Screening
L1

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Learning Objectives

- Define screening, principles, types, screening tests and criteria.
- Analysis of screening and the terms used to evaluate screening test validity … by sensitivity, specificity, PPV, NPV …..

what is screening ??

"Is the process of a *PRESUMPTIVE* identification of *UNRECOGNIZED* disease or defect by a systematic application of *tests, exams or inquiry procedures* which can be *RAPIDLY* applied to *"apparently well population" or "people at risk" of developing a disease.* In order to sort out them into 2 categories:

1- Those who *PROBABLY* have a disease

2- Those who *PROBABLY* do not

Screening aims:

- To detect early disease before it becomes symptomatic (timely detection & intervention).

- Is an important aspect of prevention.

What level of prevention does screening serve?

- ***Primary prevention***:

✓ "Person with risk factors"

✓ Aims to "prevent the occurrence of disease".

examples: ??

Can reduce the occurrence of disease??

- ***Secondary prevention***:

✓ "persons with unrecognized disease"

✓ Aims to "prevent the occurrence of adverse outcomes"

Can reduce the occurrence of disease??

Screening process principles:

- **Apparently normal population.**
- **The choice of disease for which to screen;**
- **Rapidly applied screening test to the "apparently healthy" people.**
- **The disease is generally less severe, why?.**
- ***Should we start treatment now?***
- **Facilities for confirmation of diagnosis must be available. So diagnostic workup started after screening tests.**

- **Is screening for any disease??**

Criteria of disease under screening:

1. **Disease with a high public health importance**
2. **Disease with a detectable preclinical phase**
3. **Availability of *screening test.***
3. **Availability of effective, acceptable, and safe early treatment ;**
4. **Early treatment should be more effective than later.**

Screening test ..

- *Is specific technology .. Lab test, physical observation or questionnaire, radiological procedure, etc. used to identify unrecognized disease or unrecognized risk factors for disease.*

Criteria of a Screening Test

- Should be applicable and acceptable to a large no. of individuals.
- Simple- non invasive, Inexpensive,
- Able to detect Preclinical stage, that can improve health outcomes.
- Should be valid and reliable* …….

- Does a Screening tests are diagnostic?
- What is Case-finding??

Types of Screening

1* .**Mass Screening***: **For entire pop. or** specific pop.

*E.g.: Universal newborn screening for congenital hypothyroidism.

2* .**Targeted Screening***: For specific high-risk groups.

* -E.g.: Screening for diabetes in obese individuals with a family history of DM.

3* .**Opportunistic Screening***: Screening individuals who visit PHCs, for unrelated reasons.

* -E.g.: Blood pressure screening during routine check-ups.

Key Concepts in Screening

* .**Validity*: The accuracy of the screening test in correctly identifying individuals with and without the disease.**

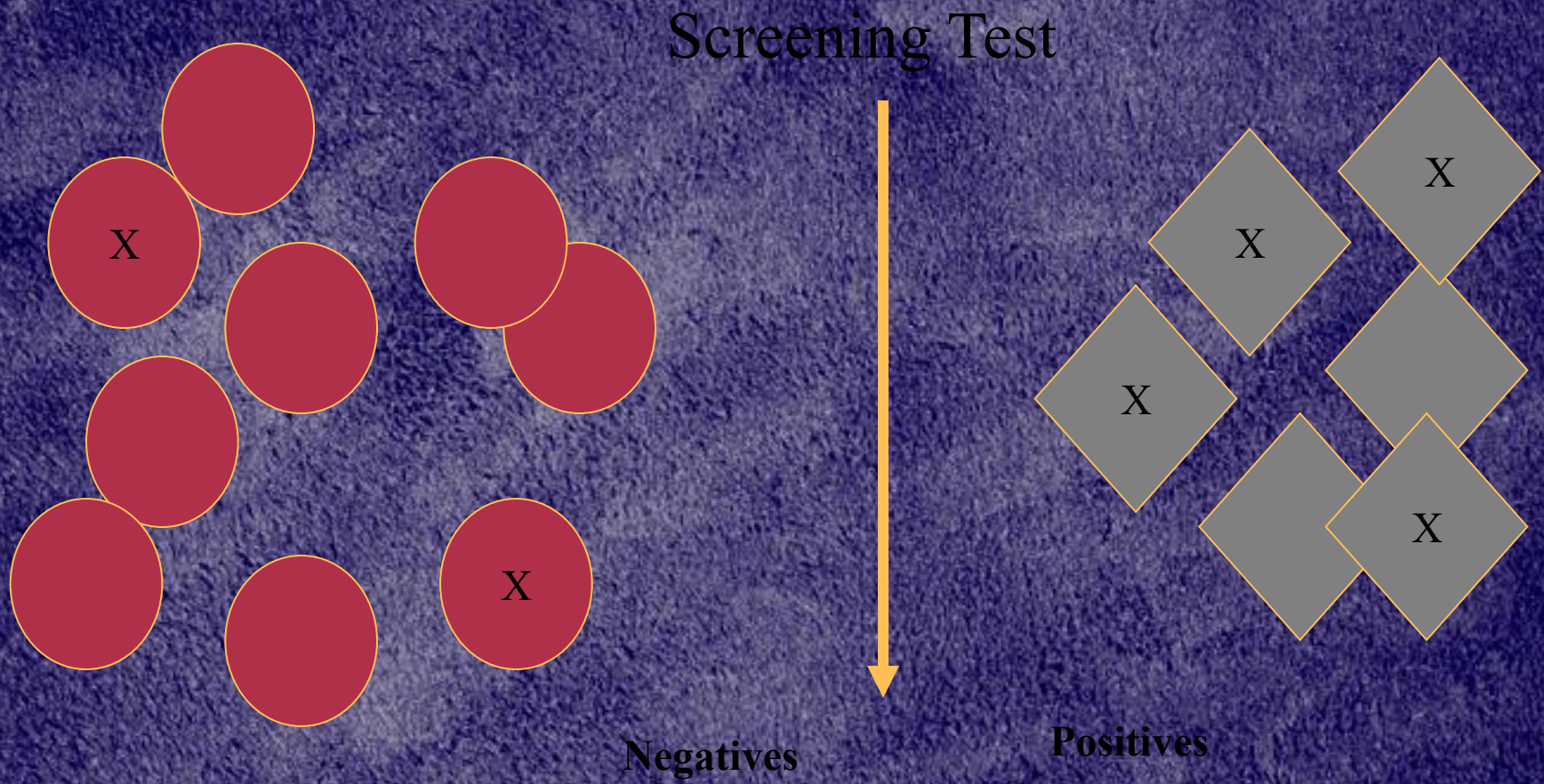
* **-Sensitivity*: The ability of the test to correctly identify those with the disease (true positive rate).**

* **-Specificity*: The ability of the test to correctly identify those without the disease (true negative rate).**

* .Reliability*: **The consistency of the screening test results when repeated under similar conditions.**

* **.Yield*:** The amount of disease detected through screening.

Yield from a Screening Test for Disease X

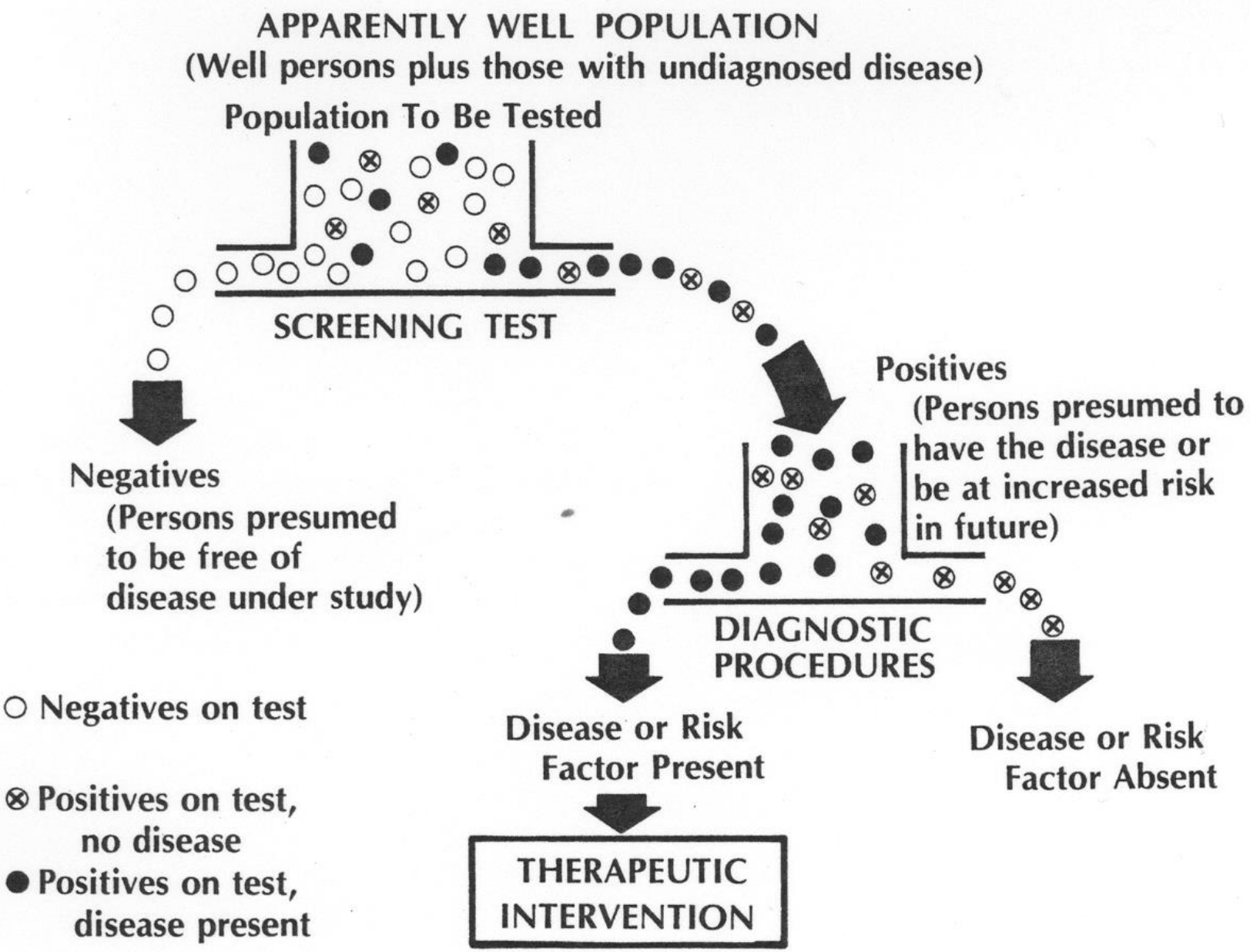


How can we confirm the diagnosis ???

- "Gold Standard" (Reference, confirmative, Definitive) Test:

- " The tests necessary to definitively establish to a high level of certainty the presence or absence of the disease in an individual" .

- e.g.: biopsy for cancer , endoscopy for duodenal ulcer , culture for bacterial infections.


APPARENTLY WELL POPULATION
(Well persons plus those with undiagnosed disease)
Population To Be Tested
SCREENING TEST
Negatives
(Persons presumed to be free of disease under study)
Positives
(Persons presumed to have the disease or be at increased risk in future)
DIAGNOSTIC PROCEDURES
Disease or Risk Factor Present
Disease or Risk Factor Absent
THERAPEUTIC INTERVENTION
○ Negatives on test
⊗ Positives on test, no disease
● Positives on test, disease present

Challenges and Limitations of Screening

1* .False Positives*: Individuals without the disease may test positive, leading to unnecessary anxiety and further testing.

2* .False Negatives*: Individuals with the disease may test negative, leading to false reassurance and delayed diagnosis.

3* .Overdetection*: Detection of disease that would not have caused symptoms or harm during a person's lifetime, leading to life disturbances, health system overload ….

Outcomes of screening programm

Screening test	Gold standard Test Disease +ve	 Disease -ve	Total
Positive	(a) True Positive	(b) False Positive	(a+b) Total Test positive
Negative	(c) False Negative	(d) True Negative	(c+d) Total Test Negative
Total	(a+c)Total Disease +ve	(b+d) Total healthy	(a+b+c+d) Grand Total

Uses of screening …

1. Early Detection of Disease

2. Reduction in Morbidity and Mortality

(reduce complications and death rates, as Ca Cx)

3. Improved quality of life.

4. Identification of risk factors for prevention or monitoring.

5. Cost-Effectiveness by preventing more severe disease and intensive treatment.

The performance of screening test is assessed by epidemiologic methods to determine the:

- **Validity (sensitivity, specificity)**

Good validity if the test have Sn &Sp of ≥ 80%.

- **PPV & NPV**

Sensitivity

- Is the ability of test to detect the true positives. "Those who have the disease"
- "Sensitivity" ….. ***(true positive rate).***
- Proportion of true cases who identified +ve by the screening test from all real patients.

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Total	(a+c)Total Disease +ve	(b+d) Total healthy	(a+b+c+d) Grand Total

Sensitivity: proportion of those with a disease who test positive among real patients.

$$\frac{(a)}{(a) + (c)} \times 100$$

	Disease present	Disease absent
Positive result	**Group (a)** True Positive	Group (b) False Positive
Negative result	**Group (c)** False Negative	Group (d) True Negative

- *Specificity:*

- proportion of persons *without* the disease who are identified –ve by the screening test from all non-diseased.
- Ability of the test to detect True negative.
- The probability that any non-diseased person will be identified as negative from all non-diseased ..
- ***specificity (true negative rate).***

Specificity:

proportion of those with true negative screening test among disease absent.

$$\frac{(d)}{(b) + (d)} \times 100$$

	Disease present	Disease absent
Screening Positive result	Group (a) True Positive	**Group (b)** False Positive
Negative result	Group (c) False Negative	**Group (d)** True Negative

Example In validating the use of chest X-rays (CXR) for the diagnosis of pulmonary TB. Against culture of Mycob TB from the sputum. To validate the use of CXR, we would have to select a certain number of TB suspects and perform both CXRs & sputum cultures on them. Let us say 200 people were screened. Interpret the results given in the table:

Chest X-rays for TB	Sputum Culture for TB		Total
	Positive	Negative	
(+)ve	80(a)	70(b)	150 (a+b)
(-)ve	20(c)	30(d)	50(c+d)
Total	100 (a + c)	100 (b + d)	200 a+b+c+d

Sensitivity:

It is :a/ (a + c) = 80/ (80 + 20) = 80 %. 80% of all those with TB are successfully picked up by chest X-rays.

Specificity:

it is : d/ (b + d) = 30 / (30 + 70) = 30%. 30% of all those without TB are picked up by chest X-rays as negative.