Properties of a Screening Test

**Validity:** Validity refers to the degree to which the test measures the characteristic it is supposed to measure.

- In other words, the validity indicates the usefulness of the test.
- Is the ‘dropping a ruler’ experiment valid measure of reaction time?

**Accuracy:** Accuracy is the proximity of measurement results to the true value.

**Reliability:** Reliability refers to the consistency of a measure.

- In other words, a measure is said to have a high reliability if it produces similar results under consistent conditions.

Example:

If the scale is reliable it tells you the same weight every time you step on it as long as your weight has not actually changed. However, if the scale is not working properly, this number may not be your actual weight. If that is the case, this is an example of a scale that is reliable, or consistent, but not valid. For the scale to be valid and reliable, not only does it need to tell you the same weight every time you step on the scale, but it also has to measure your actual weight.

Example sourced from: http://www.cal.org/flad/tutorial/reliability/3andvalidity.html
Criteria for a screening test:

Wilson’s criteria for screening
- the condition should be an important health problem
- the natural history of the condition should be understood
- there should be a recognisable latent or early symptomatic stage
- there should be a test that is easy to perform and interpret, acceptable, accurate, reliable, sensitive and specific
- there should be an accepted treatment recognised for the disease
- treatment should be more effective if started early
- there should be a policy on who should be treated
- diagnosis and treatment should be cost-effective
- case-finding should be a continuous process

WHO criteria for a good screening test:
- the condition screened for should be an important one
- there should be an acceptable treatment for patients with the disease
- the facilities for diagnosis and treatment should be available
- there should be a recognised latent or early symptomatic stage
- there should be a suitable test or examination which has few false positives - specificity - and few false negatives - sensitivity
- the test or examination should be acceptable to the population
- the cost, including diagnosis and subsequent treatment, should be economically balanced in relation to expenditure on medical care as a whole

Criteria pdf sourced from http://www.ldh.nhs.uk/:
**Confirmatory Testing:** is the testing used to validate the results of another test. The confirmatory test must be based on different examining principles.

**Appropriateness:** of a test is how suitable or fitting a test is for a particular purpose.

**Lead-time Bias:** Lead-time bias occurs if testing increases the perceived survival time without affecting the course of the disease.

![Lead-time Bias](https://upload.wikimedia.org/wikipedia/commons/0/02/Lead_time_bias.svg)

**Length-time Bias:** Length-time bias can occur when the lengths of intervals are analyzed by selecting intervals that occupy randomly chosen points in time or space. In doing so, this process favors longer intervals and so skews the data.

![Length-time Bias](https://en.wikipedia.org/wiki/Length_time_bias#/media/File:Length_time_bias.svg)

Caption: Length time bias in cancer screening: Screening appears to lead to better survival even if no effective treatment is given.
**Screening vs diagnostic tests:**

The primary purpose of screening tests is to detect early disease or risk factors for disease in large numbers of apparently healthy individuals.

The primary purpose of diagnostic test is to establish presence (or absence) of disease as a basis for treatment decisions in symptomatic or screen positive individuals (confirmatory test).

<table>
<thead>
<tr>
<th>Purpose</th>
<th>Screening tests</th>
<th>Diagnostic tests</th>
</tr>
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<tbody>
<tr>
<td><strong>Target population</strong></td>
<td>Large numbers of asymptomatic, but potentially at risk individuals</td>
<td>Symptomatic individuals to establish diagnosis, or asymptomatic individuals with a positive screening test</td>
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<tr>
<td><strong>Test method</strong></td>
<td>Simple, acceptable to patients and staff</td>
<td>maybe invasive, expensive but justifiable as necessary to establish diagnosis</td>
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<tr>
<td><strong>Positive result threshold</strong></td>
<td>generally chosen towards high sensitivity not to miss potential disease</td>
<td>Chosen towards high specificity (true negatives). More weight given to accuracy and precision than to patient acceptability</td>
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<tr>
<td><strong>Positive result</strong></td>
<td>Essentially indicates suspicion of disease (often used in combination with other risk factors) that warrants confirmation</td>
<td>Result provides a definite diagnosis</td>
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<tr>
<td><strong>Cost</strong></td>
<td>Cheap, benefits should justify the costs since large numbers of people will need to be screened to identify a small number of potential cases</td>
<td>Higher costs associated with diagnostic test may be justified to establish diagnosis</td>
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