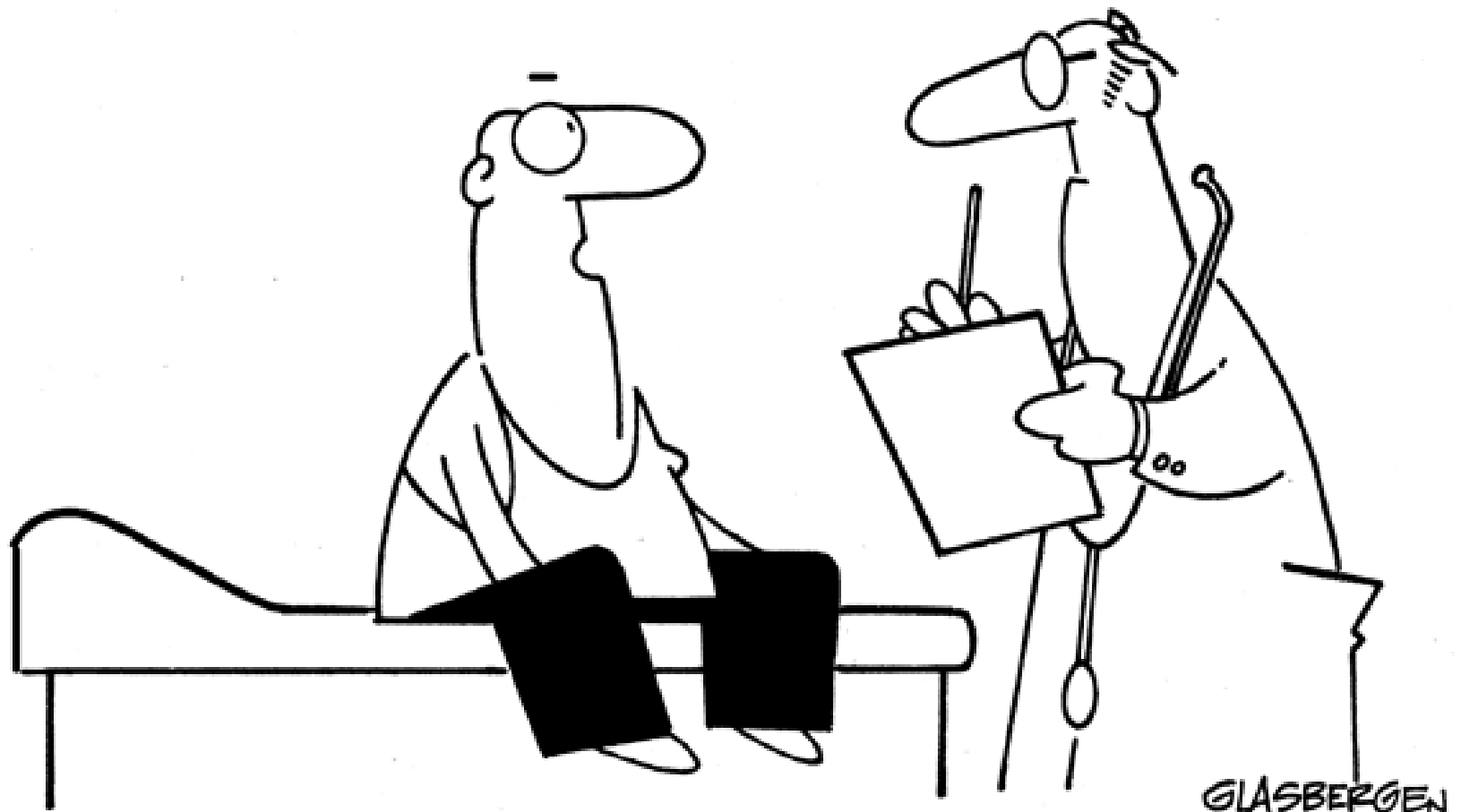


Clinical biochemistry in modern medicine: the information value of laboratory results.



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Pécs, Ifjúság u. 13.

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“If you hadn’t done those tests to find out what’s wrong with me, *I’d still be healthy!*”

Why do I ask for lab investigation?



- 1) **What is in the expected result I want to find?**
- 2) **Do I have a preliminary diagnosis for which the result will be supportive? What if not?**
- 3) **Will it affect my duties/decisions around the patient?**
- 4) **Will the lab result serve the interest of the patient? ?**

Asher, R.: British Medical Journal 2,460,1954

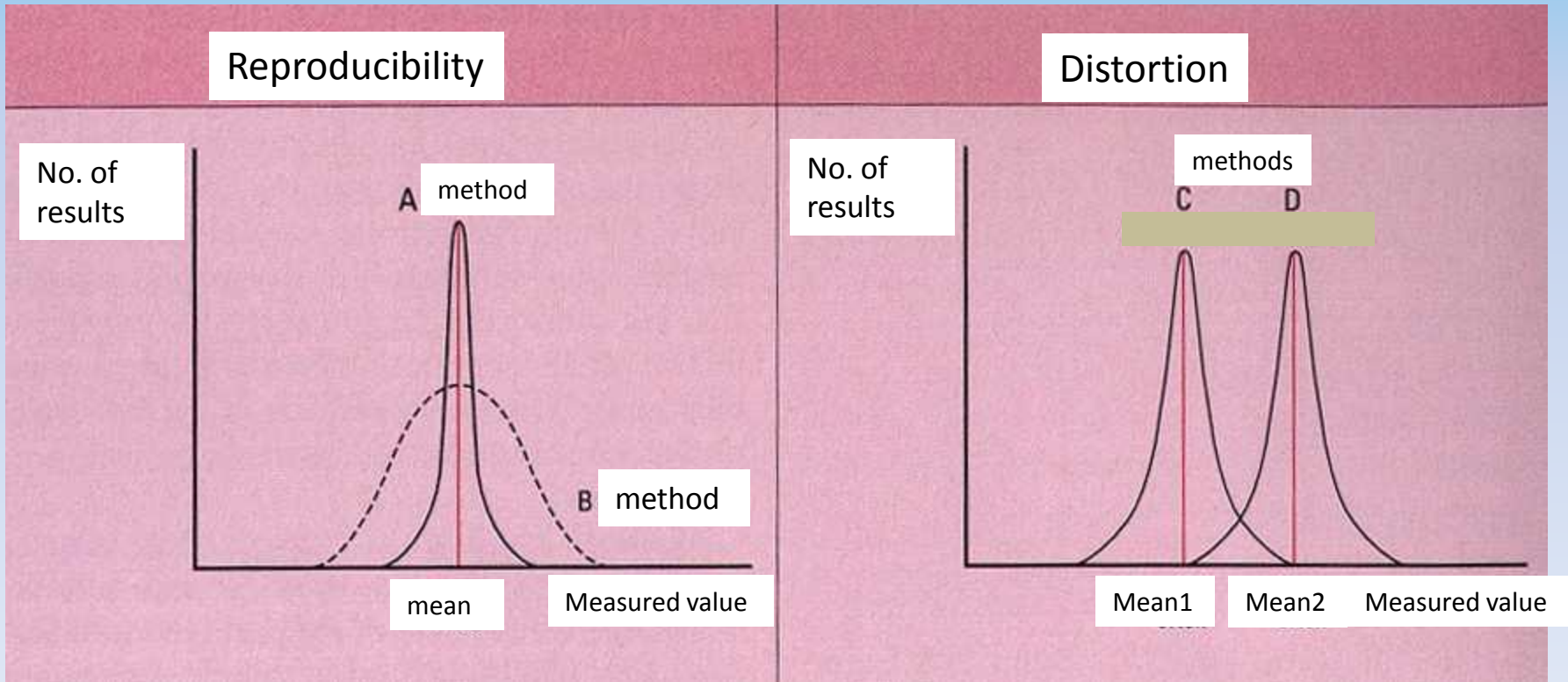
The purpose of laboratory investigation

1. Screening: **healthy or not healthy?**
2. Lab diagnosis: **helps to establish a correct clinical diagnosis.**
3. Follow up: **what is going on?**
4. Prognosis: **the likely outcome of the disease.**

What the laboratory knows?!

REPRODUCIBILITY: Small error around the mean value

RELIABILITY: small distortion close to the mean value

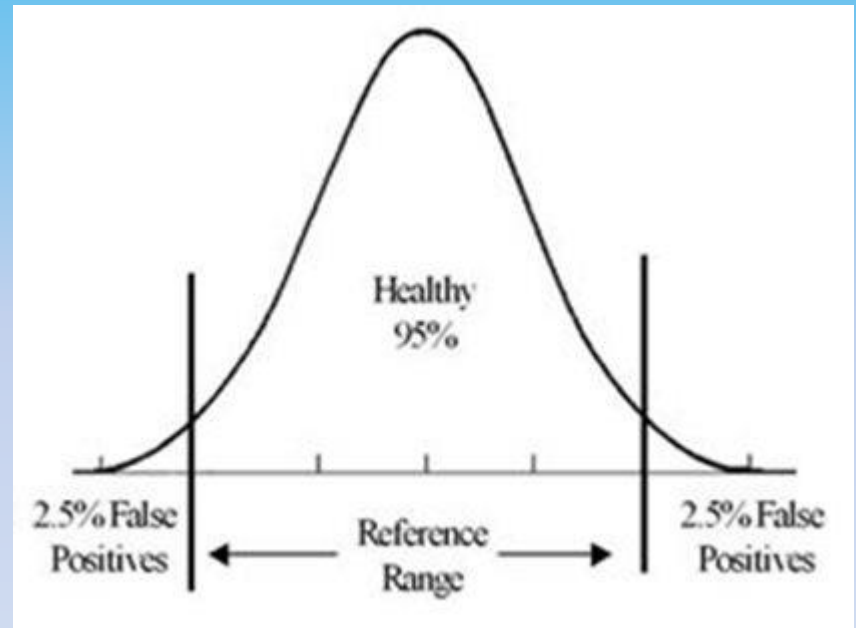


The reference range

The statistical result of measurement made in a sizable, presumably healthy population.

Mean \pm 2SD

Note, 5% of the results will be outside the reference range!



More lab requests = more false results!

MCHUMOR.COM by T. McCracken



“Off hand, I'd say you're suffering from an arrow through your head, but just to play it safe, I'm ordering a bunch of tests.”

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$$\text{Sensitivity \%} = \frac{\text{TP}}{\text{TP} + \text{FN}} \times 100$$

$$\text{Specificity \%} = \frac{\text{TN}}{\text{TN} + \text{FP}} \times 100$$

$$\text{Positive predictive value \%} = \frac{\text{TP}}{\text{TP} + \text{FP}} \times 100$$

$$\text{Negative predictive value \%} = \frac{\text{TN}}{\text{TN} + \text{FN}} \times 100$$

Number of true positives: TP
Number of true negatives: TN
Number of false positives: FP
Number of false negatives: FN

A sensitive and specific test is not necessarily performing well in practice: the prevalence is also important.

Sample

Alpha phoetoprotein measurement results...

$$\text{Sensitivity \%} = \frac{\text{TP}}{\text{TP} + \text{FN}} \times 100 = 91\%$$

$$\text{Specificity \%} = \frac{\text{TN}}{\text{TN} + \text{FP}} \times 100 = 99.9\%$$

$$\text{Positive predictive value \%} = \frac{\text{TP}}{\text{TP} + \text{FP}} \times 100 = 96\%$$

$$\text{Negative predictive value \%} = \frac{\text{TN}}{\text{TN} + \text{FN}} \times 100 = 99.9\%$$

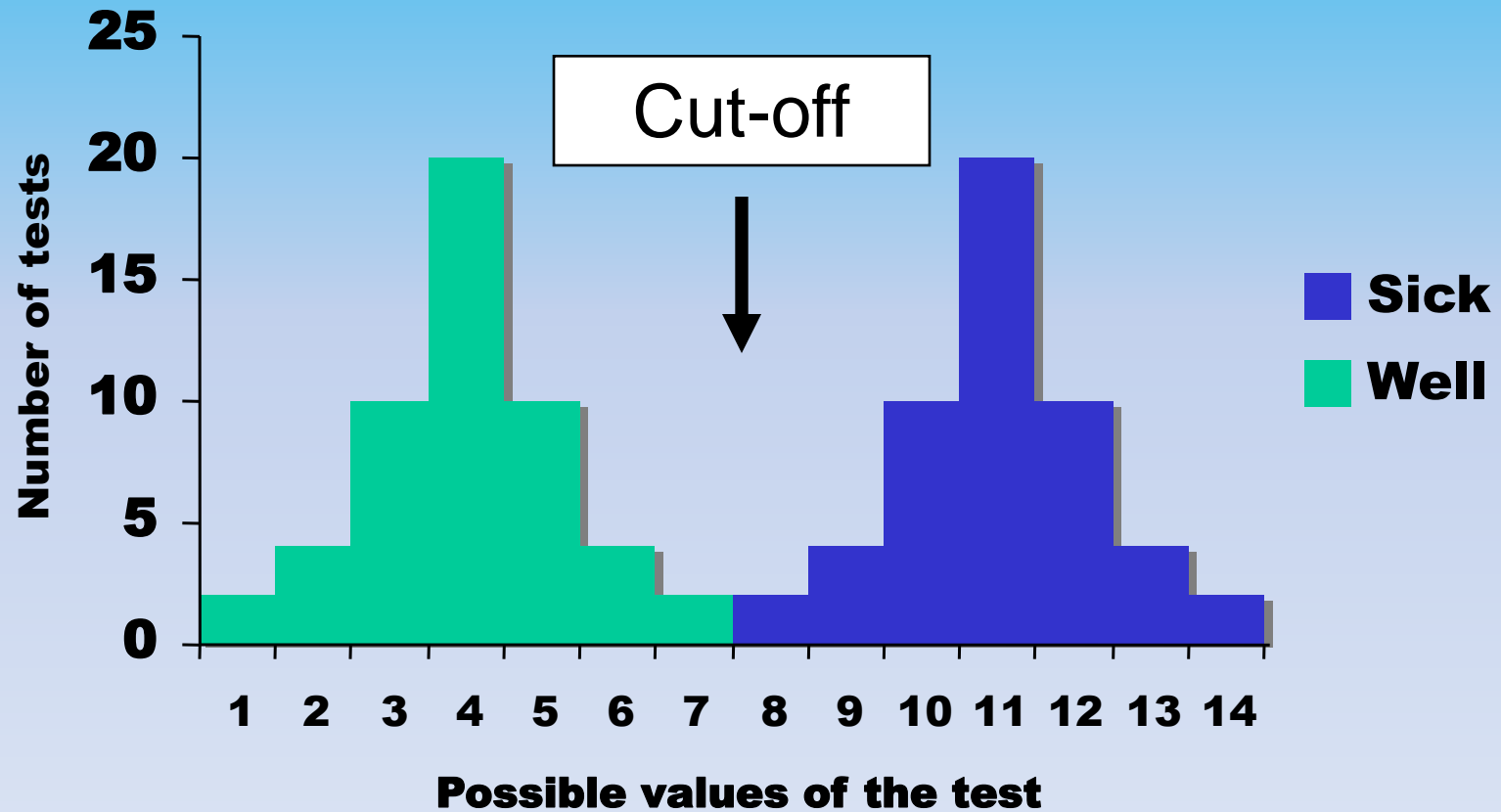
Positive AFP results: TP = 50

Negative AFP results: TN = 10 000

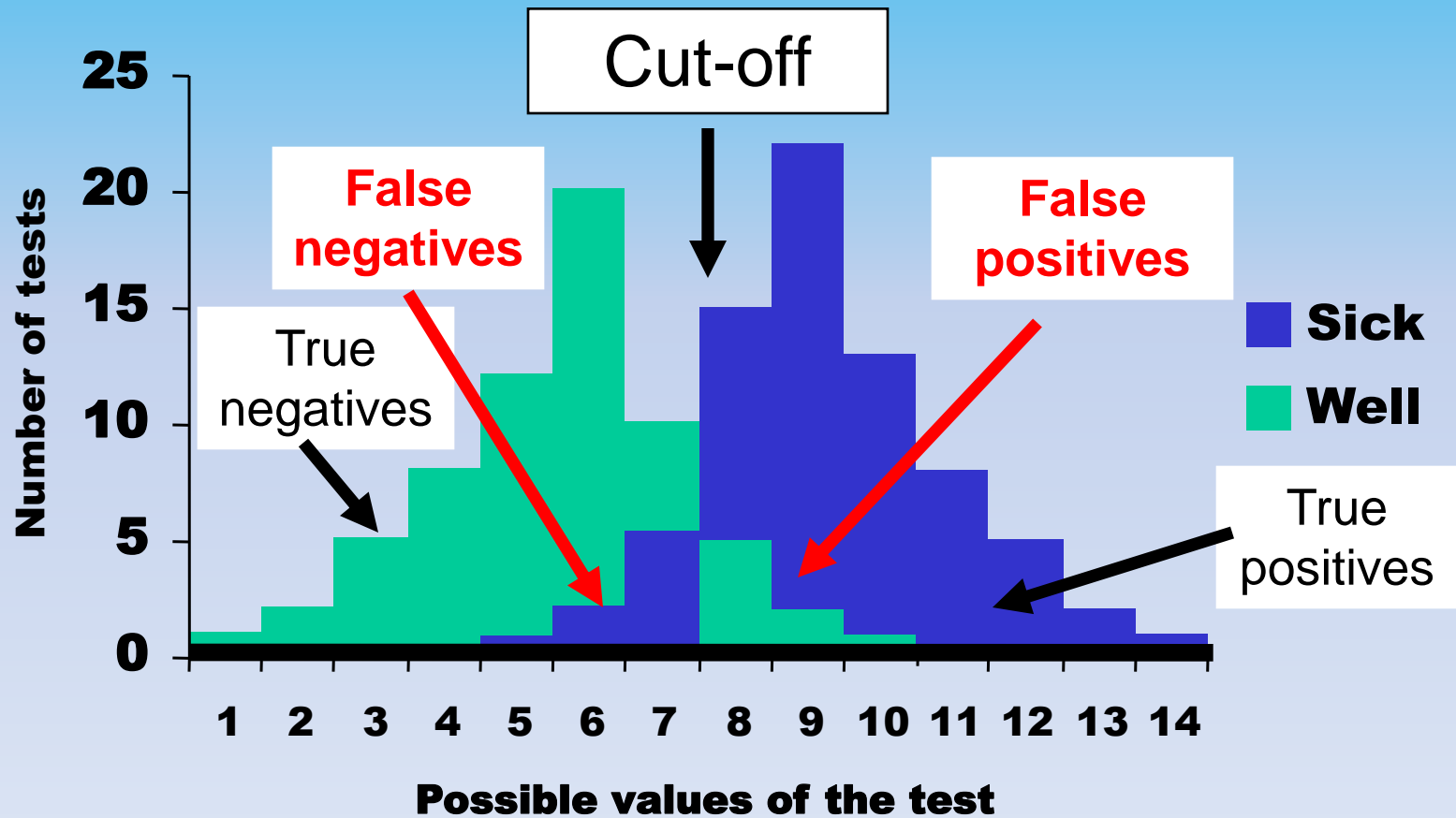
False positives: FP = 2

False negatives: FN = 5

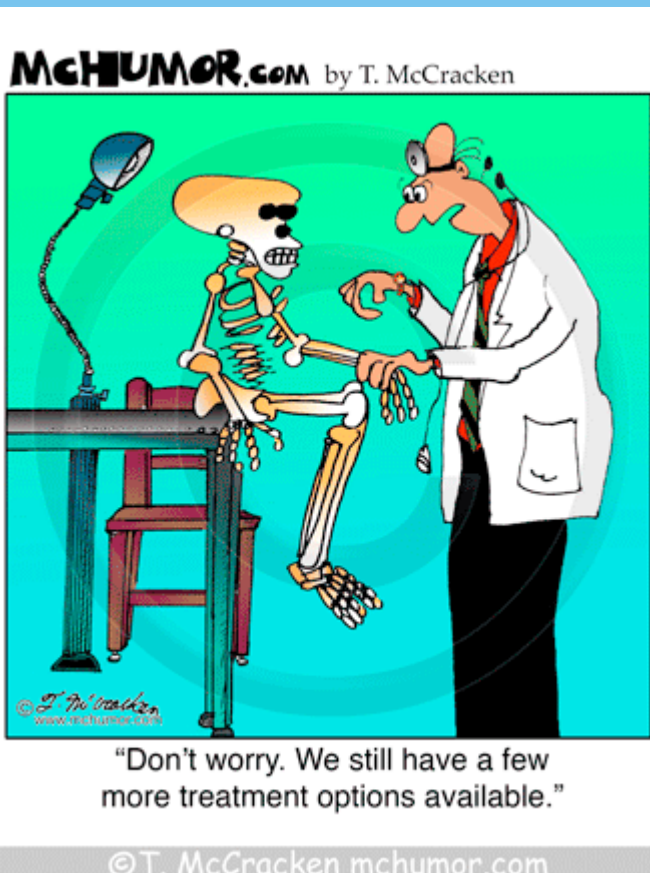
Identifying the cut-off to use with a test on the basis of panel analysis: Ideal case



Identifying the cut-off to use with a test on the basis of panel analysis: Real case



The „problem of diagnostic tests”

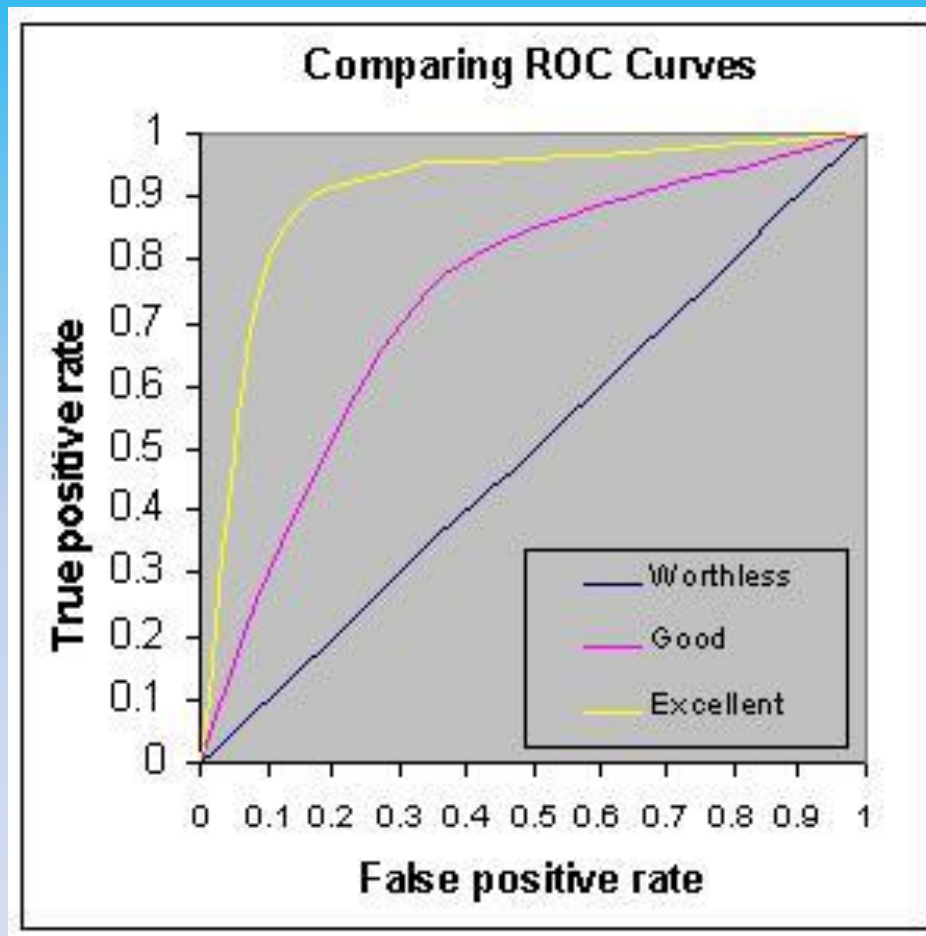


The tests are very good to distinguish between normal and strongly pathological results.

There may be problems with the milder cases. Our diagnosis must be based on multiple laboratory and non-laboratory results!

Do not be shy to ask help from specialist colleagues!

Receiver Operating Characteristics



Main preanalytical errors

The preparation of the patient

Diet

Body mass

Age

Medication (drugs)

Gender

Smoking

Pregnancy

Physical exercise

Race

Dehydration

Sample taking

Posture

Daily differences

Time of sample taking

Starvation

Strangulation

Infusion, injection (IV)

Capillary vs. Venous

Anticouagulant

Order

Sample preparation

Hemolysis

Lipaemia

Centrifugation

The elapsed time

Temperature

Sunlight

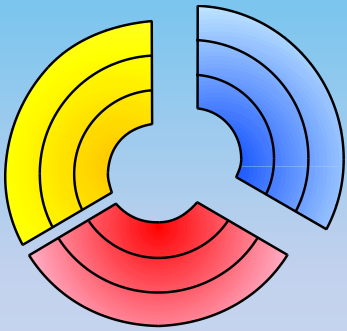
Evaporation

Distribution

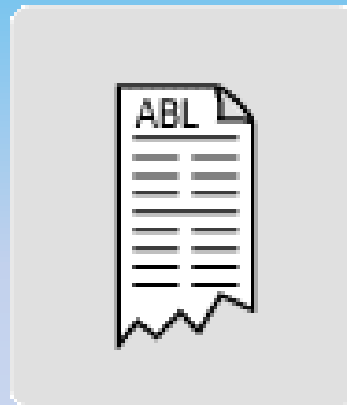
Labeling

Delivery

The preanalytical errors



- Mistakes made before the analysis...



- may alter the results....



- and result in inappropriate diagnosis and mistreatment!

Interpreting results

- NORMAL OR PATHOLOGICAL?
- IS IT DIFFERENT FROM PREVIOUS RESULTS?
- FITS CLINICAL SIGNS?



Related exam questions

1. Purpose of laboratory test requests (screening, diagnosis, differential-diagnosis, validation, monitoring).
2. Factors influencing laboratory test results. Alterations due to errors in sample collection, sample preparation and application of different analytical methodologies. The effect of individual biological variations on the test results. Patient preparation before sampling.
3. Proper method to carry out blood collection (venous, capillary) and urine collection. Type of tubes, rules to obey during sample collection. Sampling errors; recognition and troubleshooting.
4. Reference values and ranges, specificity, sensitivity and predictive value of laboratory tests.
5. Interpretation of laboratory results (results influencing the therapy, differential-diagnosis, ordering additional, confirmatory or repeated tests, panic values).