



SENSITIVITY & SPECIFICITY

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AGENDA

INTRODUCTION

IMPORTANCE

FACTORS AFFECTING

SENSITIVITY AND

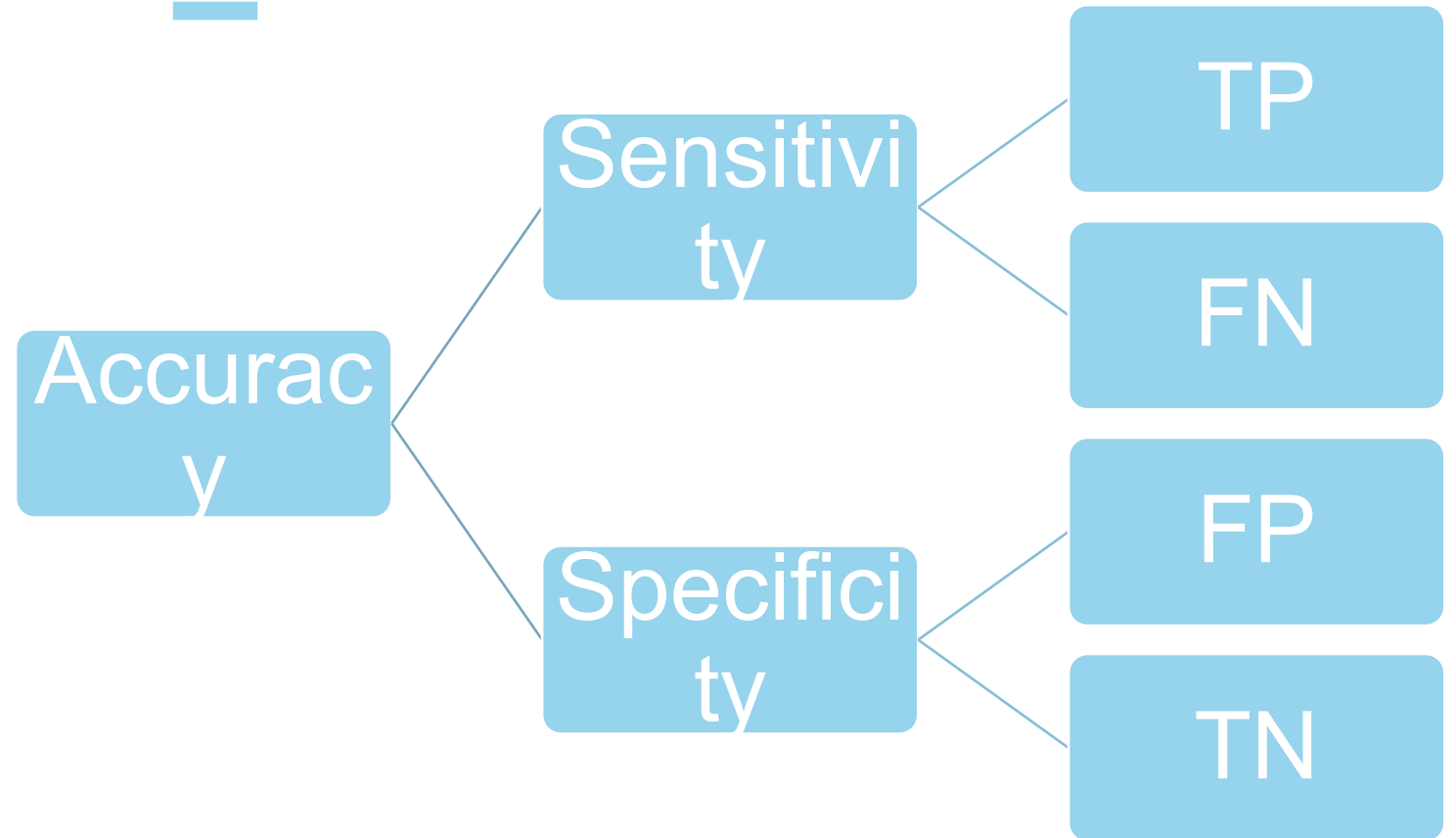
SPECIFICITY

COMPUTATION



SCREENING TEST

Aim of screening test is to detect disease among healthy individuals.



SENSITIVITY

Outcome	Disease Present (Condition Positive)	Disease Absent (Condition Negative)
Test Positive	True Positive (TP) (a)	False Positive (FP) (b)
Test Negative	False Negative (FN) (c)	True Negative (TN) (d)

- **True Positives (TP):** These are cases where the test correctly identifies a person as having the disease.
- **False Negatives (FN):** Population is having disease but screening test result gives negative result
- **False Positive (FP):** Population not having disease but screening test result gives positive result
- **True negative (TN):** These are cases where the test correctly identifies a person as not having the disease.
- **Total population having Disease** = $a+c=TP+FN$
- **Total population not having Disease** = $b+d=FP+TN$

SENSITIVITY

The sensitivity of a test refers to its ability to correctly identify individuals who have a specific disease or condition. It is a measure of the test's effectiveness at detecting true positives.

Specifically, sensitivity is defined as the proportion of true positives (people who have the disease and test positive) among all those who actually have the disease. It is usually expressed as a percentage.

$$\text{Sensitivity} = \frac{a}{a+c}$$

$$\text{Sensitivity} = \frac{\text{True Positives (TP)}}{\text{True Positives (TP)} + \text{False Negatives (FN)}}$$

Importance of Sensitivity in

Accurate Diagnosis

High sensitivity helps ensure that tests can correctly identify the presence of a condition, reducing false negatives and improving diagnostic accuracy.

Early Detection

Sensitive tests can identify issues at earlier stages, enabling timely intervention and potentially better health outcomes for patients.

Informed Decisions

Sensitivity data informs important medical and clinical decisions, allowing healthcare providers to make more confident and appropriate treatment recommendations.

Interpretation of

Sensitivity

To calculate the sensitivity of a test, we need to consider the number of true positives (TP) and false negatives (FN) identified by the test. Sensitivity is the proportion of true positives out of all the actual positive cases.

75%

Sensitivity

The percentage of actual positive cases that are correctly identified by the test.

25%

False Negative Rate

The percentage of actual positive cases that are missed by the test.

By understanding the sensitivity of a test, healthcare providers can better interpret the results and make more informed decisions about treatment and further testing.

Interpreting Sensitivity

Results

Sensitivity results indicate how effectively a test can detect a specific condition or outcome. High sensitivity means the test is good at identifying true positives, while low sensitivity suggests the test may miss cases.

Interpreting sensitivity requires considering the test's intended use and the consequences of false negatives.

Sensitive tests are useful for screening, while less sensitive tests may be better for confirmation.

Limitations of

Diagnostic Accuracy

1

Limited Predictive Value

High sensitivity alone does not guarantee an accurate test result. It must be considered alongside specificity to determine the overall predictive value.

2

Affected by Prevalence

Sensitivity can be influenced by the prevalence of the condition in the tested population, leading to variable performance across different settings.

3

Potential for False Positives

A highly sensitive test may identify more true positives, but also increase the likelihood of false positive results, requiring additional confirmatory testing.

SPECIFICITY

The specificity of a test measures its ability to correctly identify individuals who do not have a specific disease or condition. It is a measure of the test's effectiveness at detecting true negatives, i.e., accurately confirming that an individual is disease-free when they do not have the disease.

$$\text{Specificity} = \frac{d}{b+d}$$

$$\text{Specificity} = \frac{\text{True Negatives (TN)}}{\text{True Negatives (TN)} + \text{False Positives (FP)}}$$

Specificity in Diagnostic

Clinical Relevance

High specificity ensures that a positive test result accurately indicates the presence of the target condition.

Reducing False

Positives helps minimize the identification of individuals without the condition, avoiding unnecessary interventions.

Precision and

Accuracy, along with sensitivity, contributes to the overall reliability and precision of diagnostic tests.

Informed

Decision-Making allows healthcare providers to make well-informed decisions about patient care and treatment plans.

Sensitivity vs.

Specificity

Sensitivity

Sensitivity measures how well a test identifies true positives. It tells you the proportion of people with the condition that the test correctly identifies.

Specificity

Specificity measures how well a test identifies true negatives. It tells you the proportion of people without the condition that the test correctly identifies.

Tradeoff

There is often a tradeoff between sensitivity and specificity. Increasing one typically decreases the other. The right balance depends on the test's purpose and the consequences of false results.

Interpretation

High sensitivity is important when you want to minimize false negatives, while high specificity is important when you want to minimize false positives.

Practical Applications

Healthcare

Sensitivity and specificity are crucial in medical diagnostics, helping healthcare providers make informed decisions and ensure accurate patient care.



Data Science

These metrics are essential for evaluating the performance of marketing campaigns, product launches, and other business initiatives, allowing data-driven decision making.

Positive Predictive Value (PPV)

Outcome	Disease Present (Condition Positive)	Disease Absent (Condition Negative)
Test Positive	True Positive (TP) (a)	False Positive (FP) (b)
Test Negative	False Negative (FN) (c)	True Negative (TN) (d)

Positive Predictive Value (PPV) is the probability that subjects with a positive test truly have the disease. It is defined as the proportion of true positives (those who have the disease and test positive) among all the test positives (both true positives and false positives).

$$PPV = \frac{a}{a+b}$$

$$PPV = \frac{\text{True Positives (TP)}}{\text{True Positives (TP)} + \text{False Positives (FP)}}$$

Negative Predictive Value (NPV)

Outcome	Disease Present (Condition Positive)	Disease Absent (Condition Negative)
Test Positive	True Positive (TP) (a)	False Positive (FP) (b)
Test Negative	False Negative (FN) (c)	True Negative (TN) (d)

Negative Predictive Value (NPV) is the probability that subjects with a negative test truly do not have the disease. It is defined as the proportion of true negatives (those who do not have the disease and test negative) among all the test negatives (both true negatives and false negatives).

$$\text{NPV} = \frac{d}{c+d}$$

$$\text{NPV} = \frac{\text{True Negatives (TN)}}{\text{True Negatives (TN)} + \text{False Negatives (FN)}}$$

SUMMARY

Sensitivity and specificity are key metrics used to evaluate the accuracy of diagnostic tests. Sensitivity measures the test's ability to correctly identify individuals who have a specific disease, focusing on minimizing false negatives. It is expressed as the proportion of true positive results among those who actually have the disease.

On the other hand, specificity measures the test's ability to correctly identify individuals who do not have the disease, aiming to reduce false positives. It is calculated as the proportion of true negative results among those who are disease-free. Together, sensitivity and specificity provide a comprehensive overview of a test's diagnostic accuracy, helping healthcare providers make informed decisions about disease detection and management.

Positive Predictive Value (PPV) is the probability that individuals with a positive test result actually have the disease. Negative Predictive Value (NPV) is the probability that individuals with a negative test result truly do not have the disease.

A SCREENING TOOL IS USED TO DETECT A COMMON CARDIOVASCULAR CONDITION. IT CORRECTLY IDENTIFIES 80 INDIVIDUALS WITH THE CONDITION BUT FAILS TO IDENTIFY 20 OTHERS WHO HAVE THE CONDITION. ADDITIONALLY, IT INCORRECTLY IDENTIFIES 10 HEALTHY INDIVIDUALS OUT OF 100 HEALTHY INDIVIDUALS AS HAVING THE CONDITION. WHAT IS THE SPECIFICITY OF THIS SCREENING TOOL?

- 80%
- 90%
- 88.8%
- 66.7%

	D+	D-
ST+	80	10
ST-	20	90

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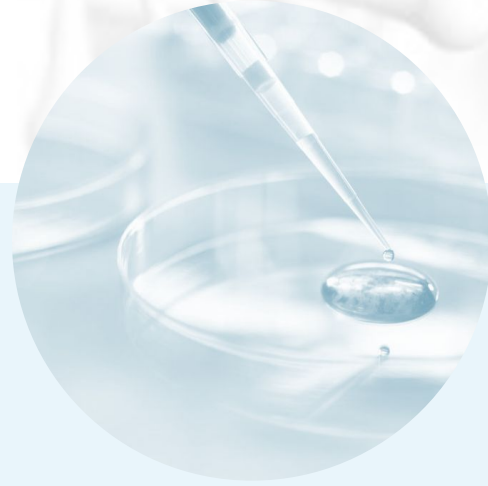
- 80%
- 90%
- 88.8%
- 66.7%

MOST POWERFUL PARAMETER OF THE SCREENING TEST IS:

- Sensitivity
- Specificity
- Positive predictive value
- Negative predictive value

VALIDITY OF A TEST IS BASED UPON ALL EXCEPT:

- Sensitivity
- Specificity
- Precision
- Accuracy



THANK YOU

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