



Screening for diseases

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Outline

- **Concept of screening**
- **Objectives of the screening.**
- **Criteria of screening.**
- **Characteristics of screening test.**
- **Parameters of screening test.**
- **Uses of screening.**
- **Types of screening**



Concepts of screening

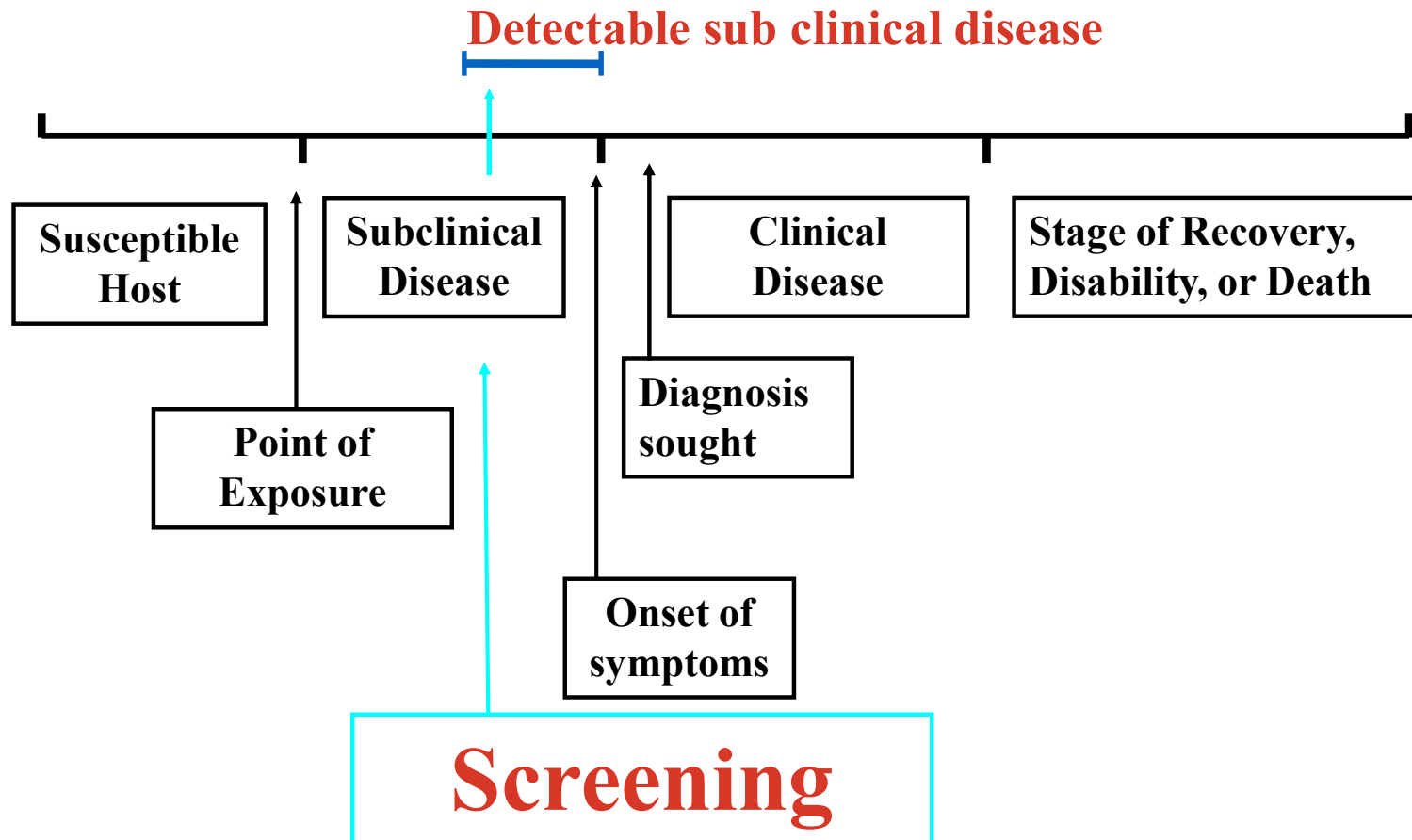
- The active search for disease among apparently healthy people is a fundamental aspect of prevention.
- The search for unrecognized disease or defect by means of rapidly applied tests, examinations or other procedures in apparently healthy individuals.



Objectives of screening

- 1- To sort out from a large group of apparently healthy persons those likely to have the disease or at increased risk of the disease under study.
- 2- To bring those who are "apparently abnormal" under medical supervision and treatment.
- 3- Screening is carried out in the hope that earlier diagnosis and subsequent treatment alters the natural history of the disease in those who are identified as "positive".

Natural history of disease





Screening and Diagnostic Tests

A screening test is only an initial examination. positive test results are referred to a physician for further diagnostic work-up and treatment.

Screening and diagnostic tests may be contrasted as in this table:

Screening	Diagnostic test
1- Done on apparently healthy person.	Done on those with indications or sick.
2- Applied to groups	Applied to single patients
3- Based on one criteria	Based on evaluation of a number of symptoms, signs and laboratory findings.
4- Less accurate.	More accurate
5- Less expensive	More expensive
6- Not a basis for treatment	Used as a basis for treatment
7- The initiative comes from the investigator.	The initiative comes from the patient with a complaint.



Criteria of screening

Based on two considerations:

- The **DISEASE** to be screened, and
- The **TEST** to be applied.



The diseases to be screened should fulfill the following criteria:

- 1- It should be an important health problem, severe, relatively common.
- 2- there should be a recognizable early asymptomatic stage.
- 3- the natural history of the disease should be adequately understood.
- 4- there is a test that can detect the disease prior to the onset of signs & symptoms.



- 5- Facilities should be available for confirmation of the Diagnosis.
- 6- There is an effective treatment.
- 7- There should be an agreed-on policy concerning whom to treat as patients.
- 8- There is good evidence that early detection and treatment reduces morbidity and mortality.
- 9- The expected benefits of early detection exceed the risks and costs.
10. In general, there should be a high prevalence of pre-clinical (early-stage) disease.



Characteristics of screening test

- The test should be:

1. Highly sensitive and specific.
2. Applicable and acceptable to a large number of individuals.
3. Simple; accomplished easily and quickly.
4. Harmless to individuals being tested.
5. Inexpensive.



Parameters of screening test

- Parameters of screening test measure the clinical usefulness of the test.
- To determine the parameters fourfold table is used, the results are tabulated according to the persons true disease status which determined by diagnostic test.

Calculating Measures (fourfold table)

	True Diagnosis		
Test Result	Disease	No Disease	Total
Positive	a(TP)	b(FP)	a+b
Negative	c (fN)	d(TN)	c+d
Total	a+c	b+d	a+b+c+d



Parameters of screening test (cont.)

- 1.Sensitivity
- 2.Specificity
- 3.Positive predictive value
- 4.Negative predictive value



1.Sensitivity

Definitions:

- It is screening test's ability to identify correctly those individuals who truly have the disease (TP).
- It is the number of individuals with the disease whose screening tests are positive to the total number of individuals with the disease under study .



Sensitivity (cont.)

- Sensitivity usually expressed as a percentage.
- It is independent of the disease prevalence in population being tested.

Calculation of sensitivity:

- Sensitivity (%) = $a / (a+c) \times 100$

Where:

a = number of individuals with the disease and +ve screening test (true +ve).

c = number of individuals with the disease and -ve screening test (false-ve).

a+c = total number of individuals with the disease.



2. Specificity

Definitions:

- It is the tests' ability to identify correctly those individuals who truly do not have the disease.(TN)
- It is the number of the individuals without the disease whose screening test are –ve to total number of individuals without the disease under study.



Specificity(cont.)

- Specificity usually expressed as a percentage.
- It is independent of the disease prevalence in population being tested.

Calculation of Specificity

- Specificity (%) = $d / (b+d) \times 100$

b = number of individuals without disease and +ve screening test (false +ve).

d = number of individuals without disease and -ve screening test (true -ve).

b+d = total number of individuals without the disease.



3. Positive predictive value

- It is the tests' ability to identify those individuals who truly have the disease (true +ve) among all individuals who have +ve screening test.
- It is the number of individuals with the disease whose screening test are +ve to total number of whose screening test are +ve.

Positive predictive value(cont.)

- Positive predictive value usually expressed as a percentage.
- Increases with increasing prevalence.

Calculation of Positive predictive value (PPV)

- $PPV (\%) = a / (a+b) \times 100$
- $A+b$ = Total number of individuals with a +ve screening test.



4. Negative predictive value (NPV)

- It is the tests' ability to identify those individuals who truly do not have the disease (true -ve) among all individuals who have -ve screening test.
- It is the number of individuals without the disease whose screening test are -ve to total number of whose screening test are -ve.



Negative predictive value(cont.)

- Negative predictive value usually expressed as a percentage.
- NPV decreased with increasing prevalence.
- Calculation:

$$\text{NPV (\%)} = d / (c + d)$$

C+d = the total number of individuals with a –ve screening test.



Uses of screening

1- Case detection:

- It is identification of unrecognized disease, which does not arise from a patient's request.
- e.g. Breast cancer, cervical cancer, diabetes mellitus, pulmonary TB.



Uses of screening (Cont.)

2- Control of disease: .

- People are examined for the benefit of others.
- e.g., screening of immigrants from infectious diseases such as tuberculosis and syphilis to protect the home population; and screening for streptococcal infection to prevent rheumatic fever.



Uses of screening (Cont.)

3-Research purposes:

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Screening may sometimes be performed for research purposes. For example, Screening may aid in obtaining more knowledge about the natural history of many chronic diseases as cancer and hypertension.



Uses of screening (Cont.)

4.Educational opportunities:

Apart from possible benefits to the individual and the acquisition of information of public health relevance, screening programmes (as for example, screening for diabetes) provide opportunities for creating public awareness and for educating health professionals.



Types of screening

1- Mass screening :

- It is screening of a whole population or a subgroup, as for all adults.
- It is offered to all, irrespective of the particular risk individual may run of contracting the disease in question.
- Mass screening for disease received strong support in the past. However, when a number of mass screening procedures were subjected to critical review, there appeared to be little justification for their use in many instances



Types of screening (Cont.)

2- High risk or selective screening:

Screening will be most productive if applied selectively to high-risk groups, the groups defined on the basis of epidemiological research.

For e.g., since cancer cervix tends to occur relatively less often in the upper social groups, screening for cancer cervix in the lower social groups could increase the yield of new cases.



Types of screening (Cont.)

3- Multiphasic screening:

Application of two or more screening tests in combination to a large number of people at one time (e.g., chemical and haematological tests on blood and urine specimens, lung function assessment, and measurement of visual acuity), all of which can be performed together.



References

- **Control of communicable diseases manual**, by Heymann DL, American Public Health Association, 19th edition, 2008.
- **Park's textbook of preventive and social medicine**, by Park K, Banarsidas Bhanot Publishers, 21st edition, 2011.