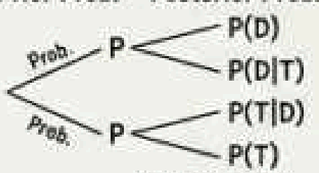


Tests and Their Interpretation

MED 535 B - Lecture 4

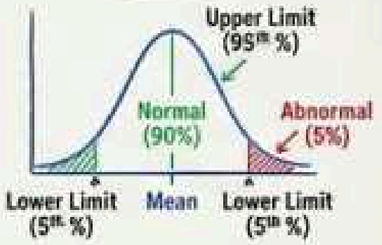
Bayesian logic

Prior Prob. Posterior Prob.



$$P(D|T) = \frac{P(T|D) \cdot P(D)}{P(T)}$$

Reference Ranges



False Positives



Not Disease.
High Anxiety.
Unnecessary Intervention.

Harm Reduction



Minimize Invasive Follow-up.
Consider Cost & Risk.

The Golden Rule of Clinical Testing

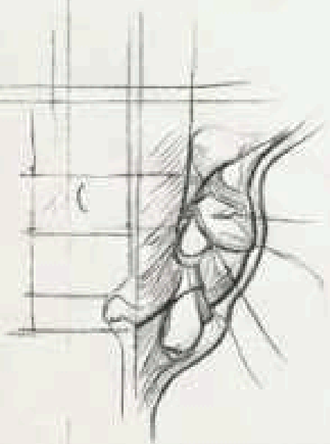
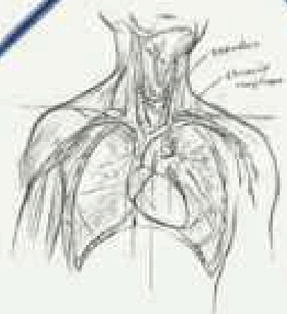
Why order a test?

- Confirm diagnosis
- Exclude diagnosis
- Assess severity
- Monitor treatment
- Screen for disease

Will the answer change what happens next?

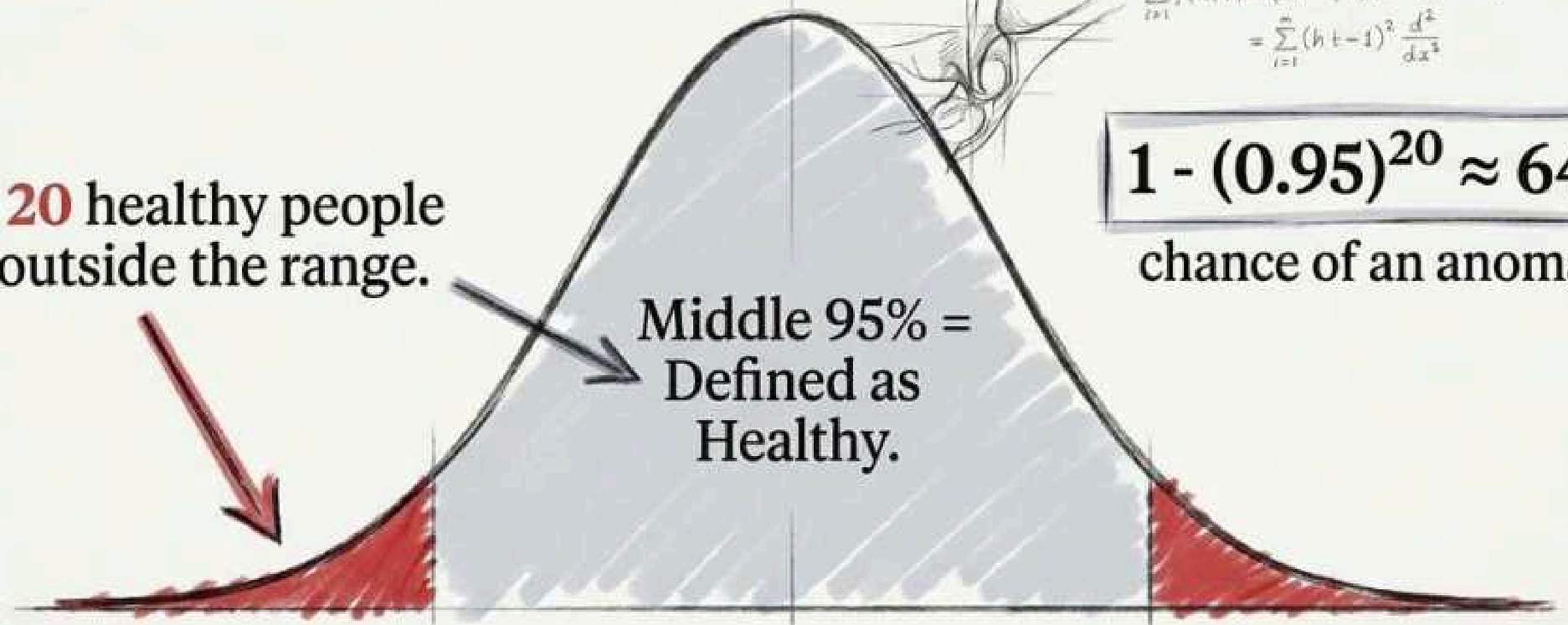
YES → **Proceed.**

NO → **A test that will not change management is rarely worth doing.**

The Statistical Trap of Reference Ranges

1 in 20 healthy people fall outside the range.



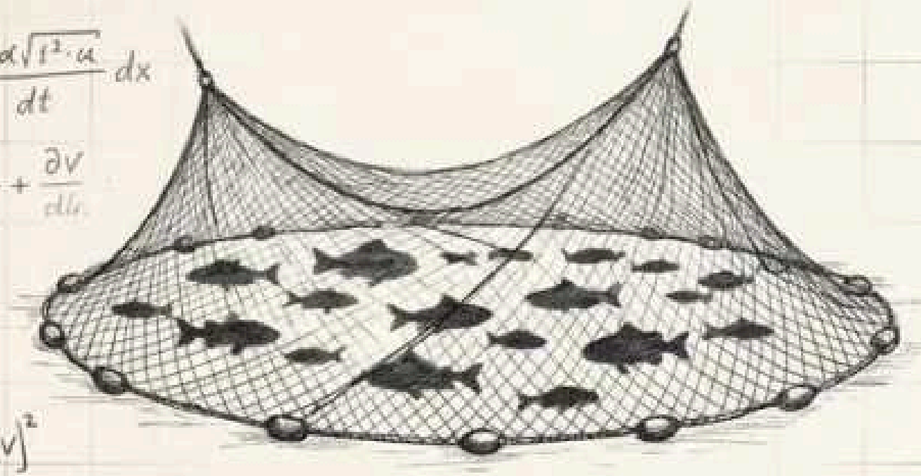
$$1 - (0.95)^{20} \approx 64\%$$

chance of an anomaly

Order 20 tests on a healthy person, and the chance that at least one is abnormal is high. Abnormal ≠ Disease.

Diagnostic Accuracy and the Power to Rule In or Out

¶ 4.3



Proportion of people with a disease who test positive.



Proportion without the disease who test negative.

SnNout

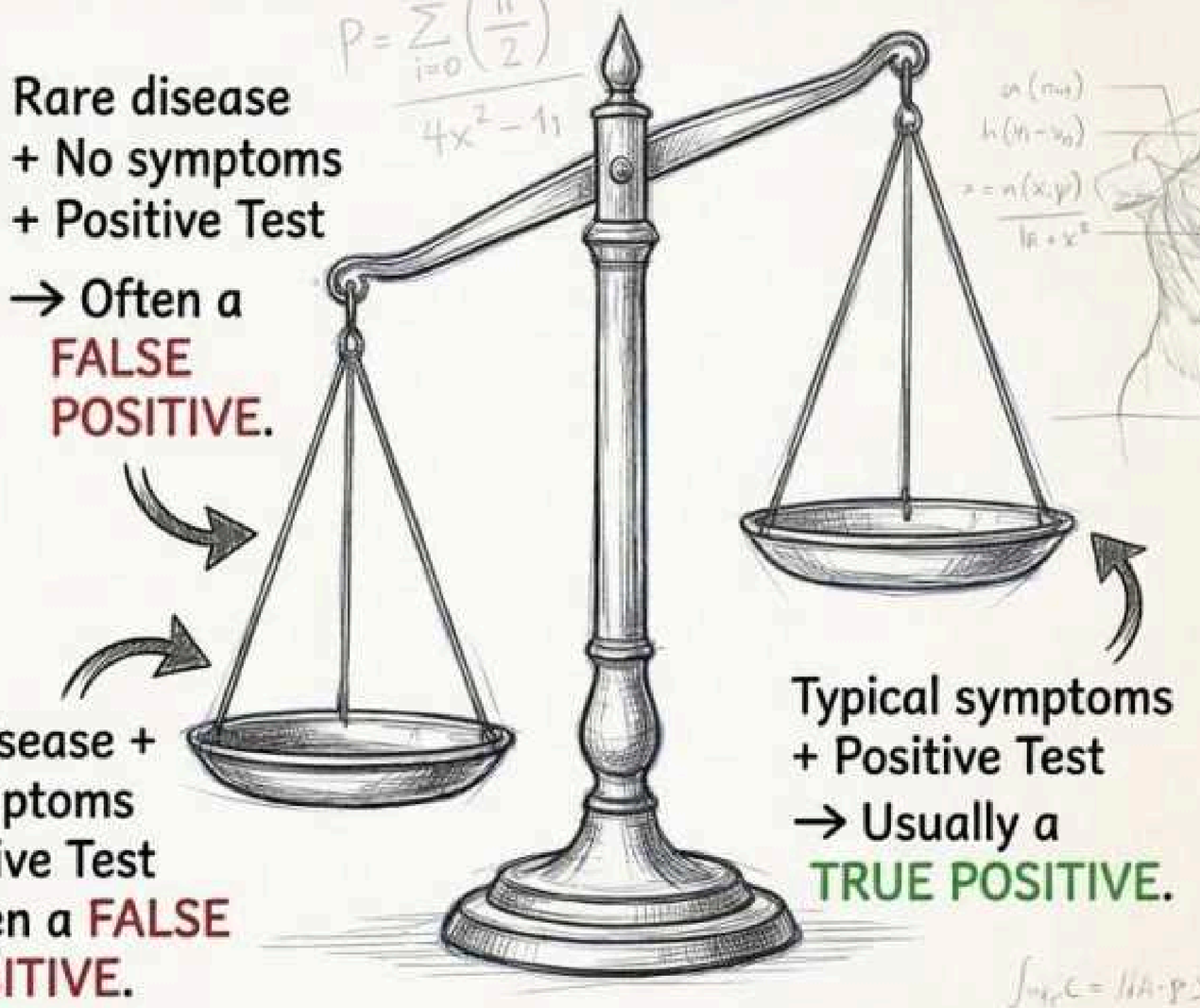
A highly Sensitive test, when Negative, rules out the condition.

SpPin

A highly Specific test, when Positive, rules in the condition.

$$P(\text{Disease}|\text{Test}) = \frac{P(\text{Test}|\text{Disease})\,P(\text{Disease})}{P(\text{Test})}$$

Thomas Bayes, 18th Century.



The same positive result means very different things in different patients.
The result updates a probability; it does not dictate the truth.

Context is Everything: The D-Dimer Case Study

D-Dimer (Med 525 B): Very Sensitive, Not Specific.

Path A (Low Risk Patient)

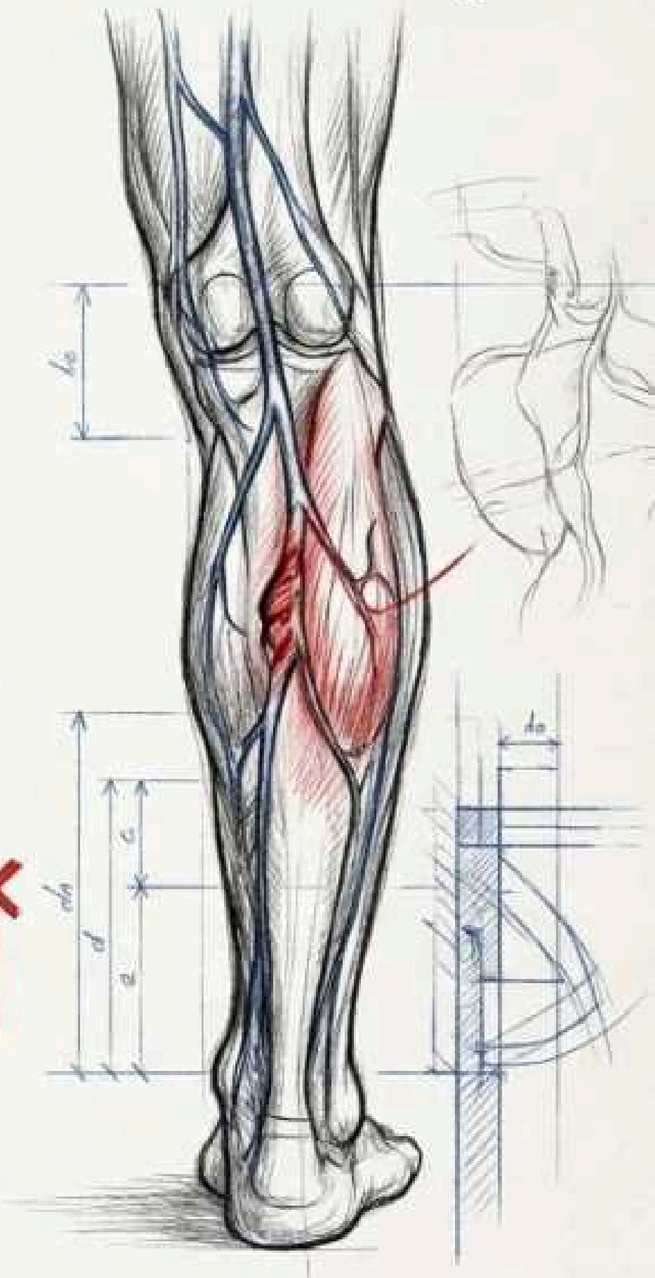
↓

Negative Result → **Safely excludes clot without a scan. (SnNout)** ✓

Path B (High Risk or Hospitalized Patient)

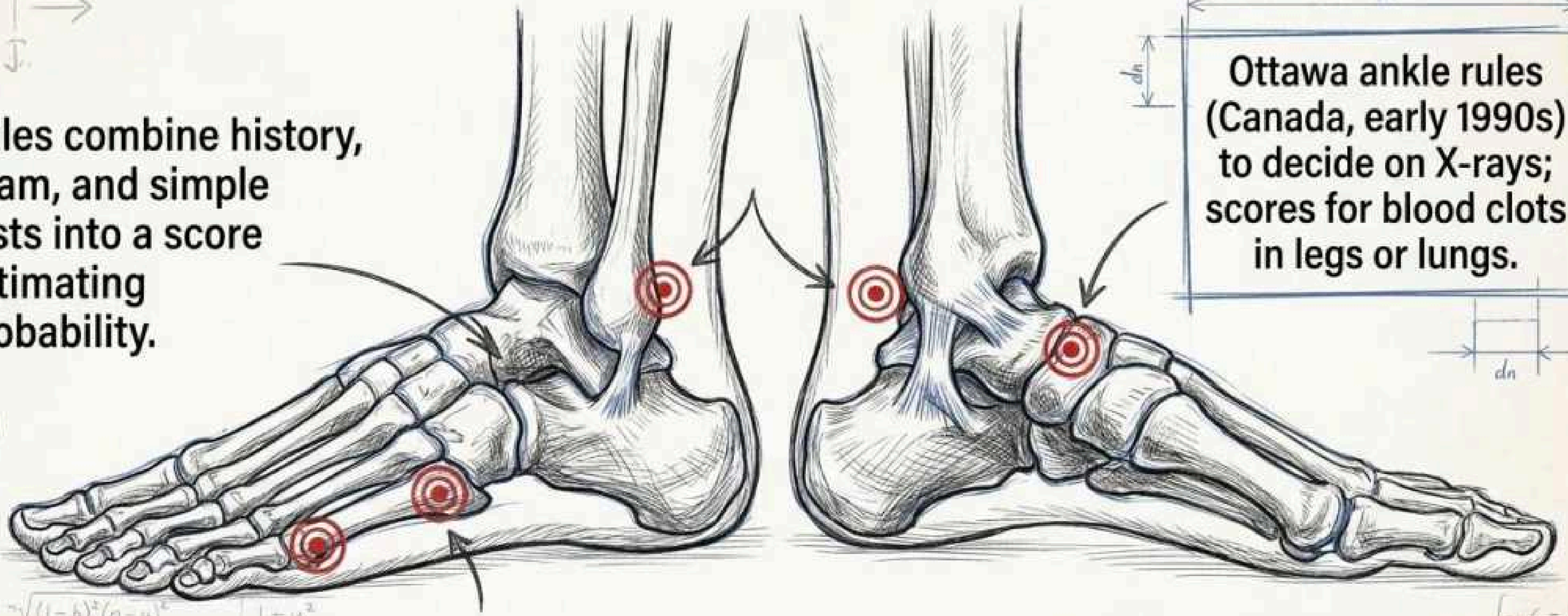
→ **Negative Result** → **Not reassuring enough.** → **The test is unhelpful in this population.** ✗

→ **Positive Result** → **Often positive for other reasons.**



Clinical Decision Rules: Structuring Probability

Rules combine history, exam, and simple tests into a score estimating probability.

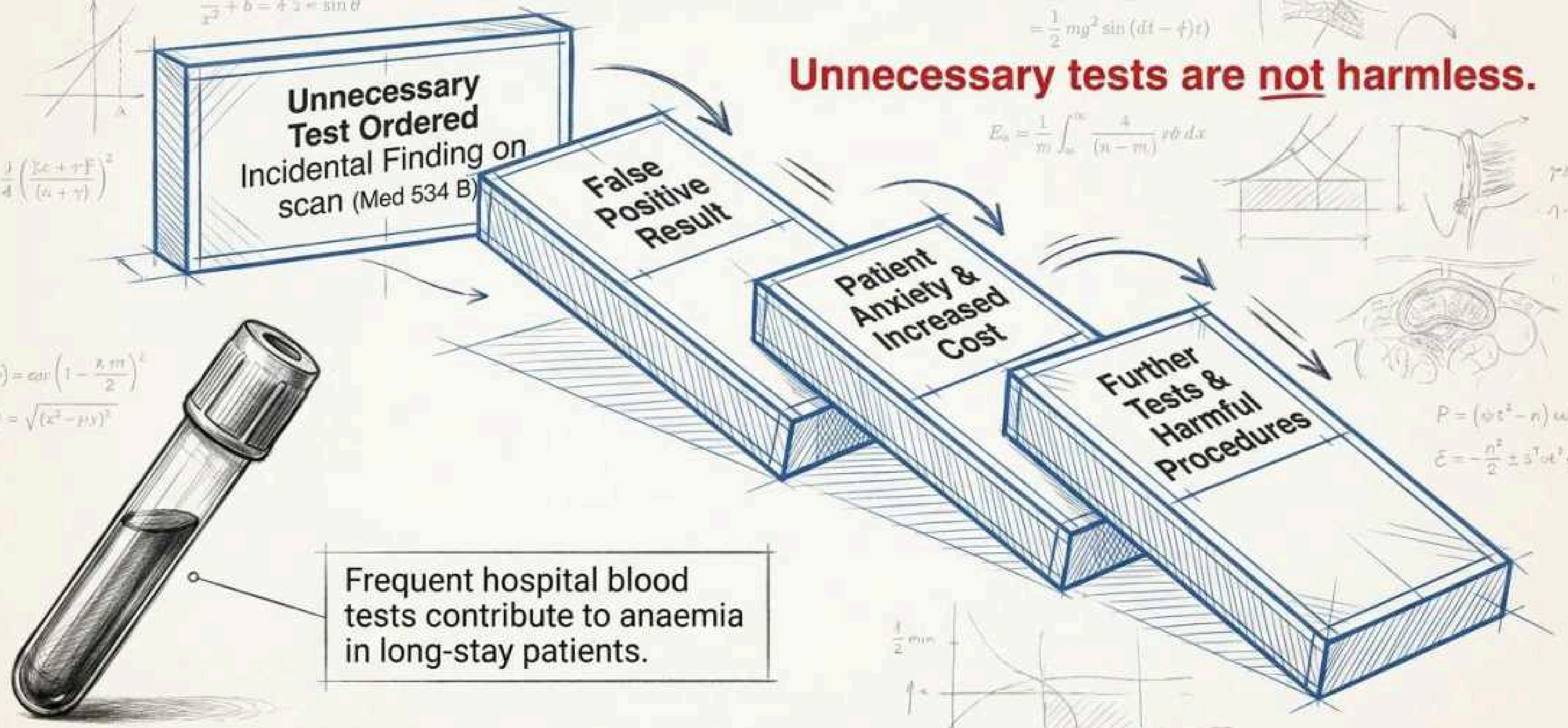


Ottawa ankle rules (Canada, early 1990s) to decide on X-rays; scores for blood clots in legs or lungs.

Makes reasoning more consistent and reduces unnecessary testing.

The Diagnostic Cascade

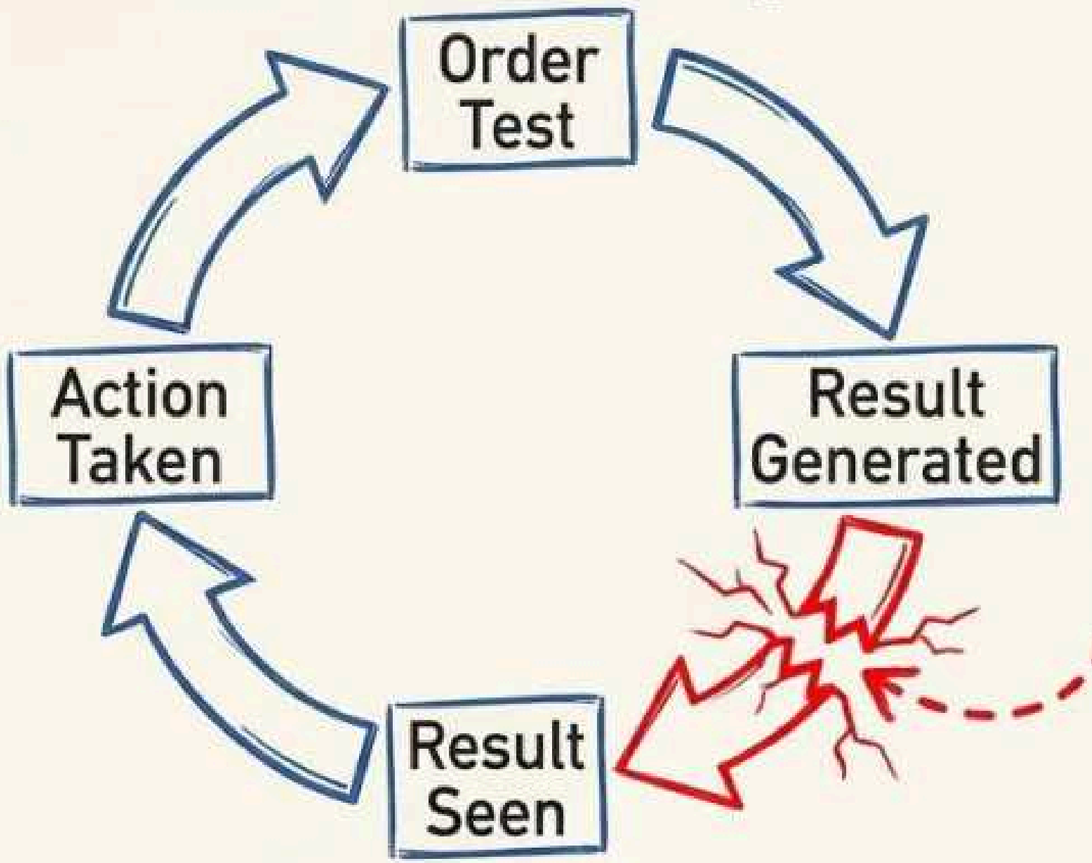
Unnecessary tests are not harmless.



Frequent hospital blood tests contribute to anaemia in long-stay patients.

Closing the Loop: The Danger of Missed Follow-up

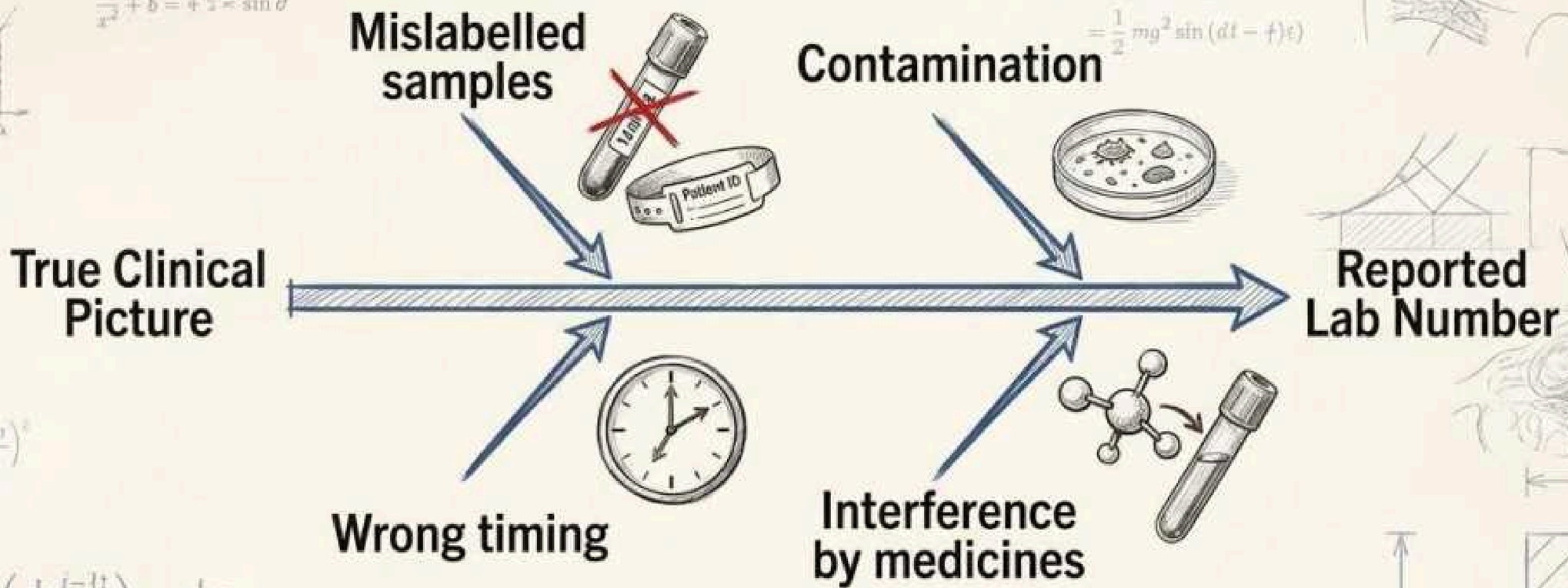
¶ 4.8



Major source of diagnostic error: Missed or delayed follow-up of abnormal results.

Essential requirements: Systems tracking whether results have been seen and acted on, coupled with clear responsibility for who will act.

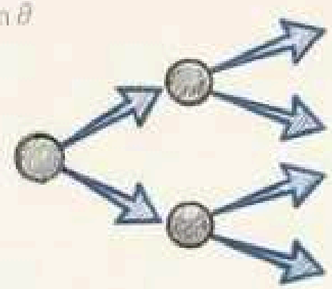
Anatomy of a Laboratory Error



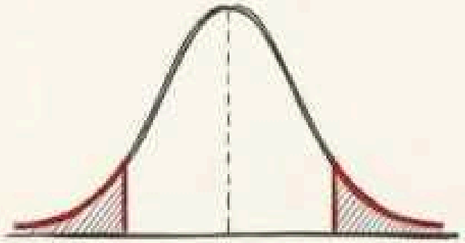
> “If a result does not fit the clinical picture, question it. Repeat it rather than acting blindly.”

Treat the patient, not the number.

Synthesis: A Framework for Clinical Testing



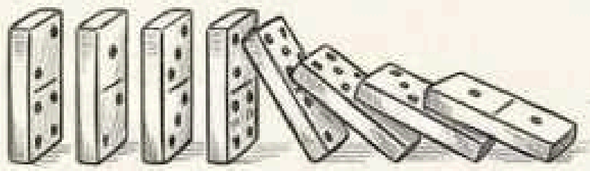
Tests must change management.



Reference ranges exclude some healthy people.



Meaning depends entirely on pretest probability.



Unnecessary tests cause cascades of harm.

Next Lecture → Communication and Shared Decisions.