

SCREENING OF DISEASES

Screening of Diseases

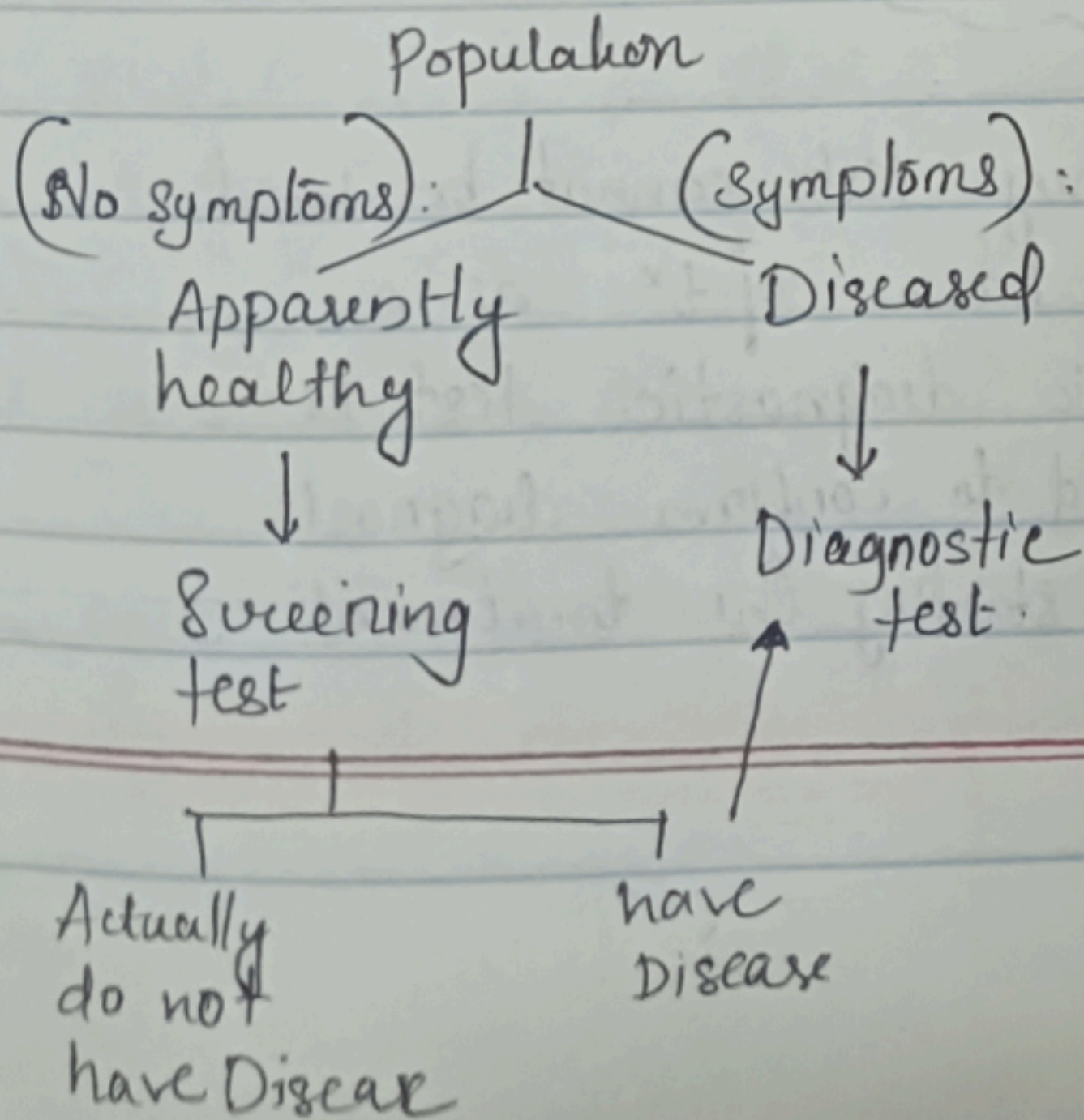
Screening and diagnostic tests contrasted

Screening test	Diagnostic test
1 Done on apparently healthy	Done on those with indications or sick.
2 Applied to groups	Applied to single patients, all diseases are considered.
3 Test results are arbitrary and final	Diagnosis is not final but modified in light of new evidence, diagnosis is the sum of all evidence.
4 Based on one criterion or cut-off point	Based on evaluation of a number of symptoms, signs (e.g., diabetes) and laboratory findings.
5 Less accurate	More accurate.
6 Less expensive	More expensive.
7 Not a basis for treatment	Used as a basis for treatment.
8 The initiative comes from the investigator or agency providing care.	The initiative comes from a patient with a complaint.

Screening test

Definition:

Screening is active search for the disease among apparently healthy people in the community by means of rapidly applied test called screening test.



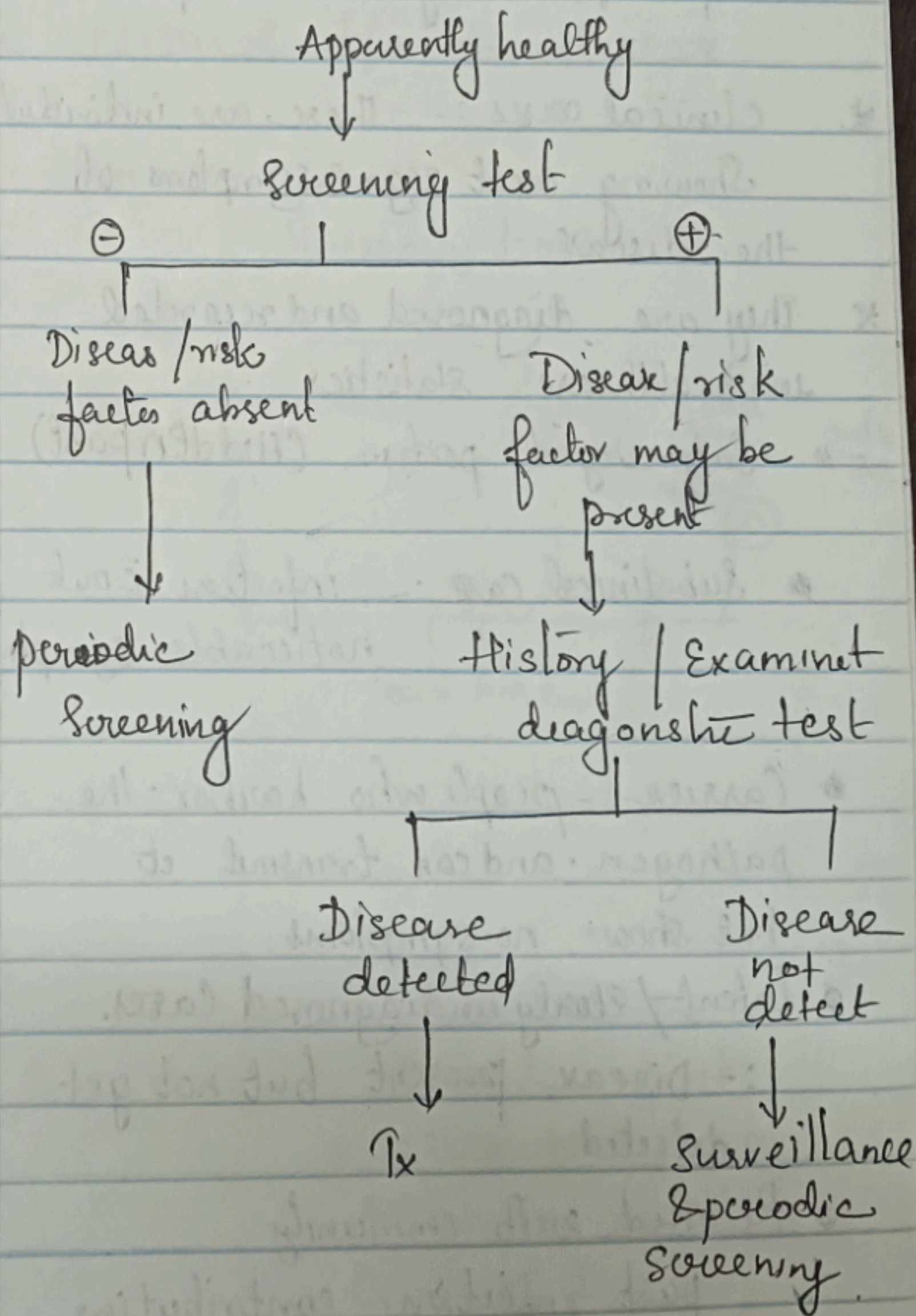
Aim:

To sort out: those having the disease and those not having disease from a group of apparently healthy individuals

Objective

earlier intervention and management in hope to reduce mortality and suffering from a disease

Algorithm:

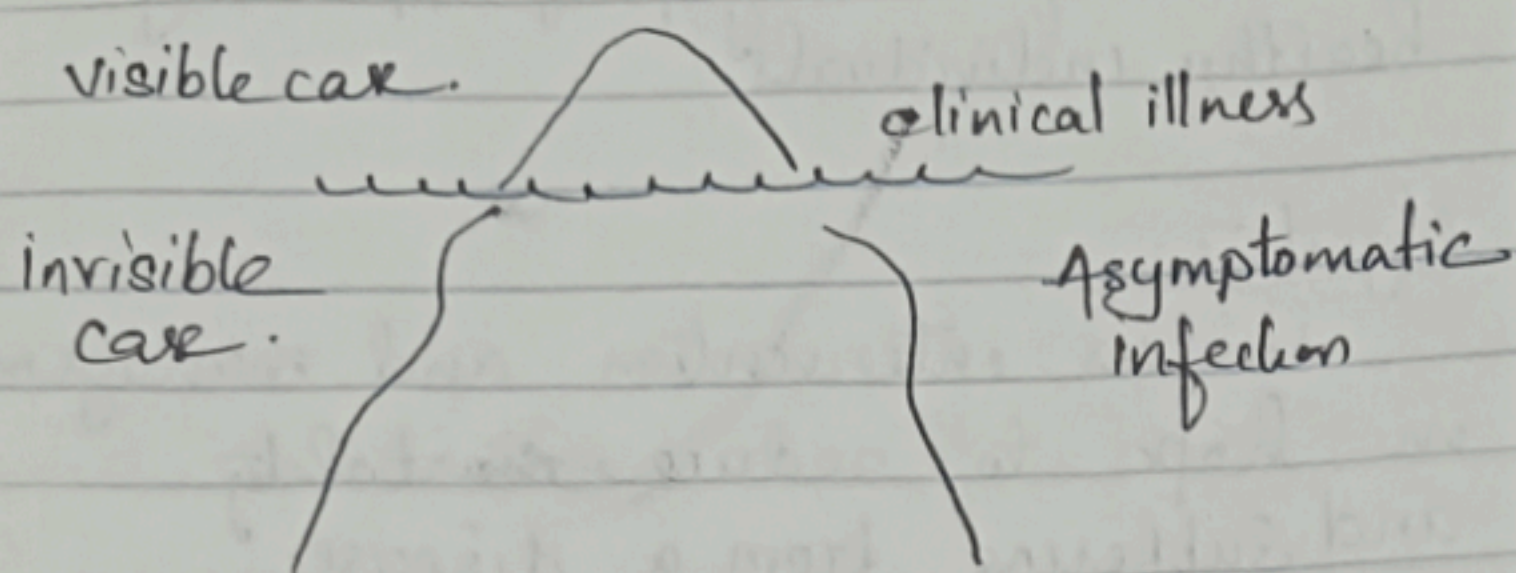


Screening tests divides healthy population into 2grp.

- ①: those probably having the disease
- ②: Those probably not having the disease

Iceberg of Disease

Disease in a community may be compared with an iceberg.



→ Tip of Iceberg (Visible part)

* Clinical cases :- These are individuals showing overt sign & symptoms of the disease.

* They are diagnosed and recorded in healthcare statistics.

→ Submerged portion (Hidden part)

• Subclinical case :- infection without noticeable symptoms.

• Carrier :- people who harbor the pathogen and can transmit it but show no symptoms.

• Latent / Early undiagnosed cases.
:- Disease present but not yet detected.

• Recorded with community past infection contributing to overall prevalence but not visible in current case counts.

- Submerged portion of ice in iceberg phenomenon of disease correspond to subclinical cases, carriers, undiagnosed cases who are all apparently healthy individuals.
- Their detection & control is a challenge.

Screening vs Diagnosis

Screening - used for screening the apparently healthy people i.e. asymptomatic.

Diagnosis :- Symptomatic people.

S asymptomatic populatio Arbitrary & final 1 criterion	← Done on → ← Applied on → ← Test result based on →	D Symptomatic Individual not final, modified Sign, Symp, Lab Finding
cheaper rapid inaccurate cannot be used as basis Initiative form	Cost Time taken Accuracy Bias for tx Investigator	Expensive Time consuming Accurate useful basis for tx Case is complete

Remember:

Screening test cannot be used as the basis of tx as a specific diagnostic test is required to confirm diagnosis before starting the treatment.

Ex:- screening test:-

- Papanicolaou (Pap) smears
- Breast self exam
- mammography
- Bimanual oral exam.
- ELISA, RAPID, SIAMPL E
- Urine for Sugar, RBS
- Alpha foeto protein
- Digital rectal examination
- Prostate Specific antigen
- fecal occult blood:

Disease screened

- Cervical cancer
- Breast
- Breast
- oral cavity:
- HIV
- DM
- Developmental anomalies in fetus.
- prostate cancer
- prostate cancer

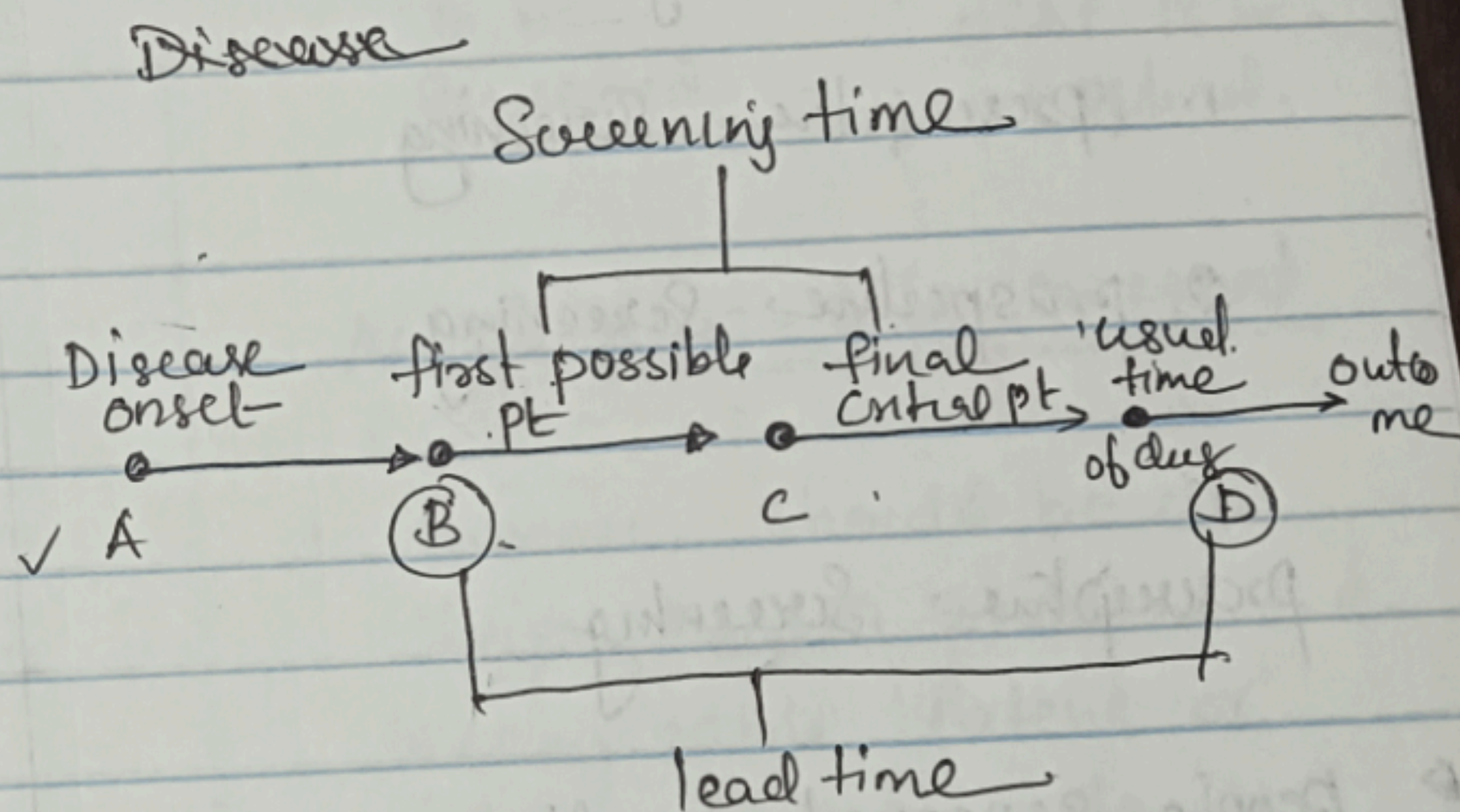
pap smear

* Disease onset:- Disease process just started:

← Natural h/o the disease

* 1st possible pt of diagnosis:

→ earliest pt in disease process where a diagnosis can be made i.e. before this pt diagnosis can not be made by any test.



* final critical pt of diagnosis:

pt after which even diagnosis and tx will not change the outcome

* Usual time of diagnosis:-

Time an disease process when most of people are diagnosed by usual diagnostic procedure.

lead time:- time b/w first possible ~~diag~~ pt of diagnosis and usual time of diagnosis

Screening:- time b/w 1st possible pt and final critical pt.

Remember

- Screen time is a portion of lead time
- Lead time is the advantage gained by screening.
- Screening is not useful for the disease, which do not have lead time - ∴ there is nothing to be gained by screening as the disease will be diagnosed at the usual time of diagnosis
- Screening - useful for disease which have long lead time

*: Type of Screening

1. prescriptive Screening
2. prospective Screening

prescriptive Screening:

- people screened for their own benefit

Eg:- disease can be detected early and treated early so that complications are prevented.

prospective Screening:

- *: people are screened for the benefit of others

ie:- by early diagnosis & early treatment further spread in the community can be prevented.

Ex:- Screening of immigrant for HIV
pulmonary TB & Syphilis
Screening of blood donors

Difference b/w Prescriptive & prospective:

	<u>Prescriptive</u>	<u>Prospective</u>
Definition:-	people screened for own benefit	people screened for others' benefit
Essential purpose	Case detection	Disease Control
Request for screening	No specific request	Specific request from authority only
Ex:-	neonatal screening :- papsmear :- urine for sugar	:- Screening of immigrants :- HIV.

2nd classification of Type of Screening

HOMe

- ① Mass screening
- ② high risk screening
- ③ Multiphasic Screening
- ④ opportunistic screening

① → mass screening: means the screening of a whole population.

→ offered to all → irrespective of: particular risk individual may run of contracting disease. is question:

→ So, it is not every useful preventive measure.

Eg: Night blood smear examination for malarial of every individual.

② High risk screening.

- Applied selectively: to high risk group: - i.e., the group which has ↑ risk of developing certain disease / cancer.

- Also called selective screening or targeted screening

- most productive screening ∴ the screening is done on concerned group, so there is proper utilization of resource.

③: Multiphasic screening

- * Application of 2 or more screening test in combination to a large number of people at one time than to carry out separate screening test for single disease

- * It ↑ the cost of health service & not any observable benefit.

④: opportunistic screening

- * Screening of a patient who consults the dr for some other purpose

- * Also called case finding screening

Criteria for Screening:

(A) Disease to be screened (B) Screening test to be Applied:

A: - Disease to be screened

1. Disease should be an imp: health problem & a recognizable latent or asymptomatic stage

2. there should be a screening test which can detect the disease prior to clinical stage & also availability for.

3. there should be an effective tx which should reduce morbidity & mortality if started early.

4. Disease & tx should have good prognosis.

B: Screening test to be applied

1. Acceptability
2. Repeatability (Reliability)
3. Validity (Accuracy)
4. Other

Acceptability.

→ Test should be acceptable to the people whom it is aimed so that they can cooperate

→ If the test is painful, embarrassing and causing discomfort → people will not cooperate: eg. injection per rectal or per vaginal exam

2. Repeatability / precision / reliability / reproducibility

Test must give consistent result when it is repeated more than once on the same individual under same condition i.e. result of test must be precise (exact). ~~Thus rep~~

3. Validity (accuracy)

If refer to what extent the test accurately measure which is purports to measure.

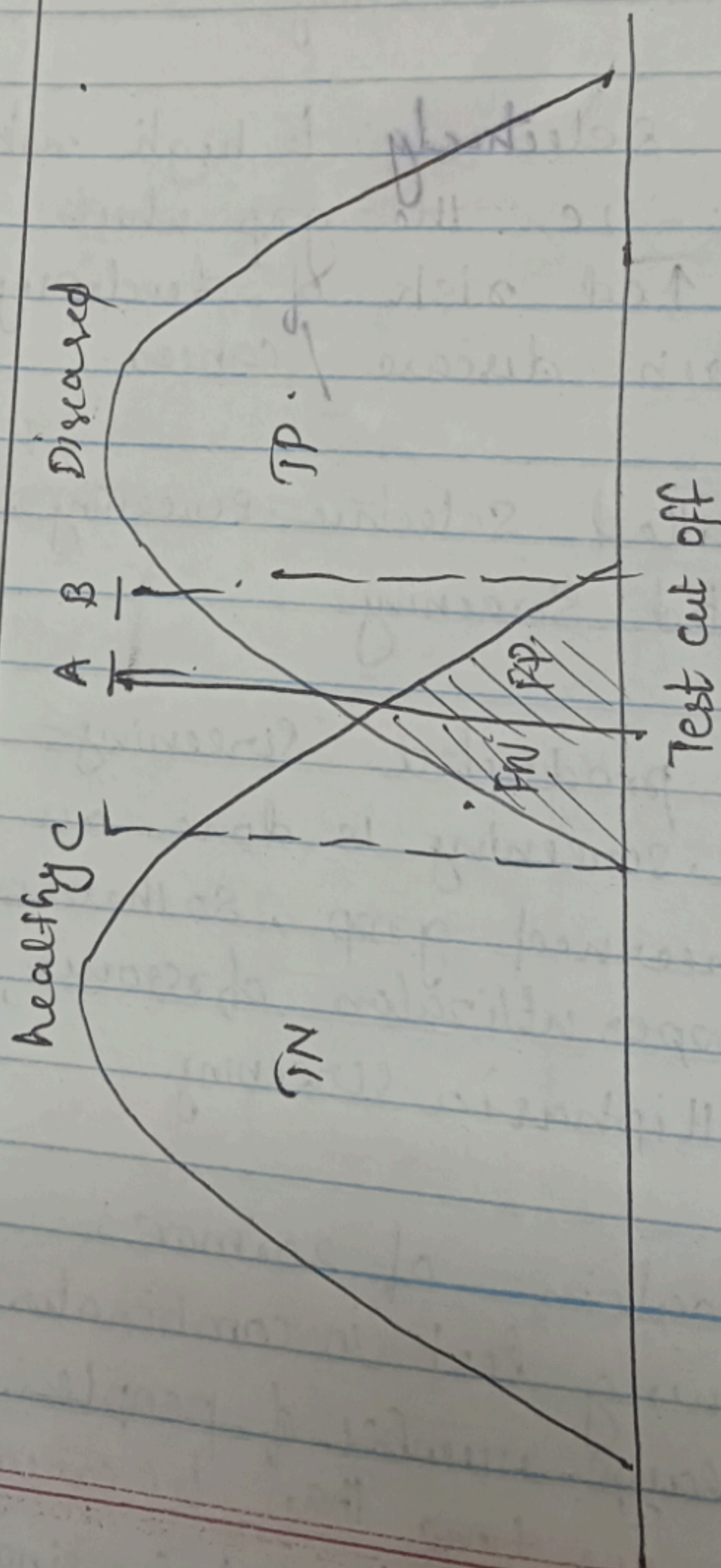
A. other:

Simplicity
Rapidity
Low cost
Safety
Ease of administration

properties of screening test.

Interpretation of screening test

- Sensitivity
- Specificity
- positive predictive value
- Negative predictive value



*

*

		Disease	
		+	-
Test	+	a (TP)	b (FP)
	-	c (FN)	d (TN)

a - who have the disease and Test is also positive:
→ they True positive (TP)

d → True negative (TN)
those who doesn't have disease and Test also -ve.

c:- false negative (FN)

b:- false positive (FP).

- True +ve: - Disease people correctly diagnosed as disease
- True -ve: - healthy people correctly identified as healthy
- False +ve: - healthy people wrongly identified as disease
- False -ve: - Disease people wrong identified as healthy.

Sensitivity and Specificity

Sensitivity

* It is the ability of a test to identify correctly all those who have the disease.
ie true +ve:

* % of diseased people that who are diagnosed as having disease

$$\text{Sensitivity} = \frac{a}{a+c} \times 100 \text{ } \left(\frac{TP}{TP+FN} \times 100 \right)$$

*: in other words sensitivity measures the % of sick people who are identified as having disease.

Eg:-

If A Test is 90% Sensitive, that means: →

- out of 100 Diseased people it will be diagnosed.
- Remaining 10% will be wrongly identified as Not having the disease - false -ve.

Specificity

It is ability of a test to identify the: all those who do not have the disease ie True Negative

Specificity :- % of healthy people who are identified as healthy.

$$TN = \frac{d}{b+d} \times 100$$

or

$$\frac{TN}{TN+FP} \times 100$$

Eg:- 90% specificity means-

one of 100 healthy people 90 will be identified not having disease

Remain 10% - will be wrongly classified as diseased i.e., false +ve

Ideal Test:

An ideal test -

Should have 100%

Sensitivity & 100% Specificity

Sensitivity:

* Sensitivity $\propto \frac{1}{\text{Specificity}}$

* Sensitivity $\propto \frac{TP}{TP+FN}$

* Sensitivity $\propto \frac{1}{FN}$

* Specificity $\propto \frac{TN}{TN+FP}$

* Specificity $\propto \frac{1}{FP}$

PPV & NPV.

positive predictive value:

* proportion of patient $\bar{e}$ +ve test result who correctly diagnosed

* In other word, it is the % of disease among those who show +ve result

* high +ve ppr - diagnostic power of a screening test to correctly identify the disease.

$$PPV = \frac{a}{a+b} \times 100$$

% of truly diseased people: among those who show.

Negative Predictive Value

* % of healthy people among those who show negative test result

* A high negative predictive value means there is high probability that -ve test rules out the disease

↓
diagnostic power of a screening test to exclude the disease

NPV % of 1

$$NPV = \frac{d}{c+d} \times 100$$

or

$$\frac{TN}{FN+TN} \times 100$$

$$\text{Sensitivity} = \frac{a}{a+c} \times 100 \text{ or } \frac{TP}{TP+FN} \times 100$$

$$\text{Specificity} = \frac{d}{b+d} \times 100 \text{ or } \frac{TN}{TN+FP} \times 100$$

$$PPV = \frac{a}{a+b} \times 100 = \frac{TP}{TP+FP} \times 100$$

$$NPV = \frac{d}{c+d} \times 100 = \frac{TN}{TN+FN} \times 100$$

ie Value

to

show

it

means

probably

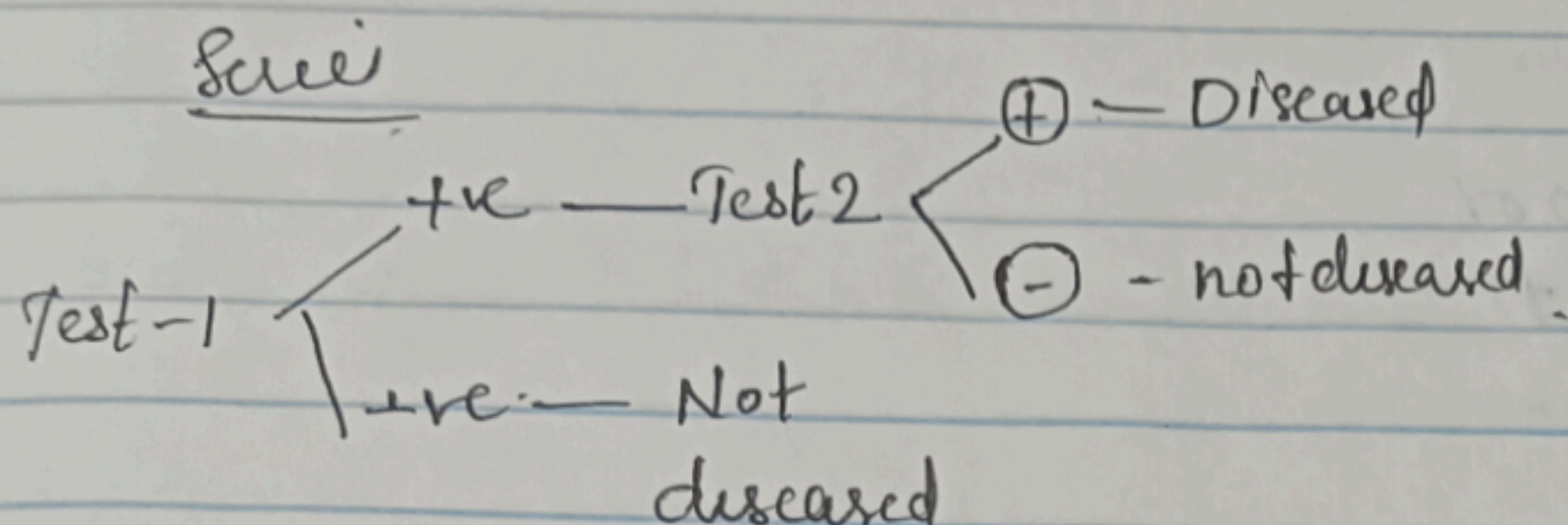
out

of a

excludes

Screening test in series mode & parallel testing

1. Screening test used in series.
2. Screening test used in parallel.



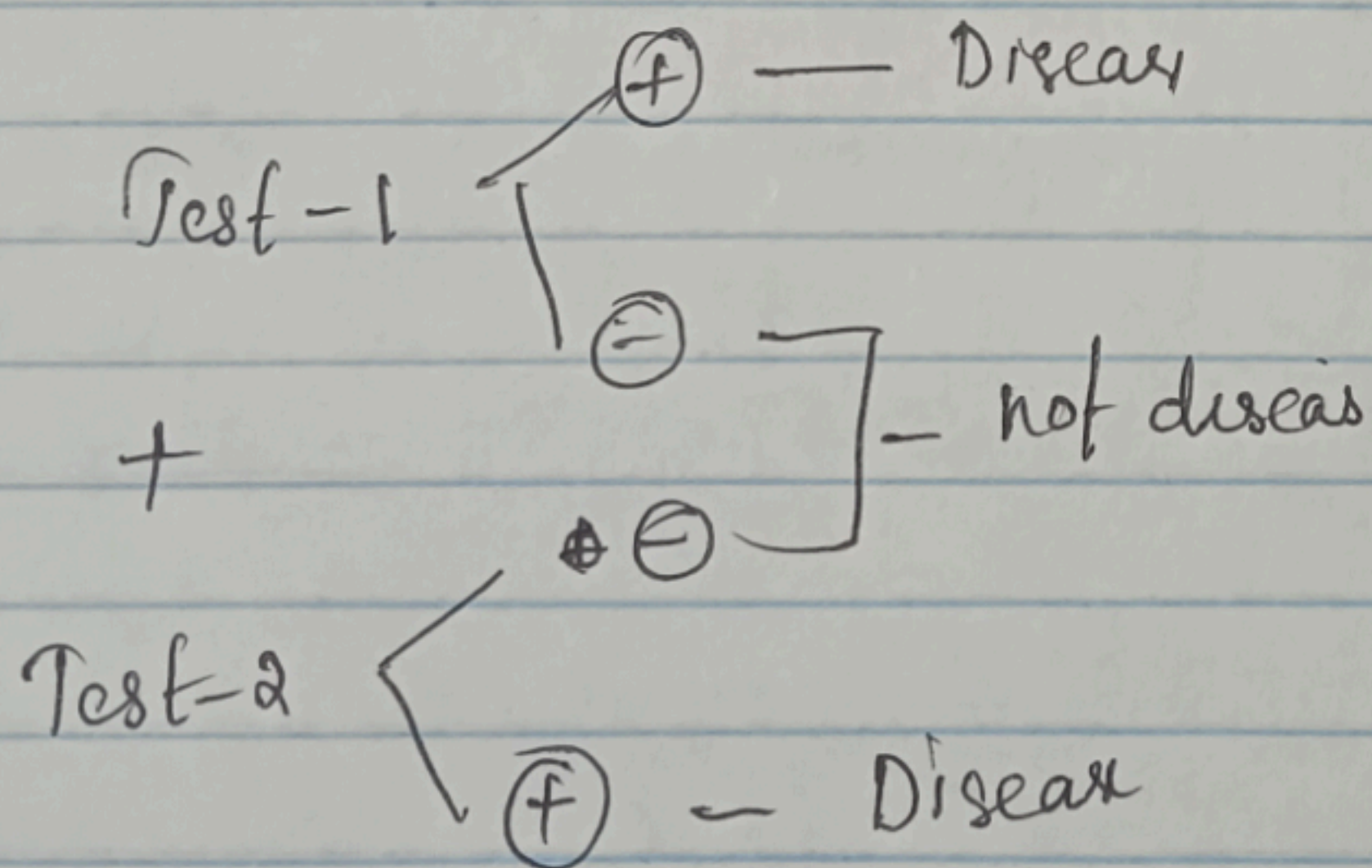
- * one after other
- * 2nd screening test is applied on those where the 1st test is +ve.

* Sensitivity ↓

* Specificity ↑

* PPV → ↑ NPV → ↓

parallel



- * Simultaneously all test are applied

* Sensitivity - ↑

* Specificity - ↓

* PPV - ↓

* NPV - ↑

Validity / Accuracy

Refers to what extent the test measure what it purports to measure.

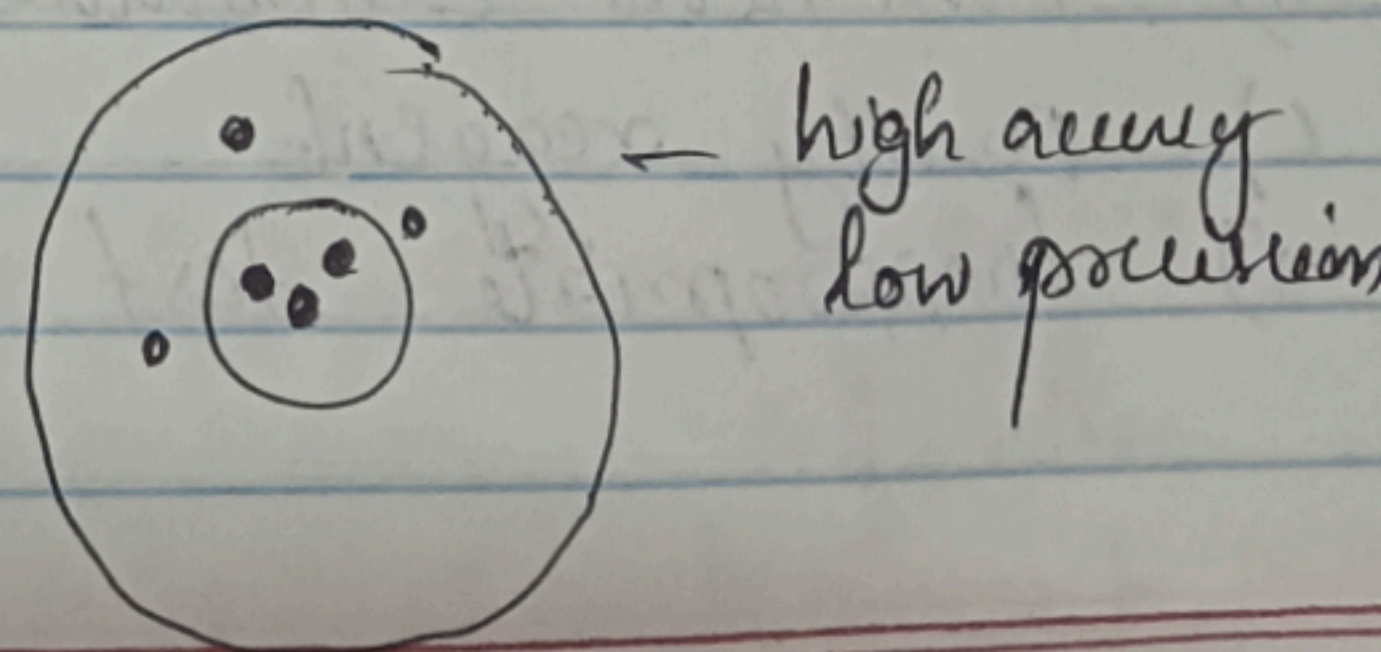
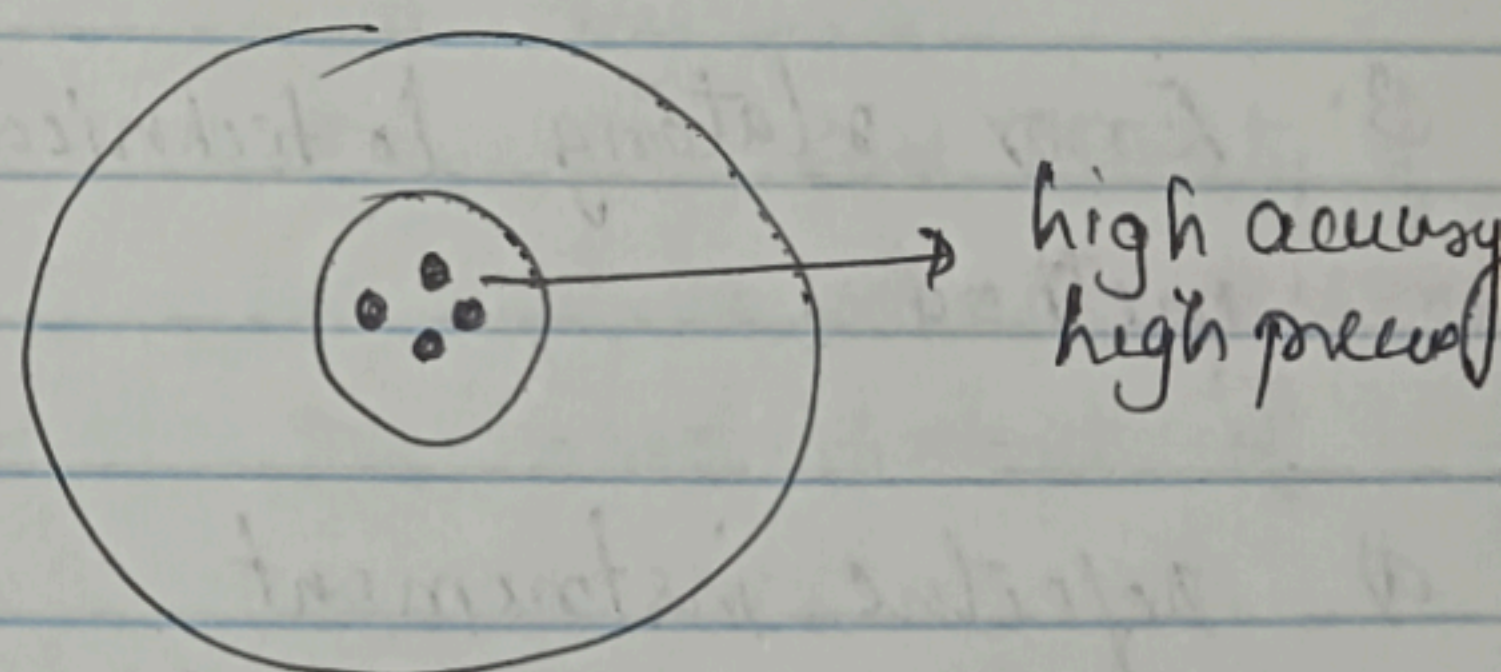
2 component $\left\{ \begin{array}{l} \text{Sensitivity} \\ \text{Specificity} \end{array} \right.$

$$V = \frac{a+d}{a+b+c+d}$$

precision

Test gives consistent result when repeated more than once on the same individual or material, under the same conditions

also called :-



Reliability of a test depend on:

- ①: observer variation
- ② Biological variation
- ③ Error relating to technical method

1. observer variation

Intra observer variation

:- Same observer taking 2 or more reading give varied result

Inter observer variation

variation b/w different observer, on same subject / material

2. Biological variation.

change in parameters observed

variation in perception & answer of patient

3. Error relating to technical method:

- a) defective instrument
- b) Erroneous calibration
- c) Faulty reagent
- d) Inappropriate test