



Natural History Of Disease & Concepts Of Prevention & Control

● Objectives :

- 1-To describe **theories** postulated for the development of diseases
2. Explain the concepts of **iceberg phenomenon** of diseases
3. Understand the **relationship between host, environment and agent** in disease causation
4. Define the term **prevention**
5. Identify the **level of prevention** in relation to stage of disease development
6. Identify the **measures** applied at each level of prevention.

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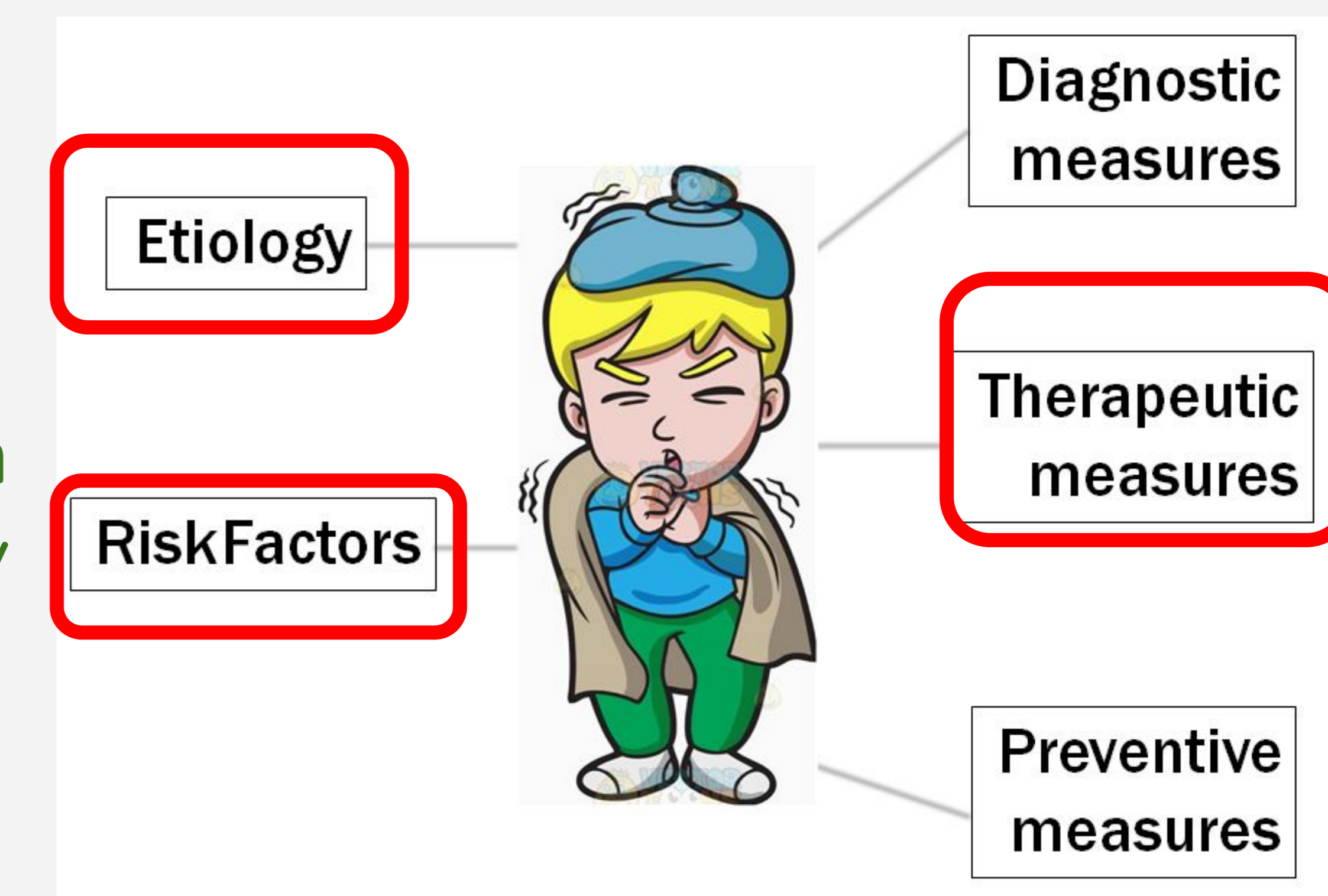
● **Resources :**

Slides.

Doctor's notes.

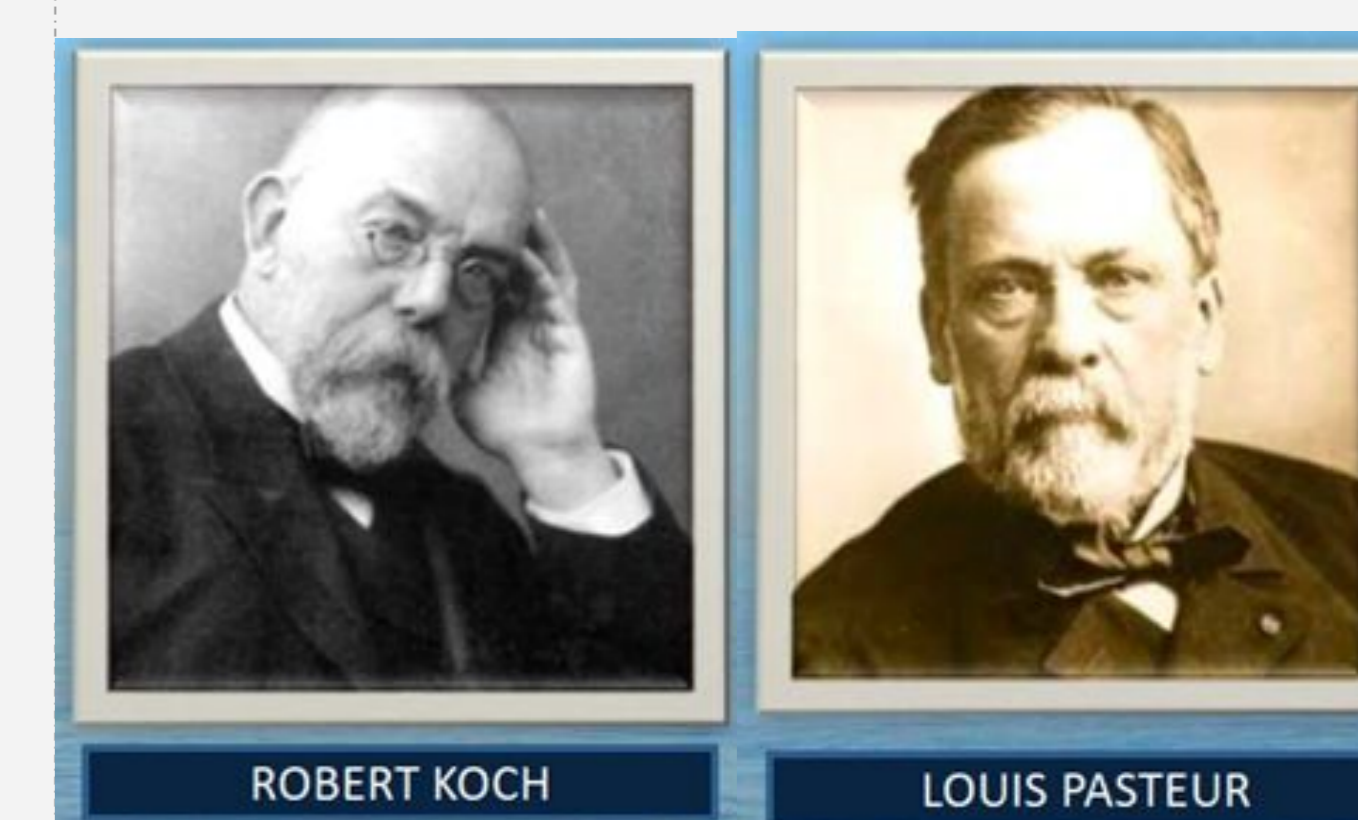
“Theories of disease causation”

- Each disease is a result of a **germ**
- After developing the germ theory, they noticed that the prevalence of tuberculosis started decreasing even though no treatment was found nor isolation of the bacteria from the human body was done. Although some people were still infected by it the prevalence start decreasing.
- This made them question whether germs were the only cause of disease. Which then made them think about if factors other than the causative organism were involved, by then they developed the **epidemiological triad theory. & it's interaction between :**
 1. **Host Factors:** factors related nutritional status and immunological conditions,
 2. **Environmental factors:** overcrowded areas, weather & climate changes.
 3. **Agent.**



Germ theory

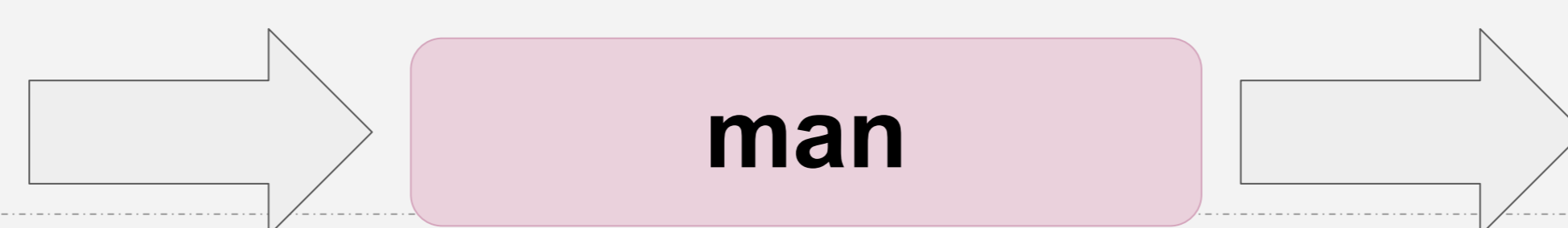
- In the second half of **19th** century Proposed by Robert Koch and Louis Pasteur (discovery of bacteria).
- Every human disease is caused by a **microbe or germ**, which is specific for that disease and one must be able to isolate the microbe from the diseased human being.
- **One to one relationship between causal agent and disease**



Disease agent

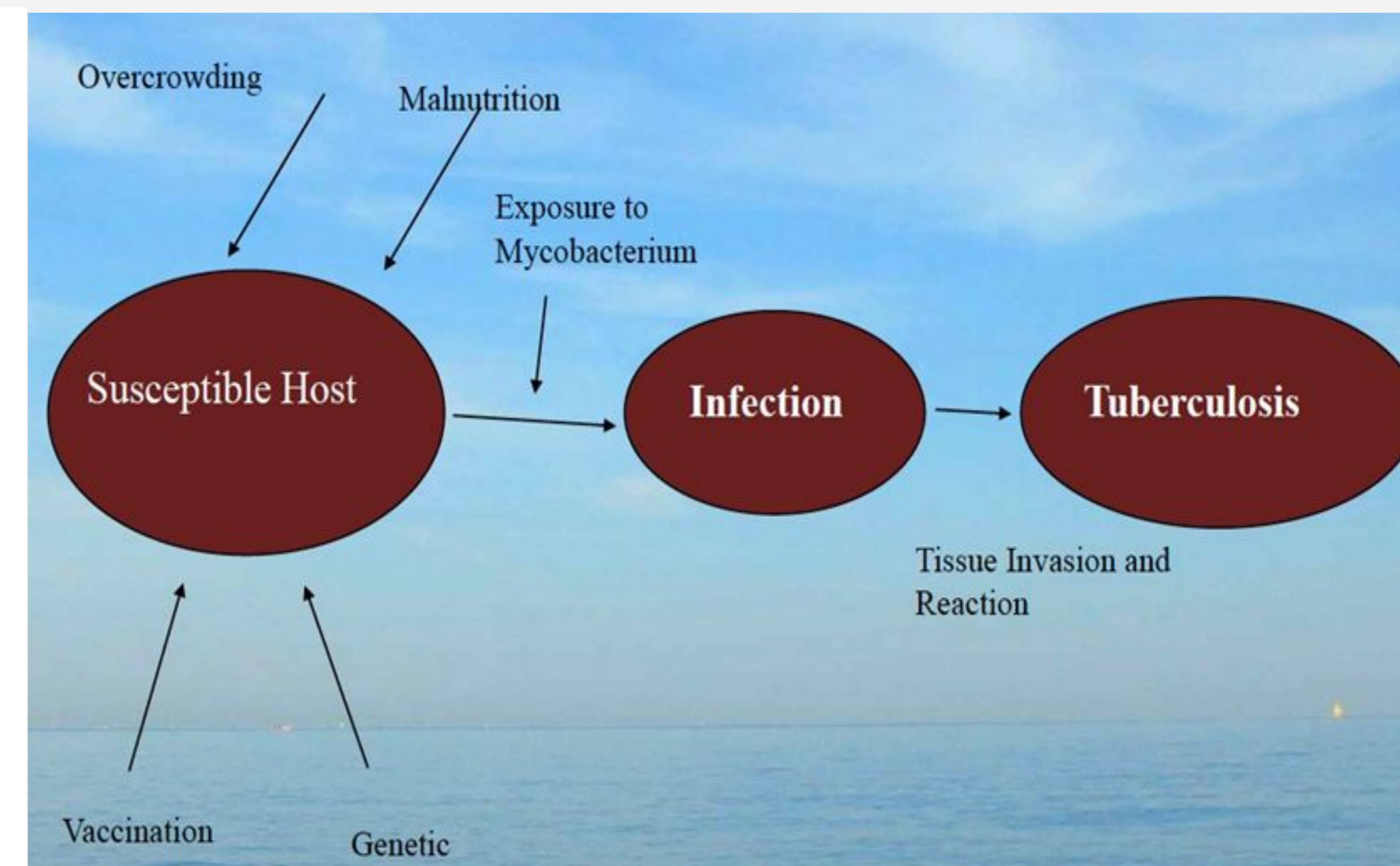
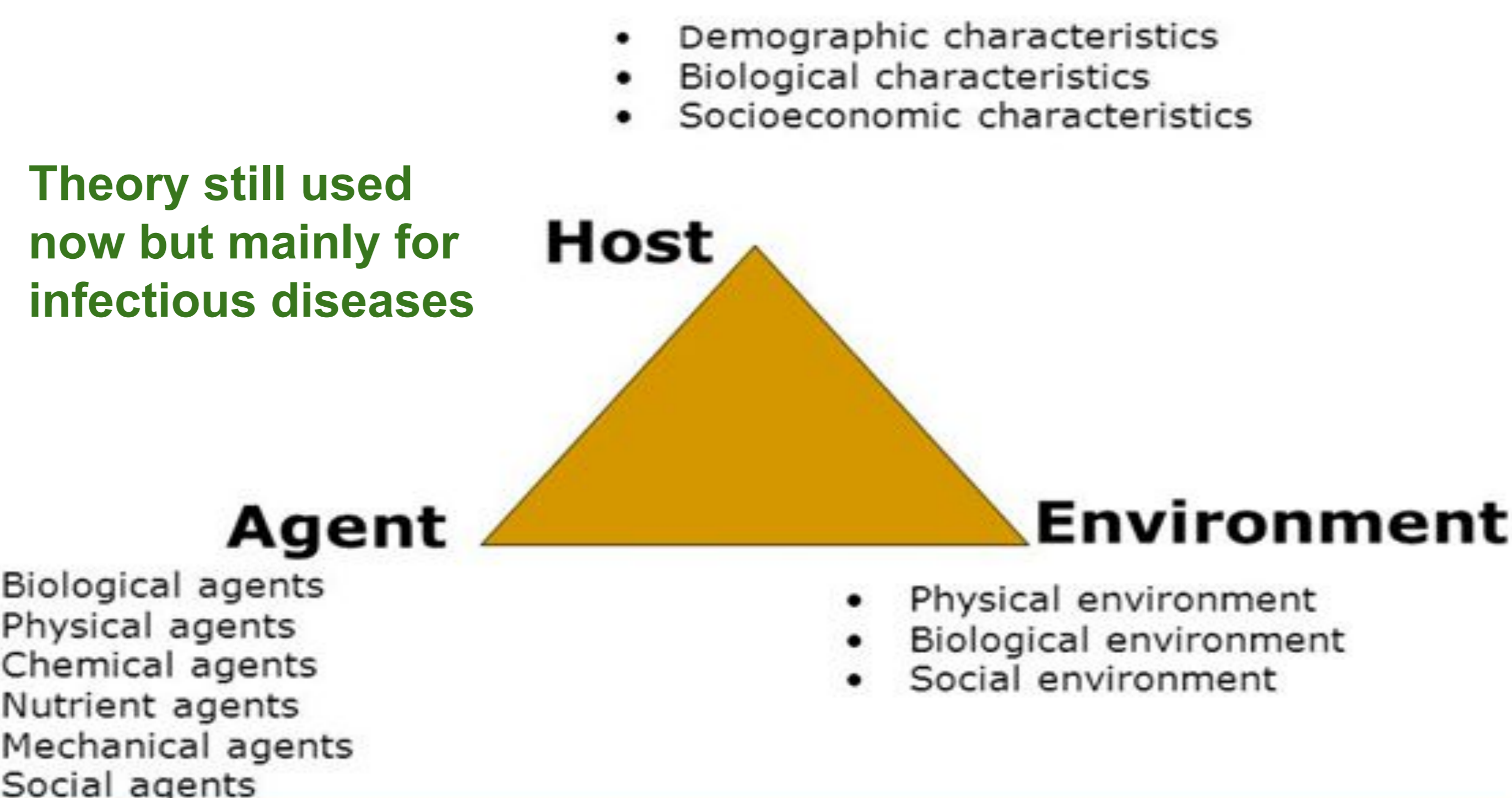
man

disease



Epidemiologic al triad

Epidemiologic triad



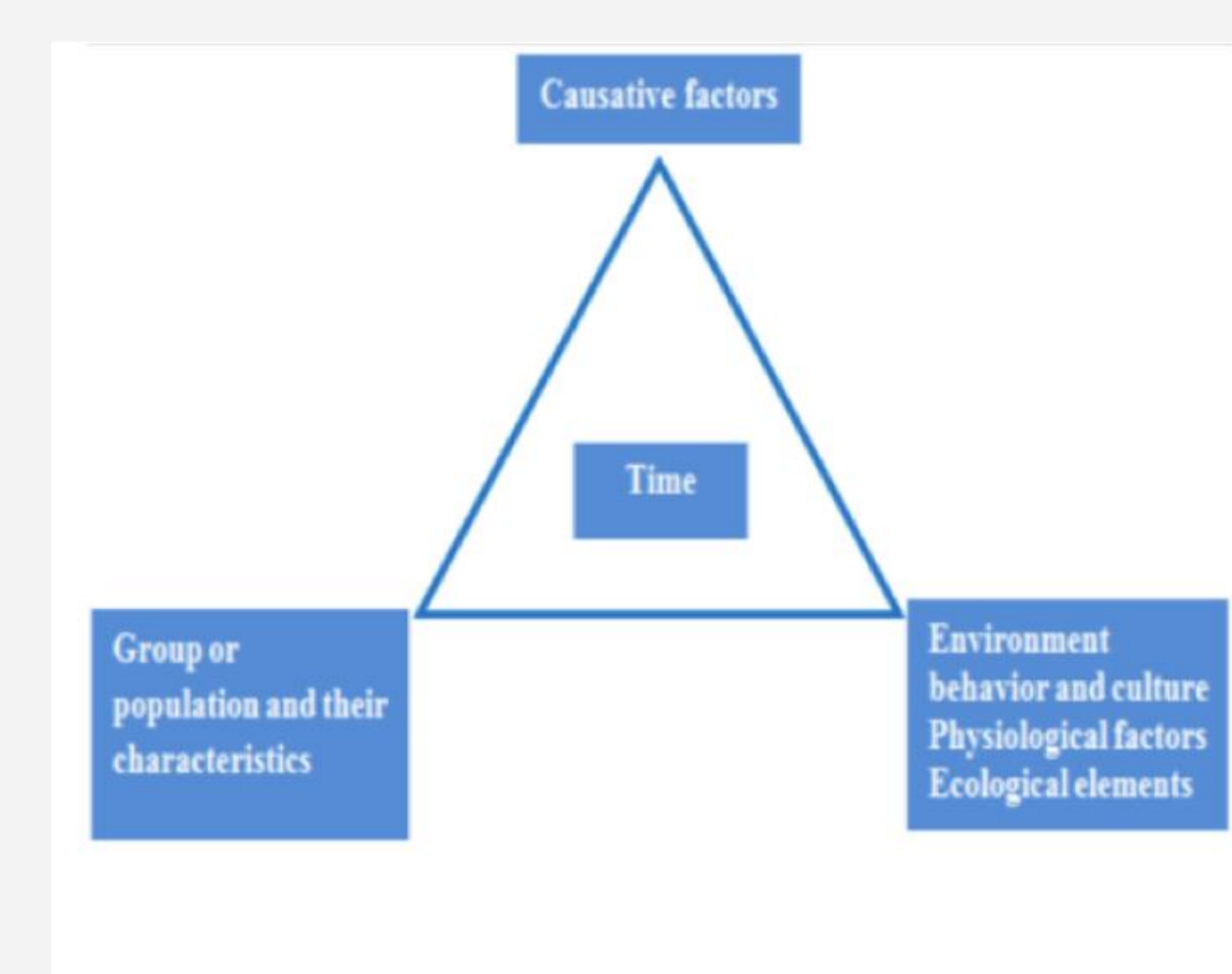
Example:

Not everyone exposed to tubercle bacteria develops tuberculosis but the same exposure in an **undernourished** or **immunocompromised** person may result in clinical disease and exposure occurs more in overcrowding.

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Epidemiologica l tetrad

- In addition to HOST, AGENT, and ENVIRONMENT, one more facto TIME factor is added.
- TIME accounts for incubation periods, life expectancy of the host or pathogen, duration of the course of illness.



The “BEINGS” Model of Disease Causation

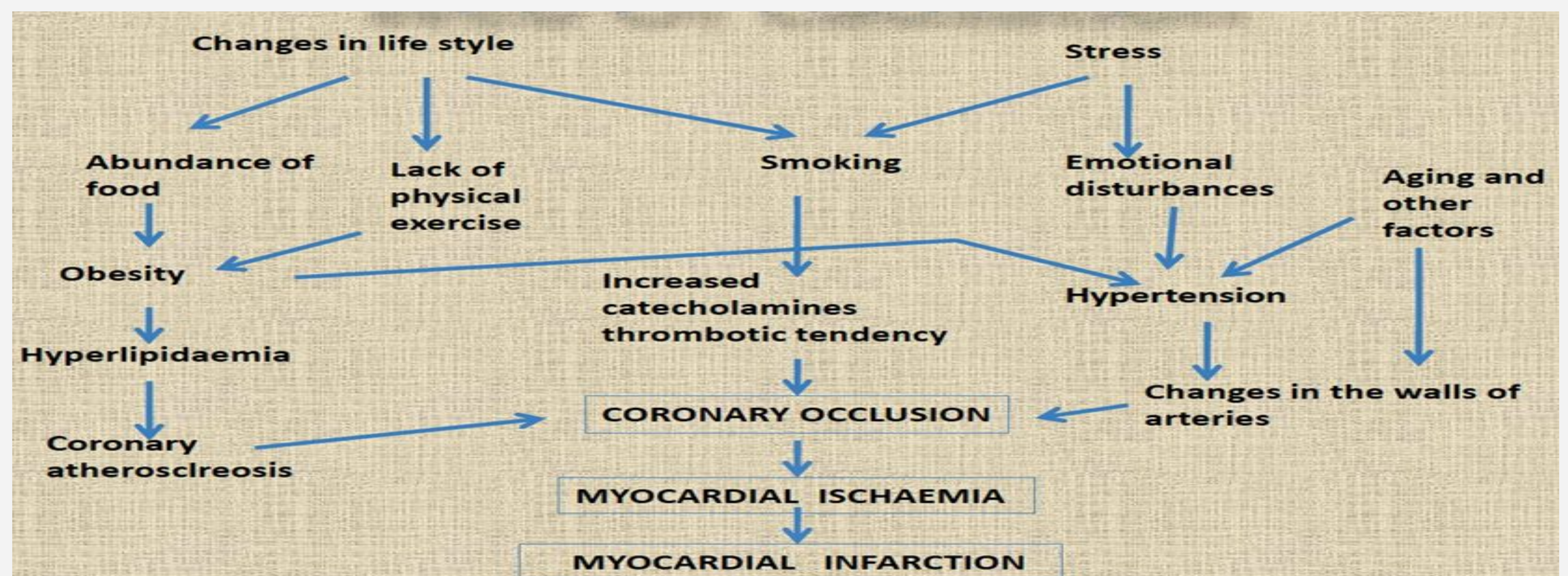
A complex interplay of nine different factors

- **B**iological factors innate in a human being,
- **B**ehavioural factors concerned with individual lifestyles,
- **E**nvironmental factors as physical, chemical and biological aspects of environment,
- **I**mmunological factors,
- **N**utritional factors,
- **G**enetic factors,
- **S**ocial factors,
- **S**piritual factors and
- **S**ervices factors, related to the various aspects of health care services.

The ‘BEINGS’ theory with the above theories don't work for **chronic conditions** because of the lack of agents.

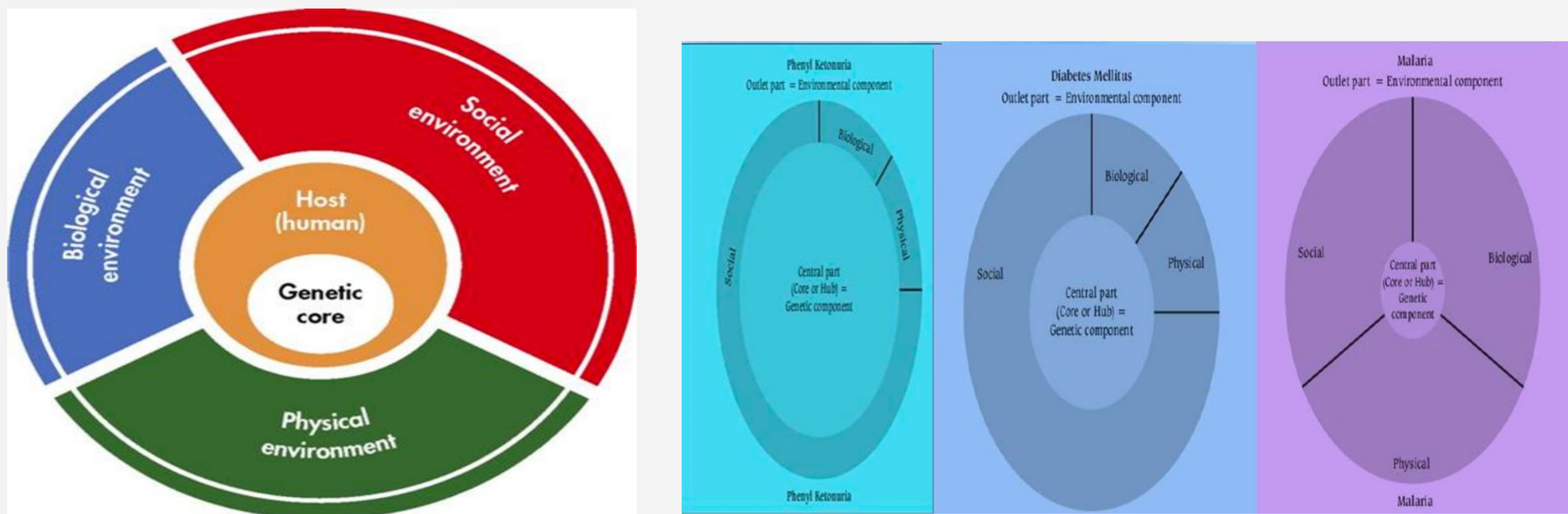
The Theory of “Web of Causation”

- Suggested by MacMohan and Pugh.
- The various factors (e.g. hypercholesterolemia, smoking, hypertension) are like an **interacting** web of a spider, Each factor has its own relative importance in causing the final departure from the state of health, as well as interacts with others, modifying the effect of each other.
- Ideally suited in the study of **chronic disease**, where the agent is often not known and **disease is the outcome of interaction of multiple factors**.
- This model of disease causation considers all predisposing factors of any type and their complex interrelationship with each other.
- **For example smoking might increase the risk of developing ischemic heart disease, but if smoker is under stress and they're hypertensive as well the will increase the risk way more than before.**
- **Once we have more factor interacting with each others this will increase the risk of developing chronic disease.**



“Wheel theory”

- As medical knowledge advanced, an additional aspect of interest that came into play is the comparative role of “genetic” and the “environmental” (i.e. extrinsic factors outside the host) factors in causation of disease.
- The size of the central and peripheral parts depend on the contribution of this factor in the development of a disease
- The “triad” as well as the “web” theory does not adequately cover up this differential.
- To explain such relative contribution of genetic and environmental factors, the wheel theory has been postulated. “Each disease represent one wheel”



First example: diabetes as you can see both environmental and genetic factors have the same proportion and if we move to the environmental factors we can see that the social part is bigger than physical and biological factors because smoking and diet are considered social factors.

Second example: phenylketonuria is a genetic disease so the genetic portion is larger than the environmental portion and that the social part of the environmental ring is more than the other two.

Third example: malaria is an infectious disease so you will mainly see it in the environmental portion more than the genetic part so the genetic circle is very small and the environmental ring is much larger.

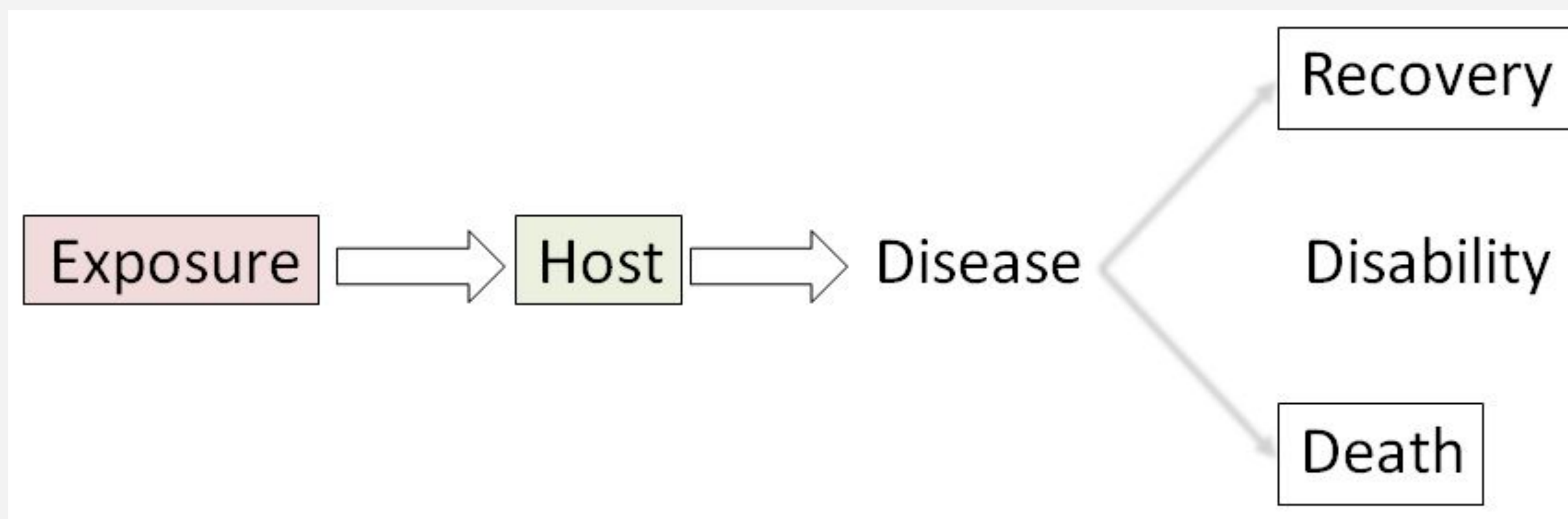


Natural History of Disease

- Natural history of disease refers to the **progress** of a **disease process** in an individual **over time**, in the **absence of intervention**. (medical intervention)
- The process begins with exposure to or accumulation of **factors** capable of causing disease

Without medical intervention, the process ends with:

- Recovery (influenza)
- Disability (diabetes)
- Death (cancer)



Why it is important?

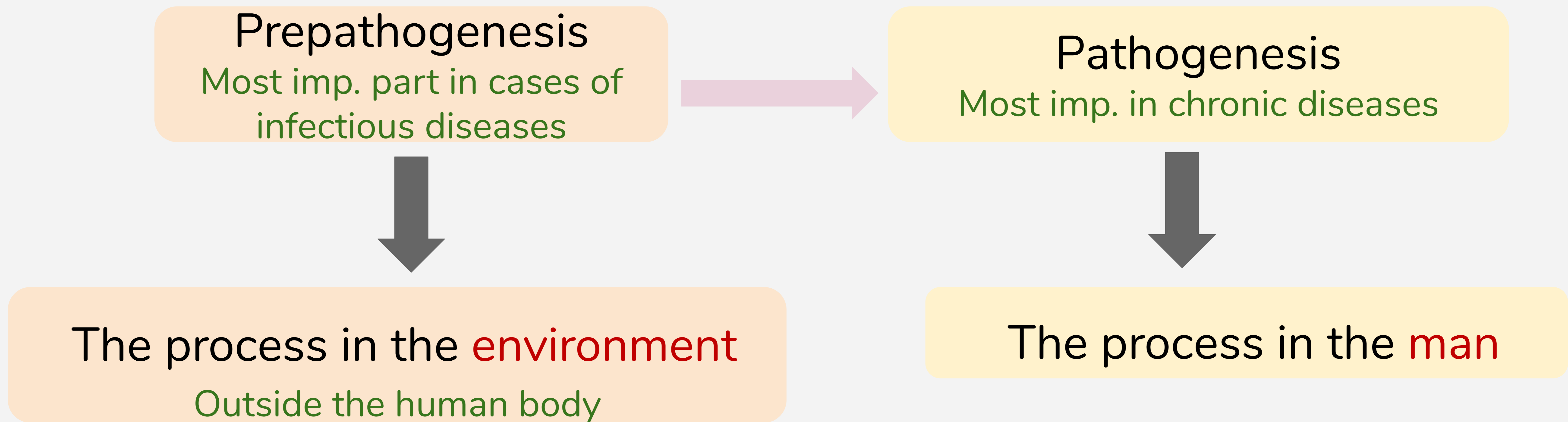
- It is one of the major elements of **descriptive epidemiology**. (describe what's happening overtime)
- Understanding the progress of disease process and its pathogenetic chain of events is must for the **application of preventive measures**

Which Design is the Best?

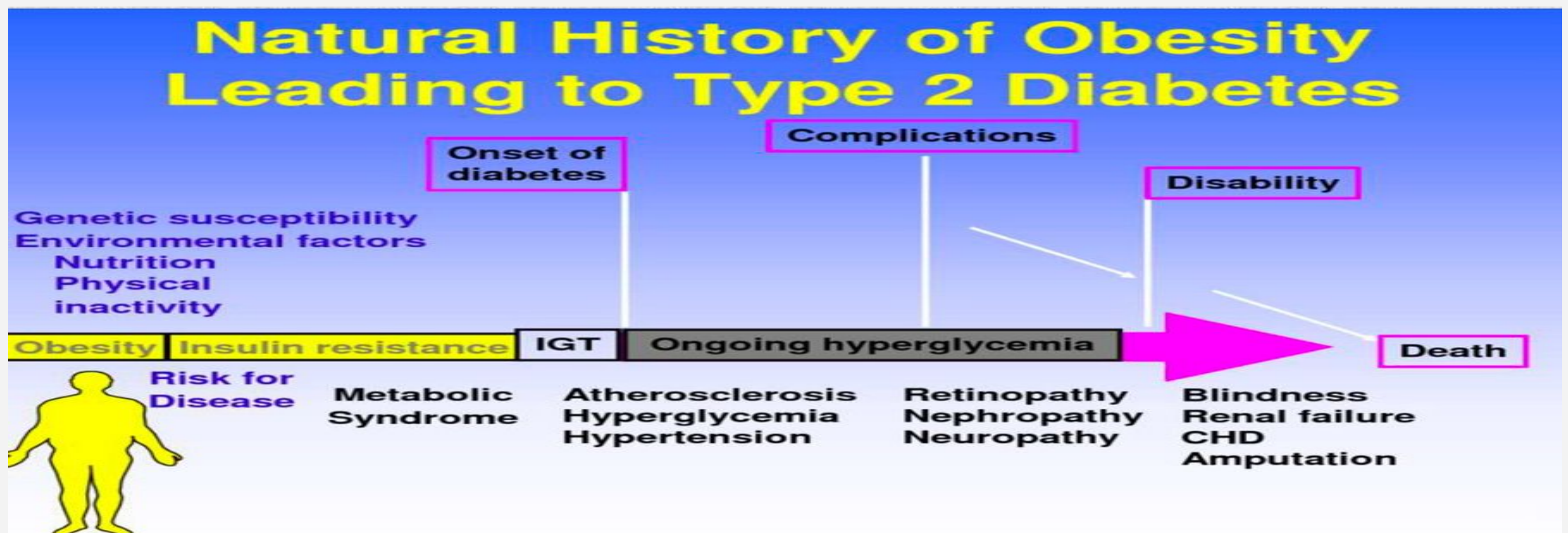
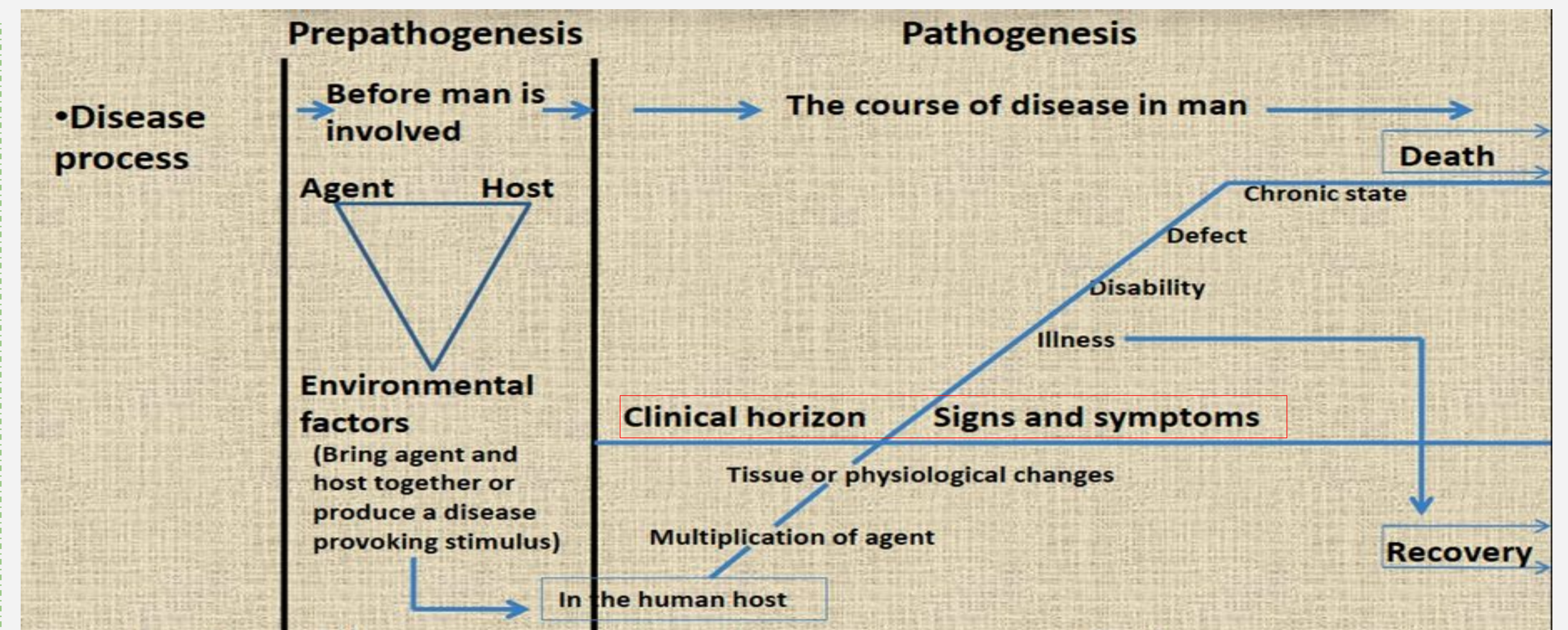
- The natural history of disease is best established by cohort studies. As these studies are costly, understanding of the natural history of disease is largely based on other epidemiological studies, such as cross-sectional and retrospective studies, undertaken in different population settings.
- What the physician sees in the hospital is just an "episode" in the natural history of disease.
- The epidemiologist, by studying the natural history of disease in the community setting is in a unique position to fill the gaps in the knowledge about the natural history of disease.

"Schematic Diagram" of The Natural history of disease in a patient

Why ?
 It is framework to understand the pathogenic chain of events for a particular disease, and for the application of preventive measures.



- The clinical horizon in cases of chronic diseases is pretty high because unlike the infectious diseases the symptoms and signs don't appear as soon as the microorganism start multiplication.
- But they appear when more factors are interacting together (web theory) and this why they're always discovered in late stages.



“Schematic Diagram” of The Natural history of disease in a patient

Pre-pathogenesis phase:

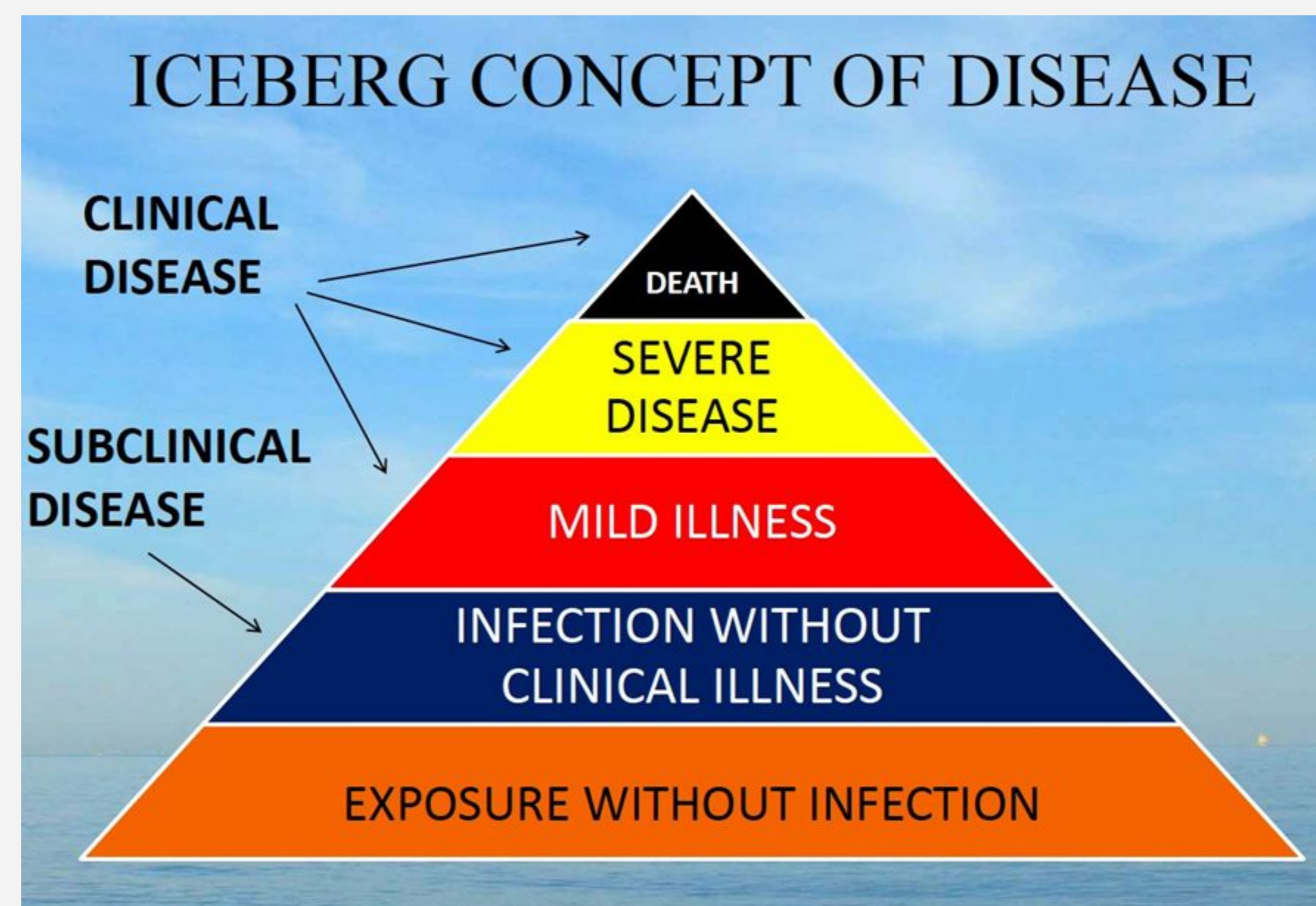
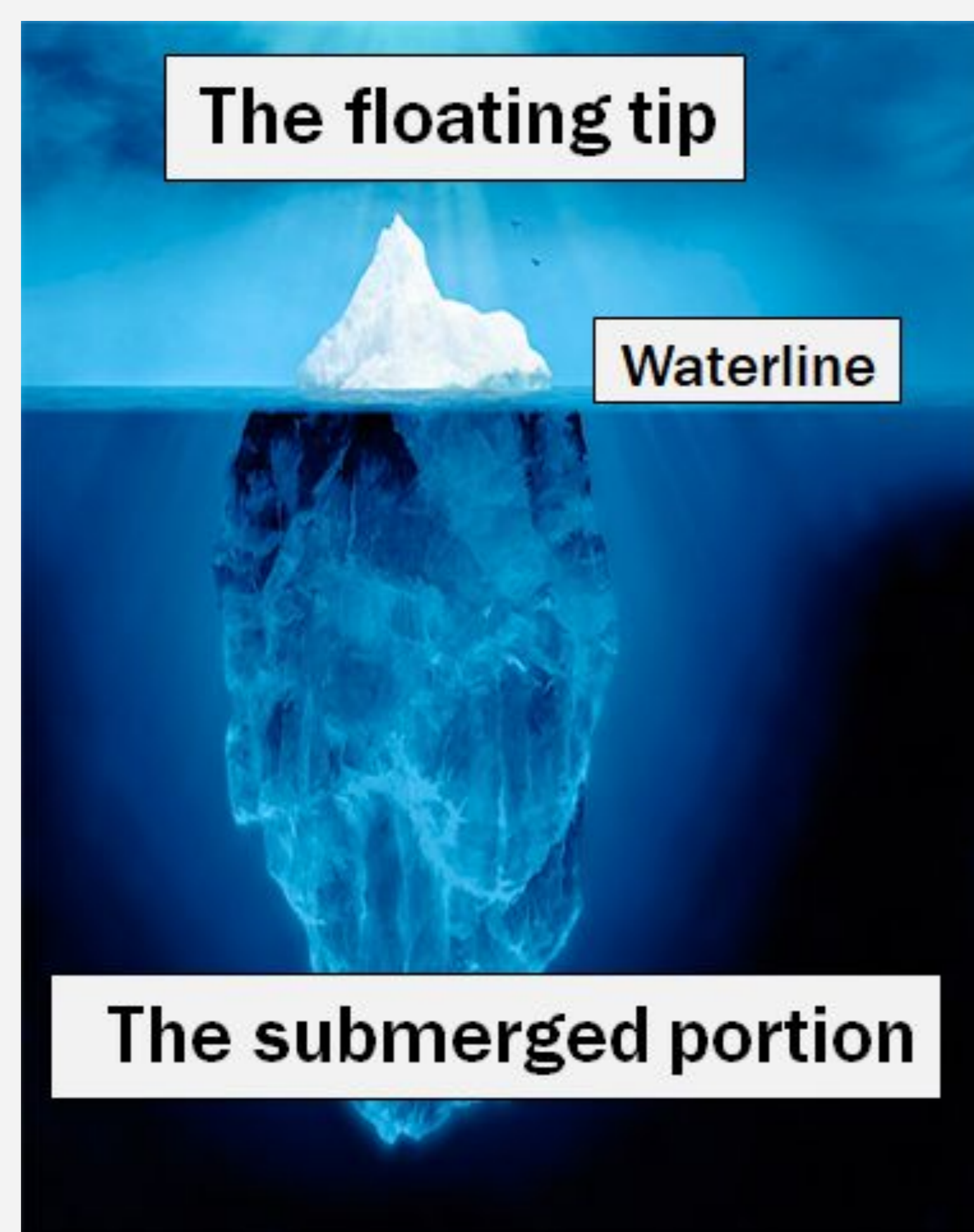
- This refers to the period preliminary to the onset of disease in man.
- The disease agent has not yet entered man, but the factors which favor its interaction with the human host are already existing in the “environment.”
- This situation is frequently referred to as “man exposed to risk of disease”

Pathogenesis phase:

- This phase begins with entry of the disease “agent” in the susceptible “human host.”
- After the entry, agent multiplies and induces tissue and physiological changes the disease progresses through the period of incubation and later through the period of early and late pathogenesis.
- The final outcome of the disease may be recovery, disability or death.
- In chronic diseases, the early pathogenesis phase is less dramatic and is also called as pre-symptomatic phase.
- During pre-symptomatic stage, there is no manifest disease. The pathological changes are essentially below the level of the “clinical horizon”.
- The clinical stage begins when recognizable signs or symptoms appear.
- By the time signs and symptoms appear, the disease phase is already well advanced into the late pathogenesis phase.

Spectrum of Disease and Iceberg Phenomenon

- It is a *graphic* representation of **variations in the manifestations of disease**.
- At the one end of disease spectrum are **sub-clinical infections** which are not ordinarily identified, and at the other end are **fatal illnesses**.
- In the middle of spectrum lie illnesses ranging in severity from **mild to severe**.
- These different manifestations are the result of **individuals' different states of immunity and receptivity**.
- **In this phenomenon you can not precisely say: mild, moderate, or severe etc.**



Spectrum of disease presents **challenges** to the clinician and to the public health worker.

WHY?

Because of the clinical spectrum, cases of illness diagnosed by clinicians in the community often represent only the “**tip of the iceberg**.” Many additional cases may be **too early to diagnose or may remain asymptomatic**.

For the public health worker, the challenge is that persons with **undiagnosed infections may be able to transmit them to others**.

Concept of Prevention of disease

Prevention is the process of intercepting or opposing the “cause” of a disease and thereby the disease process.

● Successful prevention depends on:

- Knowledge of causation (ppl knowing that smoking causes lung cancer will decrease the risk)
- Dynamics of transmission (e.g. vaccinations for some of infections)
- Identification of risk factors and risk groups (e.g. if someone has a 1st degree relative suffering from breast cancer, this person will be in a higher risk to develop it thus we use the preventive strategies.)
- Availability of prophylactic or early detection and treatment measures (e.g. give prophylactic to someone living with a person who's infected with malaria to prevent the infections)
- Organization to apply these measures (funds for healthcare services)
- Continuous evaluation (e.g. is the medication used effective or not?)

Levels Of Prevention:

- Primordial prevention
- Primary prevention
- Secondary prevention
- Tertiary prevention

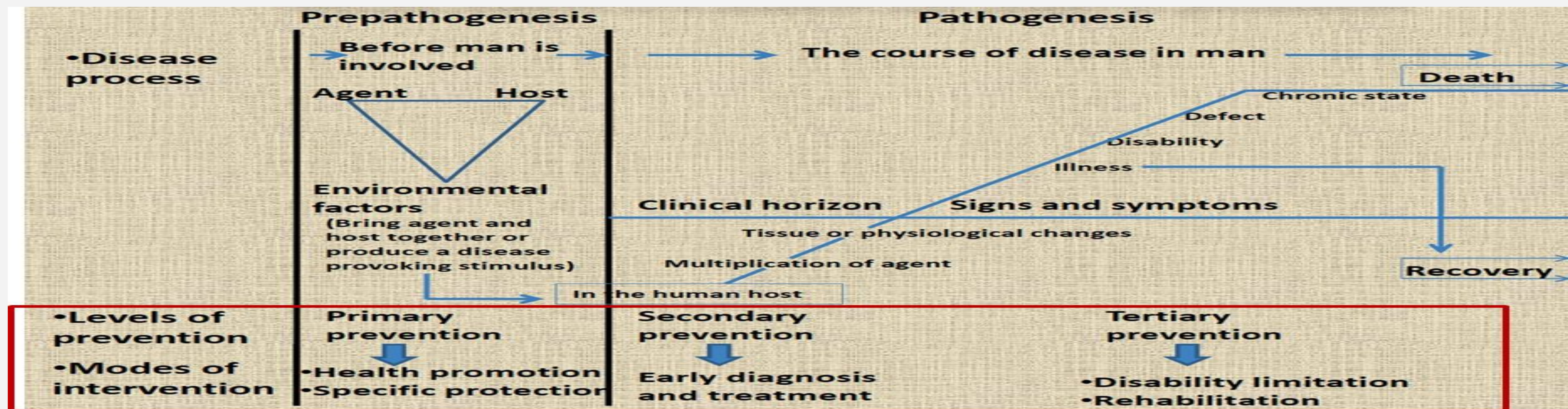


Primordial prevention

- It is the prevention of the emergence or **development of risk factors in population groups** in which they **HAVE NOT** yet appeared. **We are targeting the risk factors!** e.g **campaign for smoke cessation.**
- ***For example***, many adult health problems (e.g., obesity and hypertension) have their early origin in childhood, so efforts are directed towards **encouraging children to adopt healthy lifestyles** (e.g, physical exercise, healthy dietary habits etc.)
- The main intervention in primordial prevention is through **individual and mass education.**
- **We are targeting the risk factors!**
- e.g. smoking increase risk of lung cancer thus to do a primordial prevention we will educate kids and teenagers about the risk of smoking to **reduce** their chances on becoming smokers.

primary prevention

- It can be defined as “ **action taken prior to the onset of disease**, which removes the possibility that a disease will ever occur. **e.g wearing helmet for the risk of RTA.**
- It signifies **intervention in the pre-pathogenesis** phase of a disease.
- **We're preventing the disease!**
- **We do a regular follow up for smokers that haven't yet developed lung cancer**



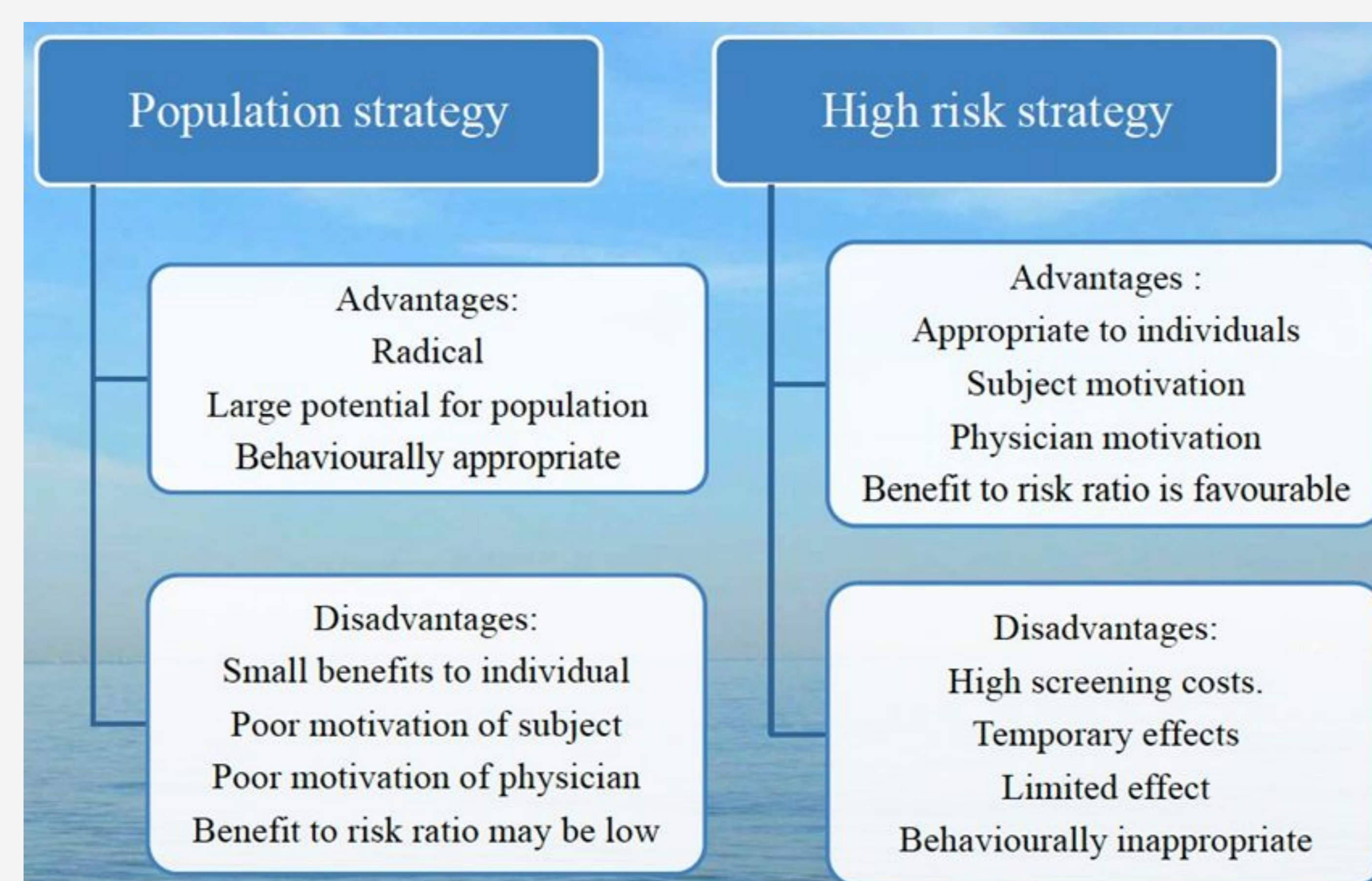
Primary prevention strategies are of two types

Population(mass) strategy

- directed at **whole population** irrespective of the individual risk levels.
- directed towards socio-economic, behavioral and lifestyle changes.

High risk strategy

- Includes identification of “**High risk groups**” in the population and bring preventive care to these risk group.
- e.g., People having the family history of Hypertension, allergic disease, Diabetes

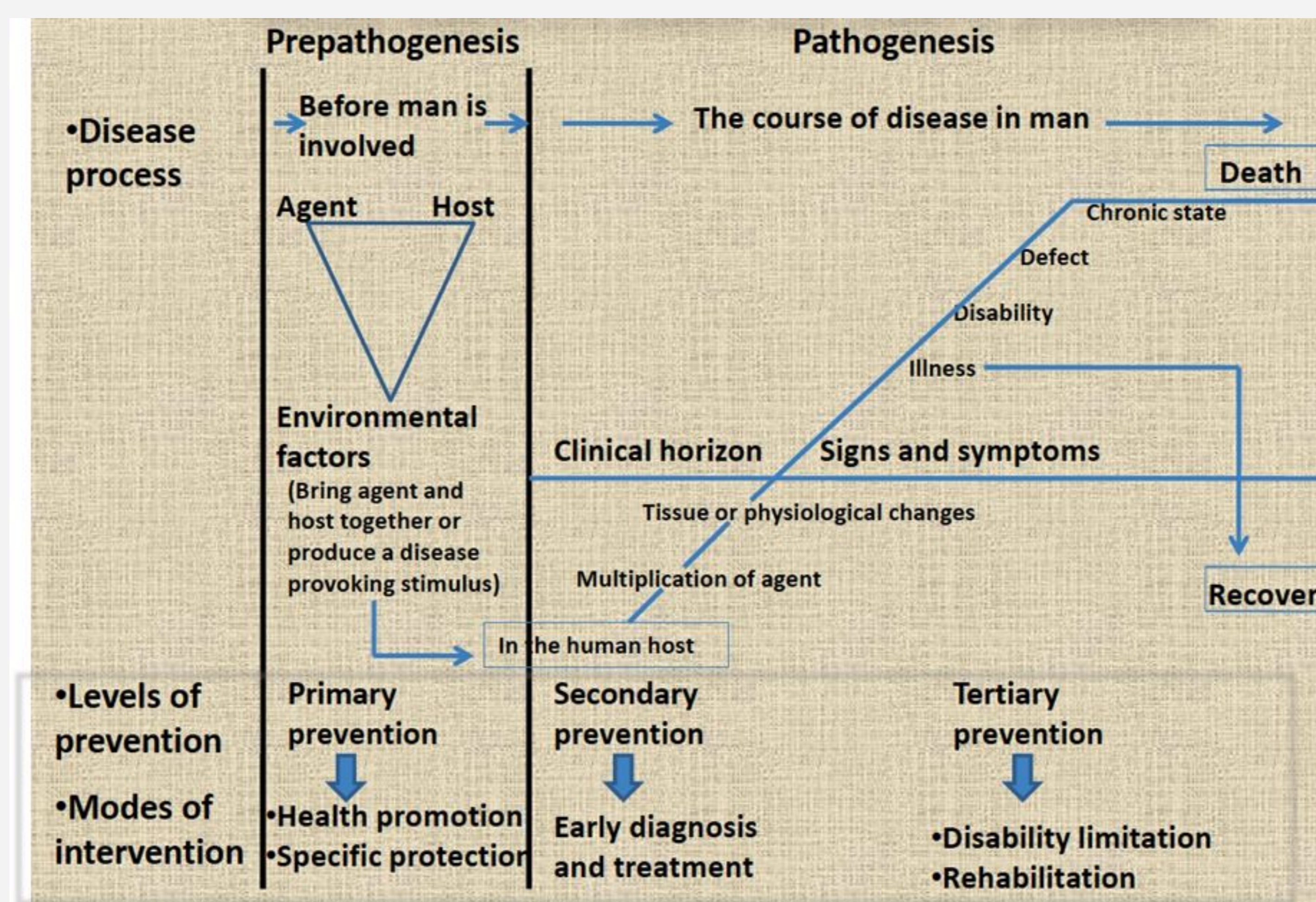


Secondary prevention

- Defined as “action which stop the progress of a disease at its initial stage and prevents complications”.
- It is applied in the early pathogenesis stage of disease.
- It reduce the prevalence of the disease by shortening its duration.
- It may also protect others in the community from acquiring the infection and thus provide, at once, secondary prevention for the infected individuals and primary prevention for their potential contacts.
- Screening and early detecting. (e.g. early detection → early intervention)
- pre-symptomatic stage

The specific interventions used is :

- Early diagnosis and treatment.
- Early detection of health impairment is defined as “ the detection of disturbances of homoeostatic and compensatory mechanism while biochemical, morphological and functional changes are still reversible.
- e.g. , “screening” for disease for breast cancer (using mammography) and cervical cancer (using pap smear).
- Medical examinations of school children, of industrial workers and various disease screening camps.

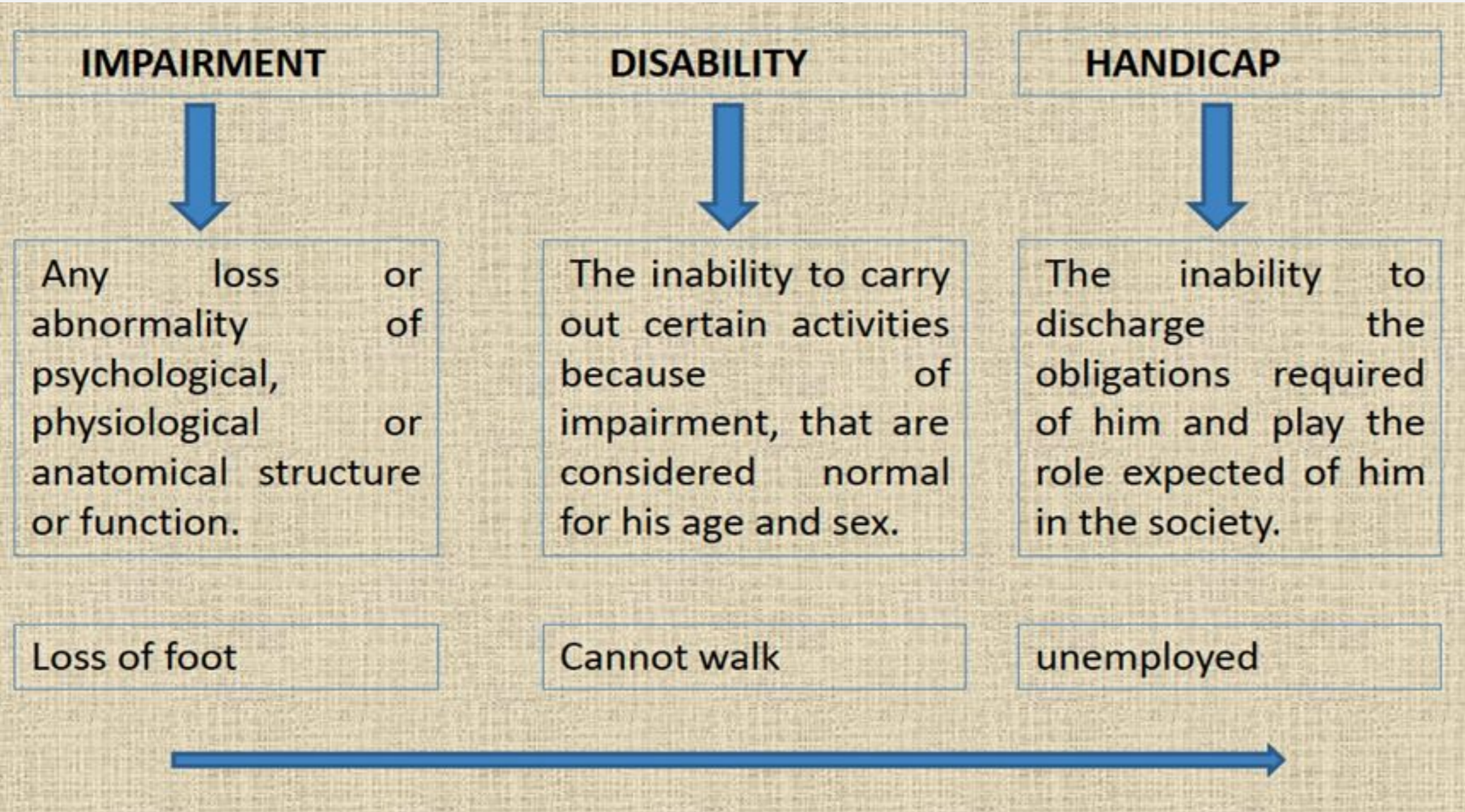
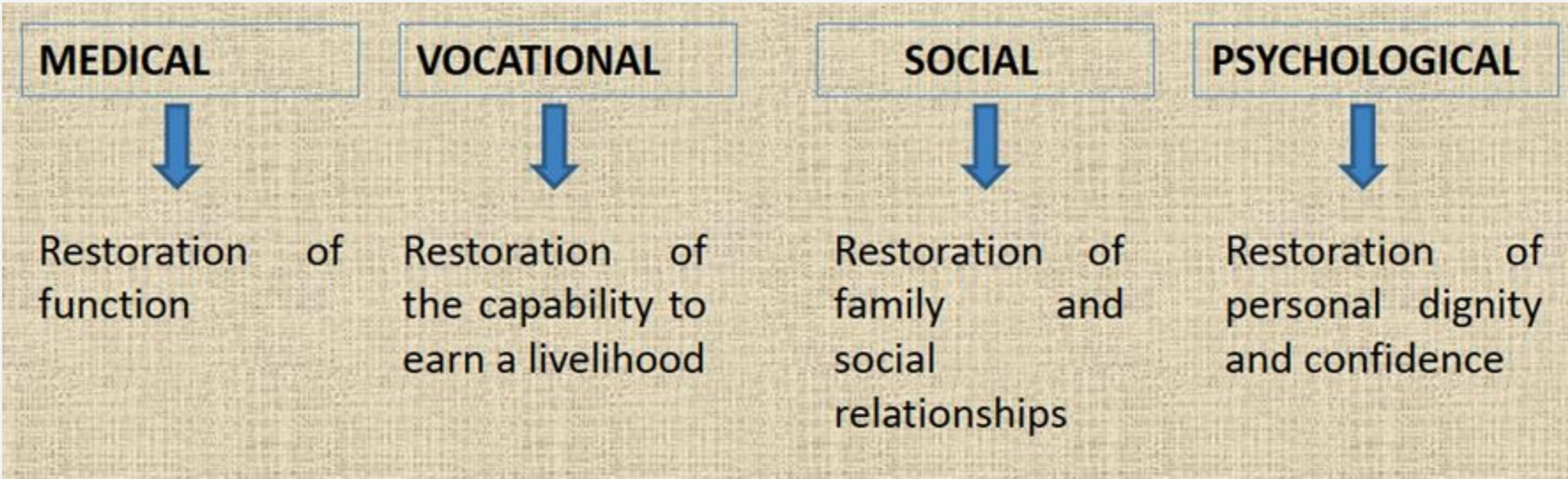


Tertiary prevention

These include **all measures undertaken when the disease has become clinically manifest or advanced**, with a view to:

- prevent or delay death,
- reduce or limit the impairments and disabilities,
- minimize suffering and
- promote the subject's adjustment to incurable conditions.
- **Prevent complications**

Tertiary prevention has two types of approaches

disability limitation	rehabilitation. Team436
<p>These include all measures to prevent the occurrence of further complications, impairments, disabilities and handicaps or even death.</p>	<p>It is defined as the combined and coordinated use of medical, social, educational and occupational measures for training and retraining the individual to the highest possible level of functional ability.</p>
<ul style="list-style-type: none"> - Complete rest, morphine, oxygen and streptokinase is given to a patient of Acute MI, to prevent death or complications like arrhythmias / CHF. - Application of plaster cast to a patient who has suffered Colle's fracture, is done to prevent complications and further disability like mal-union or non-union. 	<ul style="list-style-type: none"> - Establishing schools for blinds - Provision of aids for the handicapped - Reconstructive surgery in leprosy - Muscle re-education and graded exercises in neurological disorders
	

Levels of prevention

Level of prevention	Phase of disease	Target
Primordial	Underlying condition leading to causation	Total population and selected groups
Primary	Specific causal factors	Total population, selected groups and healthy individuals
Secondary	Early stage of disease	Patients
Tertiary	Late stage of disease	Patients

Summary

Theories of Disease Causation:

1. **Germ Theory:** Every human disease is caused by a microbe or germ, which is specific for that disease and one must be able to isolate the microbe from the diseased human being.
2. **The Epidemiological Triad:** the *triad* consists of an external agent, a susceptible host, and an environment that brings the agent and host together.
3. **The “BEINGS” Model of Disease Causation**
 - **B**iological factors innate in a human being
 - **B**ehavioural factors concerned with individual lifestyles
 - **E**nvironmental factors as physical, chemical and biological aspects of environment
 - **I**mmunological factors
 - **N**utritional factors
 - **G**enetic factors
 - **S**ocial factors
 - **S**piritual factors
 - **S**ervices factors, related to the various aspects of health care services.
4. **The Theory of “Web of Causation:**

The various factors are like an interacting web of a spider. each factor has its own relative importance in causing the final departure from the state of health, as well as interacts with others, modifying the effect of each other
5. **Wheel theory:** explains the relative contribution of genetic and environmental factors in causation of disease

Summary

Natural History of Disease

Definition: Natural history of disease refers to the progress of a disease process in an individual over time, **in the absence of intervention.**

Without medical intervention, the process ends with:

- Recovery
- Disability
- Death

Spectrum of disease

- It is a graphic representation of variations in the manifestations of disease.
- These different manifestations are the result of individuals' different states of immunity and receptivity

Prevention of disease:

Prevention is the process of intercepting or opposing the “cause” of a disease and thereby the disease process.

Levels Of Prevention:

- Primordial prevention
- Primary prevention
- Secondary prevention
- Tertiary prevention

MCQs

1. In which of the following theories there is a One to one relationship between causal agent and disease?
A-germ theory
B-The Epidemiological Triad
C-The Theory of “Web of Causation”
D-Wheel theory
2. Which theory is Ideally suited in the study of chronic disease, where the agent is often not known and disease is the outcome of interaction of multiple factors?
A-germ theory
B-The Epidemiological Triad
C-The Theory of “Web of Causation”
D-Wheel theory
3. Which theory incorporates “genetics” in the list of causations?
A-germ theory
B-The Epidemiological Triad
C-The Theory of “Web of Causation”
D-Wheel theory
4. “the prevention of the emergence or development of risk factors in population groups in which they HAVE NOT yet appeared” is the definition of which level of prevention?
A- primordial
B-primary
C-secondary
D-tertiary
5. screening for breast cancer is an example for which level of prevention?
A- primordial
B-primary
C-secondary
D-tertiary

Answers:

1-A 2-C 3-D 4-A 5-C