

SCREENING

→ It is "The search of un-recognized disease (or) defect by the means of rapidly applied tests, examinations (or) other procedures in apparently healthy individuals"

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→ The active search for disease among apparently healthy people is fundamental aspect of prevention.

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Uses of Screening Notes

① Case detection

→ Prescriptive Screening.
→ Identification of unrecognized disease Eg:- Neonatal Screening.

→ To sought by specific disease
Eg:- Breast cancer in pregnancy, Breast Cancer, Cervical Cancer, Iron deficiency anaemia.

② Control detection

→ Prescriptive Screening
→ People examined for benefit of others Eg:- Immigrants Screening such as Covid-19, Tuberculosis.

→ Early diagnosis permit
→ More effective
→ Reduce the spread of infection.

③ Research purpose

→ Chronic disease cases where Natural history is unknown Eg:- Cancer, Hypertension.
[Investigator should Inform the participants that no followup is applied]

④ Educational purpose

→ Creating public awareness & for educating health professionals.

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→ Screening is done to detect the disease early.

→ Early detection of a disease, means diagnosing a disease at an early stage that would usually occur in standard clinical practice.

→ This means detection of the disease at a presymptomatic stage, at which point the patient has "NO CLINICAL COMPLAINTS" & therefore no reason to seek medical care for the condition.

* The assumption in screening is that an appropriate intervention is available for the disease that is detected & that the medical intervention can be more effectively applied if the disease is detected at an early stage.

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SCREENING TEST

- ① Done apparently on healthy Individual
- ② Applied to Groups
- ③ Test results are arbitrary & final

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- ④ Based on one-Criterion (or) Cut-off point
- ⑤ Less accurate
- ⑥ Less Expensive
- ⑦ Not a Basis of Treatment
- ⑧ The Initiative Comes from the Investigator (or) Agency providing Care

DIAGNOSTIC TEST

Done on those with Indication (or) Sick

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Applied to ^{Notes} single patients, all diseases are considered

Diagnosis is not final but modified in light of new evidences, diagnosis is sum of all evidences.

Based on Evaluation of a number of Signs, Symptoms & lab. findings.

More accurate

More Expensive

Used as a Basis for treatment.

Initiative Comes from the patient with a Complaint.

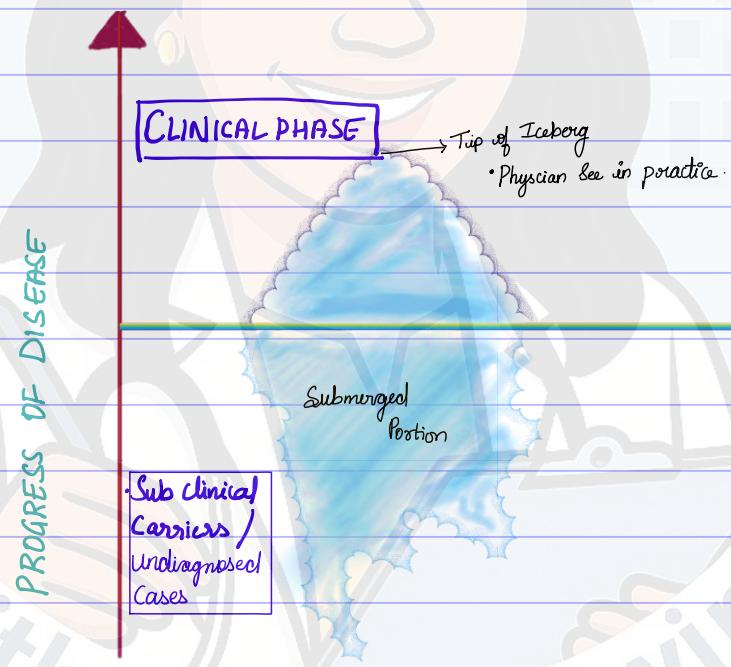
WHAT IS THE CONCEPT OF SCREENING?

→ To understand the Concept of Screening we need to understand the Concept of Iceberg phenomenon of disease :-

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→ Tip of the Iceberg :- What a physician See in practice
→ Submerged portion :-

- Subclinical
- Carriers
- Undiagnosed Cases.



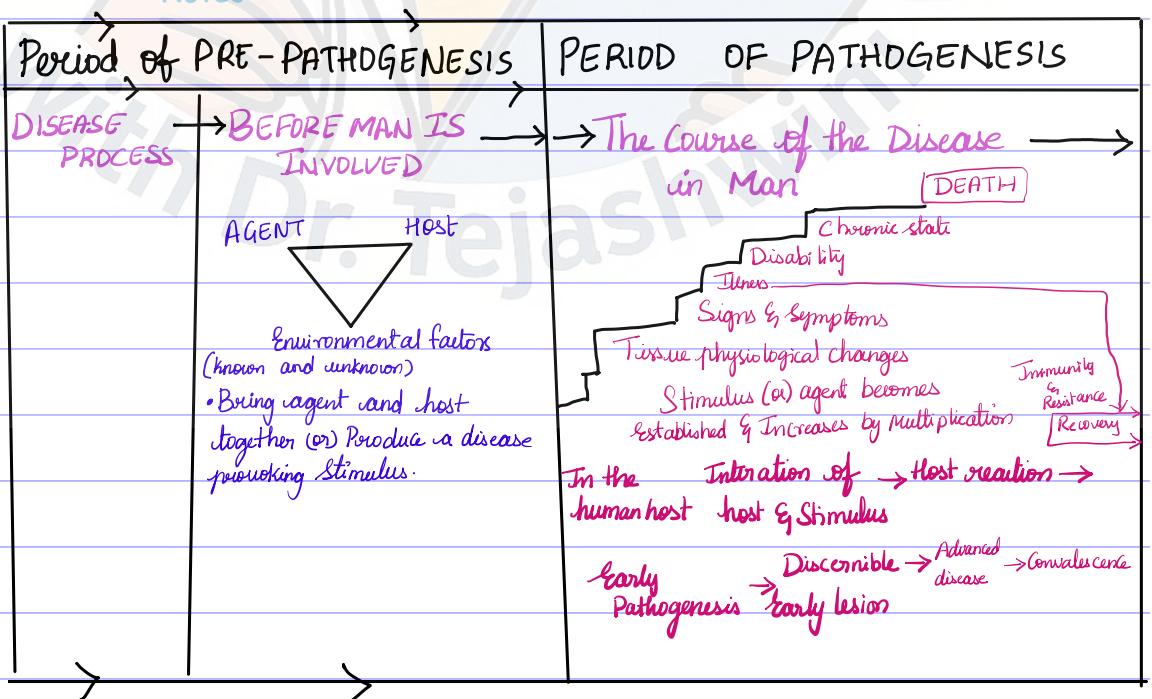
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WHAT IS THE NATURAL HISTORY OF THE DISEASE

→ It signifies the way in which a disease evolves over time from the earliest stage of its pre-pathogenesis phases to its termination as recovery, disability (or) death, in the absence of treatment (or) prevention.

→ Each disease has its own unique natural history, which is not necessarily same in all individuals.

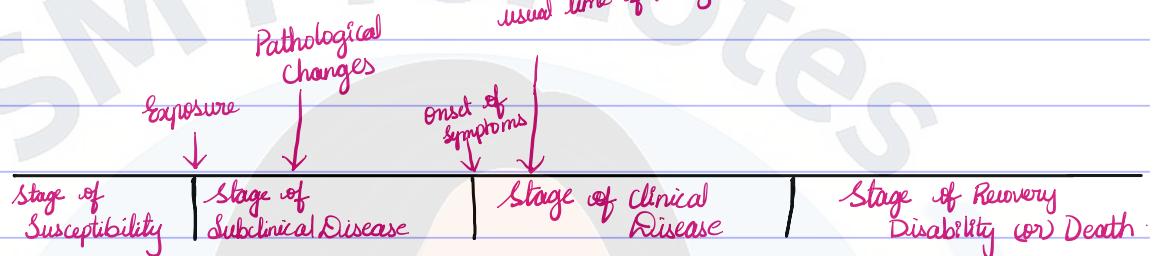
→ What a physician sees in the hospital is just an "episode" in the natural history of disease.



SPECTRUM OF DISEASE

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Spectrum of Disease:-



→ Graphic representation of manifestations of disease

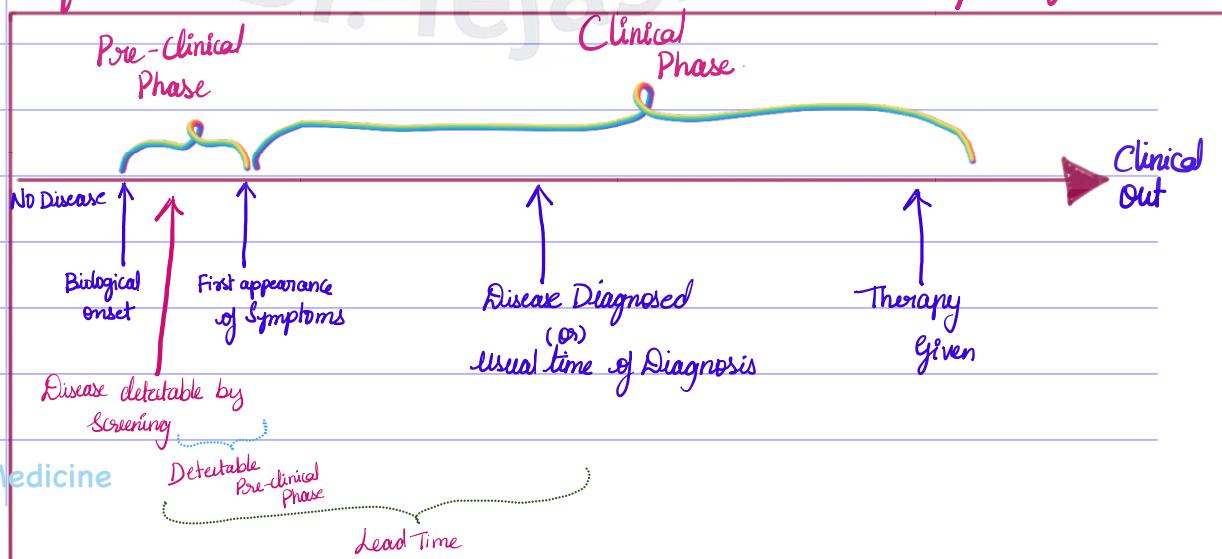
e.g.: from precursor state, to Subclinical and mild cases, to florid and very severe disease.

→ The outcome of the disease will depend on the interactions of host, agent and environmental factors.

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Q. LEAD TIME

→ The lead time is defined as the interval by which the time of diagnosis is advanced by screening for the early detection of the disease compared with the usual time of diagnosis.



CRITICAL POINT IN THE NATURAL HISTORY OF A DISEASE :-

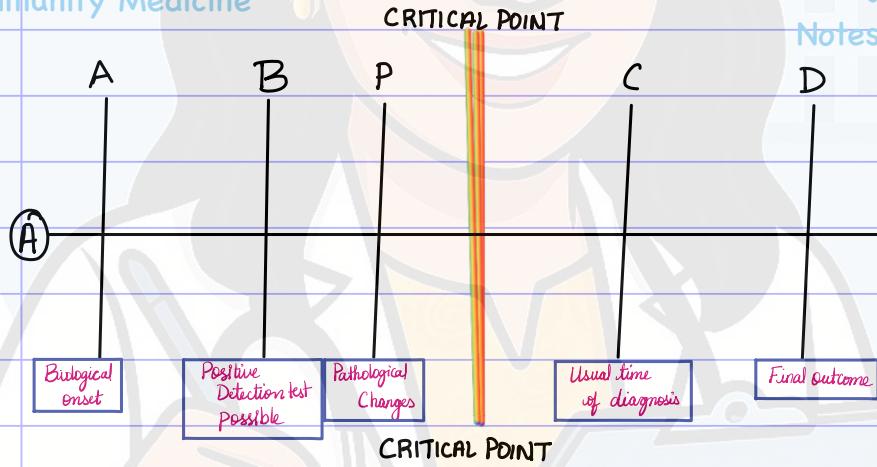
Critical point :-

This is a point in the natural history of the disease before which treatment is more effective and/or less difficult to administer.

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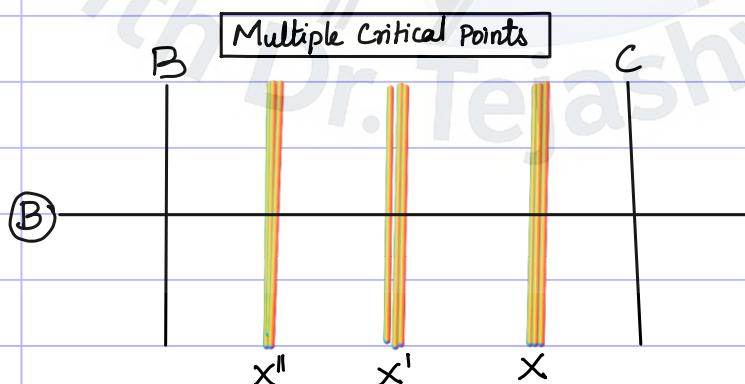
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→ If the disease is potentially curable it is possible before this point but not later on.



Eg:- Breast Cancer :- Critical point is before it spreads to axillary lymph nodes.

→ If the disease is detected at this point prognosis will be better.



Eg: Breast Cancer :-

X - First critical point Before spread to axillary lymph nodes.

X' - Spread to axillary lymph nodes.

X'' - Systemic spread

→ Earlier the diagnosis, better is prognosis

* Though Critical point is the important concept of screening we cannot identify when the critical point is reached in the natural history of the disease.

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WHAT IS THE CRITERIA FOR SCREENING

Criteria for Screening :-

- Before the Screening is initiated a discussion must be made whether it is worthwhile, which requires ethical, Scientific & Financial justification :-
- Two Consideration of Screening Includes :-

(a) The disease to be Screened.

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(b) Tests to be applied.

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(a) Disease to be Screened :- It should fulfil the following Criteria :-

- ① It should be an Important health problem.
- ② There should be recognizable in early latent (or) asymptomatic stage.
- ③ The natural history of the condition 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 a good evidence that early detection & treatment reduces mortality & morbidity.

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- ⑨ The expected benefits of early detection exceeds the risk & costs.

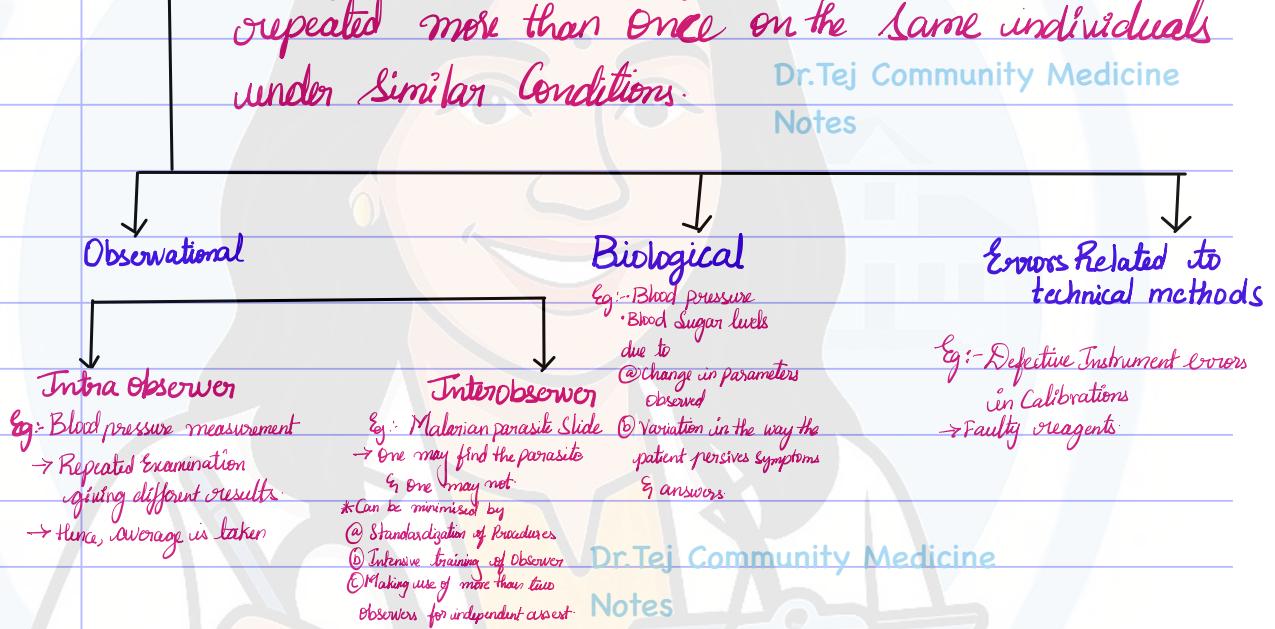
⑥ Screening tests to be applied if it is :-

i) Acceptability :- Acceptable to people to whom it is aimed.

Eg:- Rectal (or) vaginal Examination are not usually accepted to populations in mass Campaign.

ii) Repeatability :- The test must give consistent result when repeated more than once on the same individuals under similar conditions.

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iii) Validity :- Refer to what extent the accurately measures which it purports to measure.

Eg:- Glycosuria is useful screening test in diabetes, but a more valid (or) accurate test is glucose tolerance test.

* Validity has two Components

① Sensitivity :- It is the ability of a test to identify correctly all those who have the disease, that is "True-positives".

② Specificity :- It is the ability of a test to identify correctly those who do not have the disease, that is "True-negatives".

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Evaluation of Screening Test

The following are the measures used for the evaluation of screening test.

- a) Sensitivity (c) Positive predictive value (e) Percentage of False Negatives
- (b) Specificity (d) Negative predictive value (f) Percentage of False positive.

Screening Test results	DIAGNOSIS		TOTAL
	DISEASED	NOT DISEASED	
POSITIVE	a (True-Positive)	b (False-Positive)	a+b
NEGATIVE	c (False-Negative)	d (True-Negative)	c+d
TOTAL	a+c	b+d	a+b+c+d

Sensitivity :- It is the ability of a test to identify correctly all those who have the disease, that is "True-Positive" i.e., $\frac{a}{a+c} \times 100$

Eg:- 90% Sensitivity means that 90% of the diseased people screened by the test will give a "True-positive" results & Remaining 10% as a "false negative" results.

Specificity :- The ability of the test to identify correctly those who do not have the disease, that is "True-negative". i.e.,

$$\text{Specificity} = \frac{d(\text{True negatives})}{d+b} \times 100$$

Eg:- A 90% Specificity means that 90% of non-diseased people will give "true-negative" results, 10% of non-diseased people screened by the test will be wrongly classified as "diseased" when they are not.

Predictive accuracy:-

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In addition to Sensitivity & Specificity the performance of a Screening Test is measured by its "Predictive value" which reflects the diagnostic power of the test.

★ POSITIVE PREDICTIVE VALUE:- True positives among all the positives of Screening tests.

$$PPV = \frac{\text{True positives}}{\text{All positives}} = \frac{a}{a+b}$$

★ NEGATIVE PREDICTIVE VALUE:- True negatives among all the Negatives of the Test.

$$NPV = \frac{\text{True Negative}}{\text{All Negatives}} = \frac{d}{d+c}$$

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⇒ Percentage of False Negative = $\frac{c}{a+c} \times 100$

Percentage of positives which have wrongly obtained negative value by the Screening tests.

⇒ Percentage of False-Positive = $\frac{b}{b+d} \times 100$

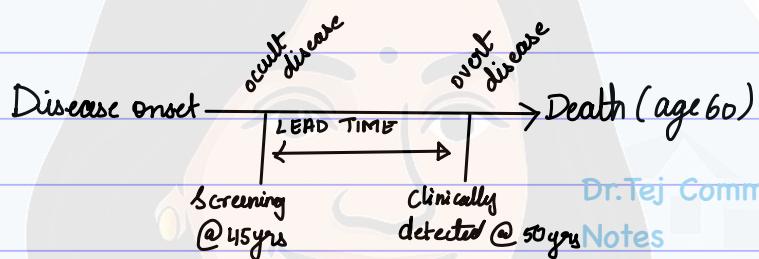
Percentage of Negatives given positive results by the Screening tests.

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WHAT IS BIAS IN SCREENING

BIAS IN SCREENING :- Bias in Screening test occurs when Screen detected Cases are compared with Cases detected by Signs & Symptoms.

Lead time Bias :- over estimation of Survival duration, among Screen detected Cases when Survival is measured from diagnosis.



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Eg:-

Biological onset of Disease

1985

Diagnosis DEATH

1992 1995

Survival

1985 1989

Disease detected by screening

Survival

usual time of Diagnosis

1985 1989

Lead time Bias

1992 1995

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Length time Bias :- overestimation of Survival duration among Screen detected Cases due to the relative excess of slowly progressive cases.

Overt diagnosis bias :- All of the people with harmless abnormalities are counted as "lives saved" by the screening, rather than "healthy people needlessly harmed by overt diagnosis".
Eg:- Prostate cancer staging, it has been found that more men die with prostate cancer than of it.

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Selection bias:-

Not everyone will take part in the Screening

Eg:- If people at a high risk of disease are more likely to be screened than other women to join a mammography program, then a screening test will outlook worse than it really is.

→ Negative outcomes among screened population will be higher than for random sampling.

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DISADVANTAGES OF SCREENING

- ① Screening tests used are not perfect - hence gives false positive & false negative results.
- ② Screening involves costs & use of medical resources on a majority of people who do not need treatment.
- ③ Adverse effects of screening :- Stress, Anxiety, Discomfort
- ④ Unnecessary investigations & treatment of false positive results.

⇒ Evaluation of Screening test:-

→ RCT

→ Uncontrolled trials

→ Others (like case control studies).

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Notes