



Natural History of Disease

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.

Resources: Doctors' slides

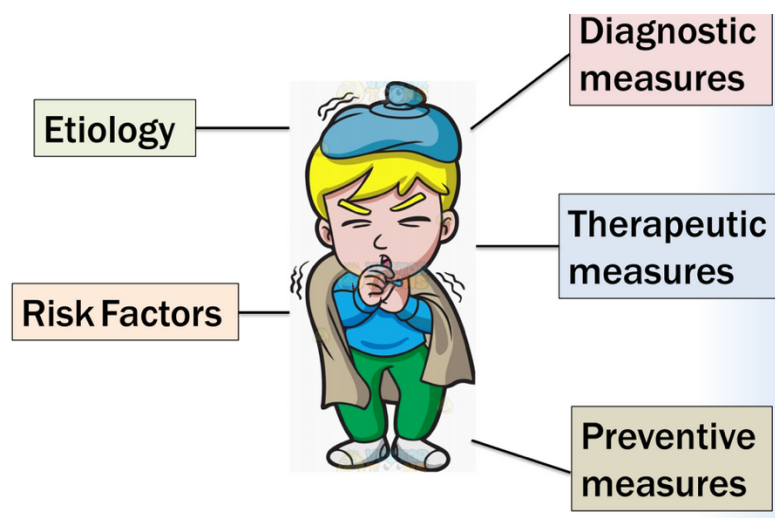
Important | **Notes** | Extra

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Theories Of Disease Causation

Understand the main concept of these theories.

Germ theory

In the second half of 19th century

Proposed by Robert Koch and Louis Pasteur (discovery of bacteria).

It states that 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. **Once you remove the microbe from this person, he will be cured.**

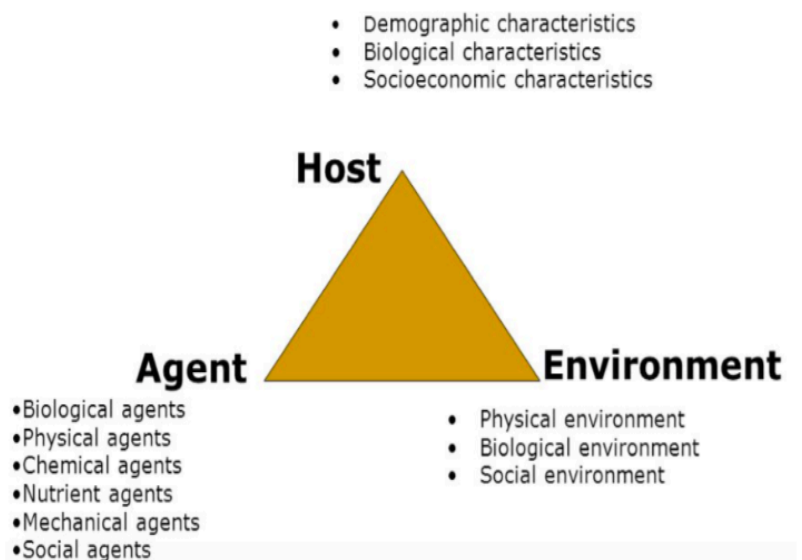
One to one relationship between causal agent and disease.



The Epidemiological Triad

The European noticed that the prevalence of TB reduced even though there wasn't any preventive methods or treatment for TB, so they start thinking there are other causes or factors beside the agent. So they announced that the first theory was wrong.

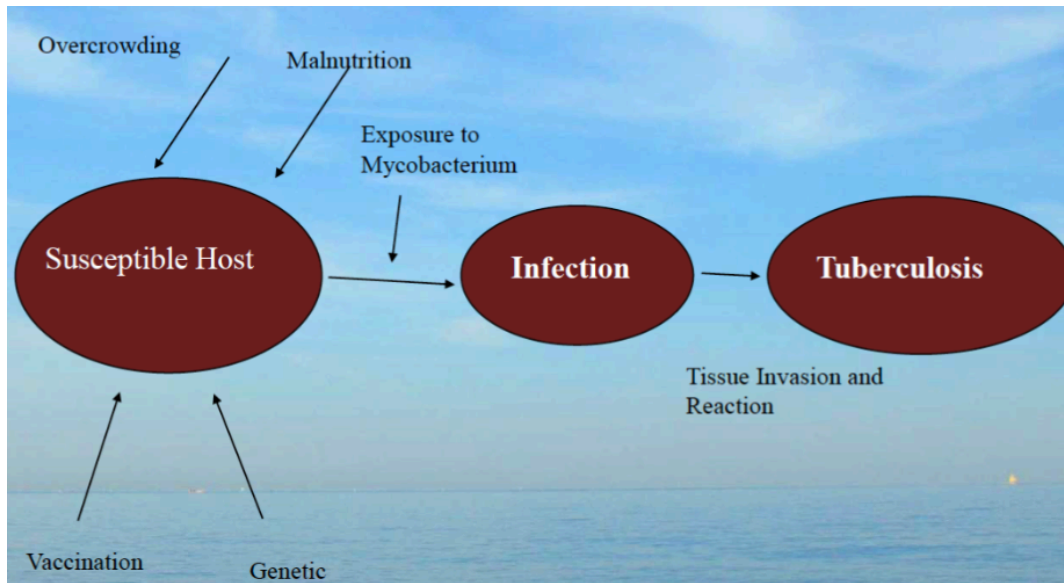
Epidemiologic triad



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**.

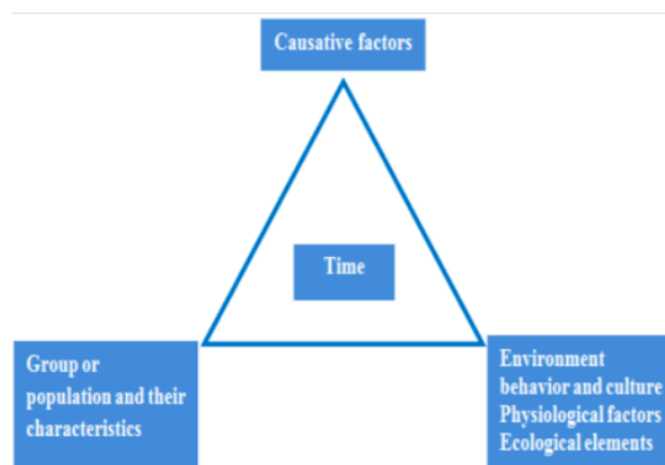
So if the immunity and nutritional status of that person is good, he won't develop the disease, that's why the interaction of these 3 factors (host, agent and environment) are important in order to develop the disease.



Epidemiological Tetrad

In addition to **HOST**, **AGENT** and **ENVIRONMENT**, one more factor **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

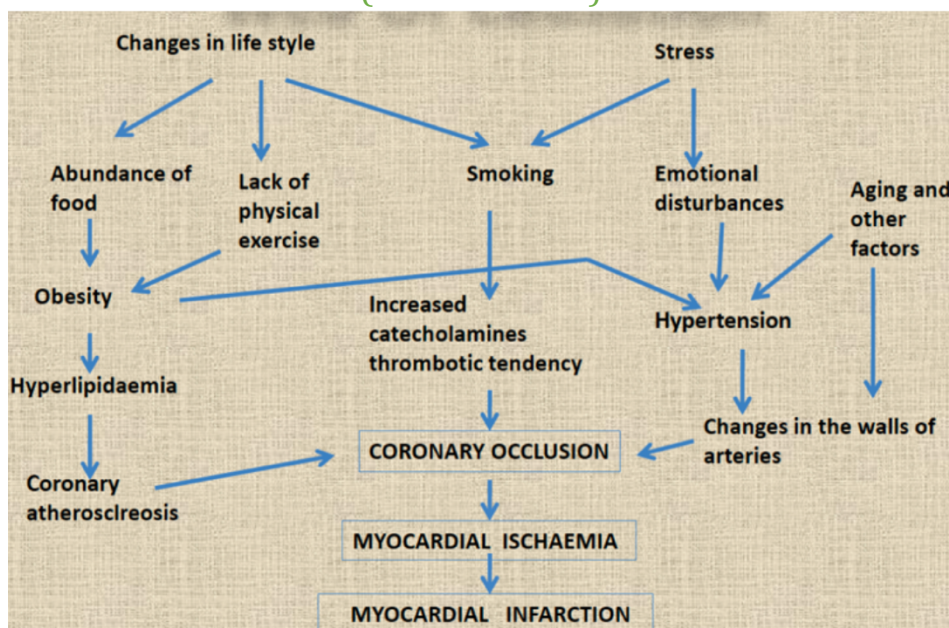
A complex interplay of nine different factors

- **B**iological factors innate in a human being,
- **B**ehavioural factors concerned with individual lifestyles, Ex. physical or sedentary lifestyle
- **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 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.

Development of MI: all these factors (more than 10) contribute to the development of MI.

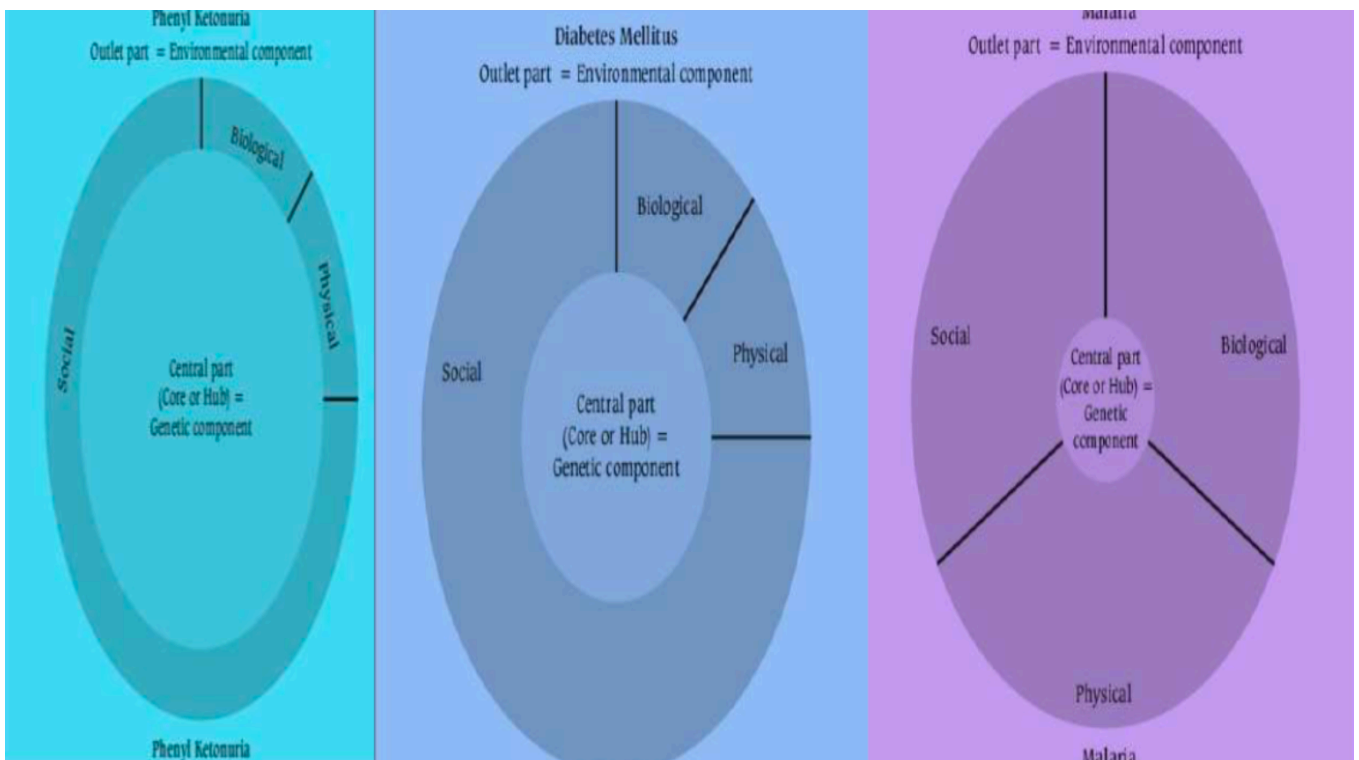
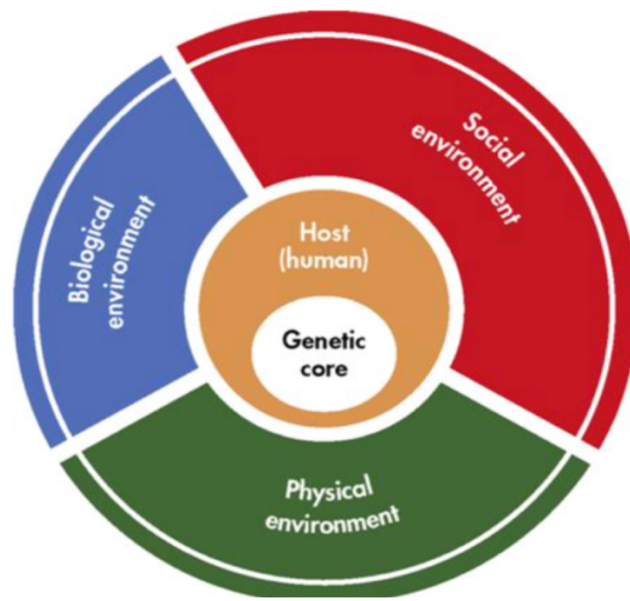


Wheel theory

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 “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.

we have 3 types of environmental factors, the higher the affect of one of them the bigger the wheel.



According to the type of the disease the wheel cycle will change the size depending on the largest contribution of such component in developing a disease.

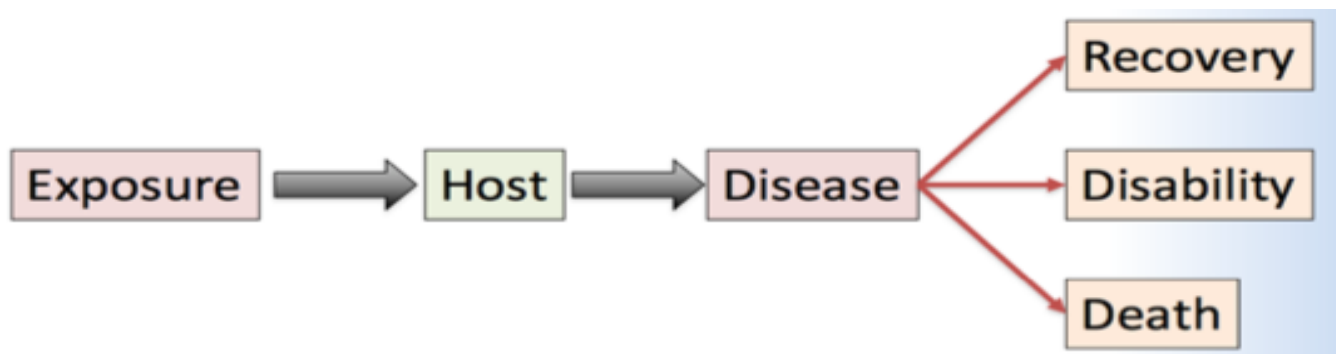
Natural History of Disease

Definition

Natural history of disease refers to the **progress** of a **disease process** in an individual **over time**, **in the absence of intervention**. We do the prevention according to the history of the disease.

The process begins with *exposure to* or accumulation of **factors** capable of causing disease without medical intervention, the process ends with:

- **Recovery.** Like flu for example, most people recover from it when taking medications.
- **Disability.**
- **Death.**



Why it is important?

It is one of the major elements of **descriptive epidemiology**.

Understanding the progress of disease process and its pathogenetic chain of events is must for the **application of preventive measures**. So if the patient develops a certain disease, we will be able to know the signs and the duration of it.

Which Design is the Best?

The natural history of disease is best established by **cohort studies**.

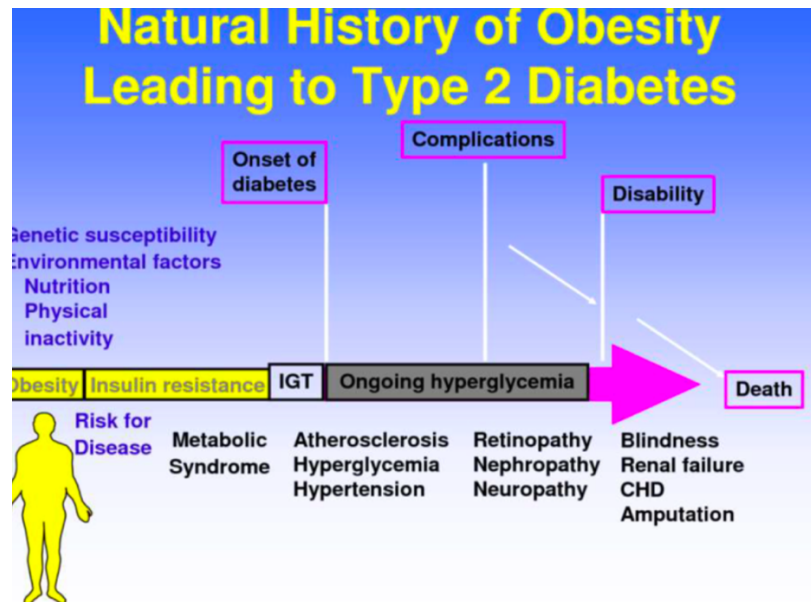
As these studies are costly, understanding of the natural history of disease is largely based on other epidemiological studies, such as **cross-sectional** and **retrospective studies**, undertaken in different population settings.

- 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

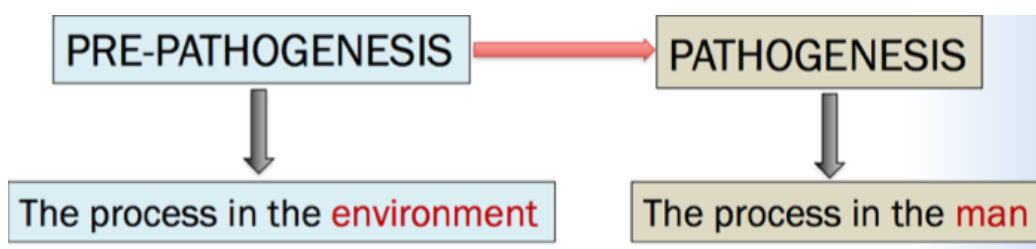
Schematic Diagram of The Natural history of disease in a patient

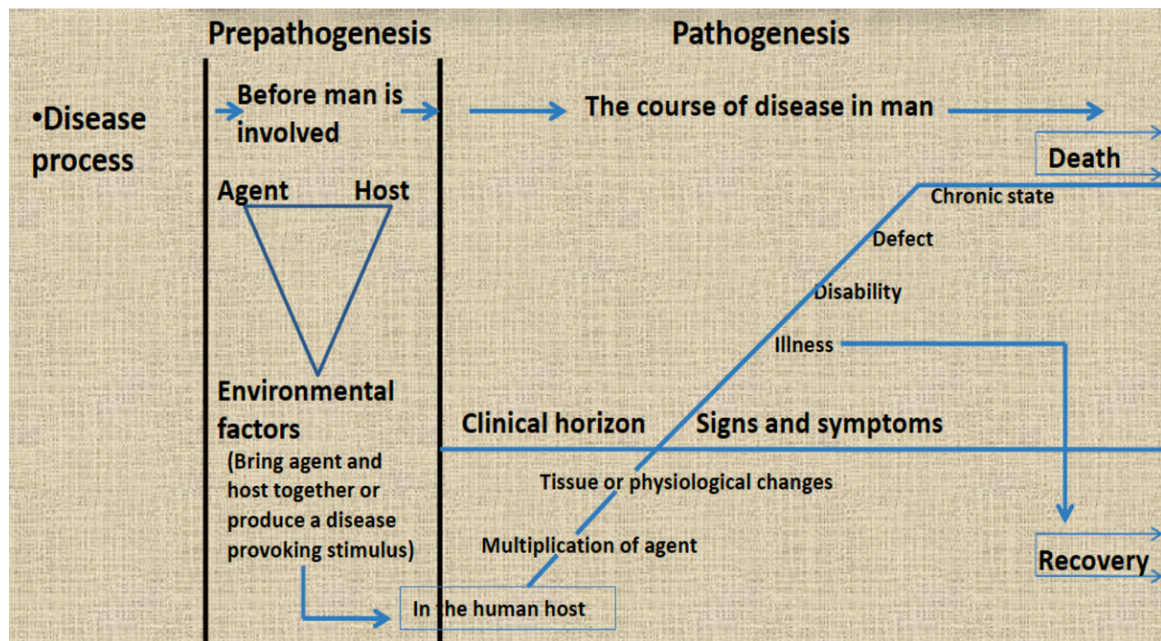
Why ?

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



Consists of two phases





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 the 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

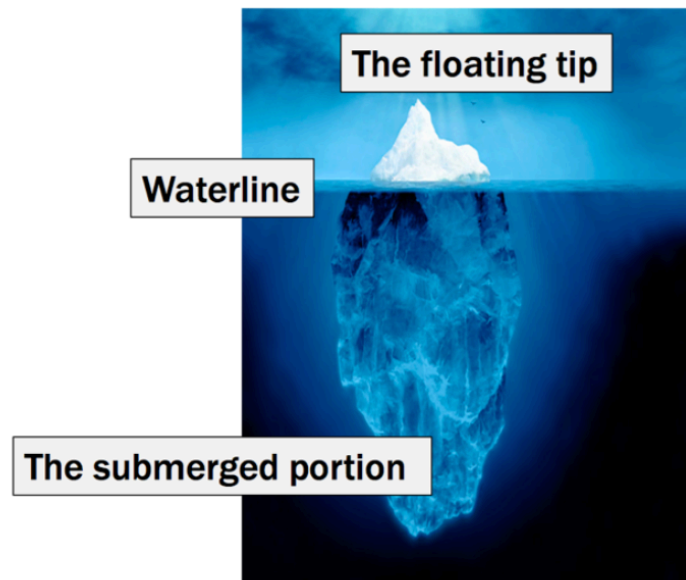
Spectrum of disease:

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**.

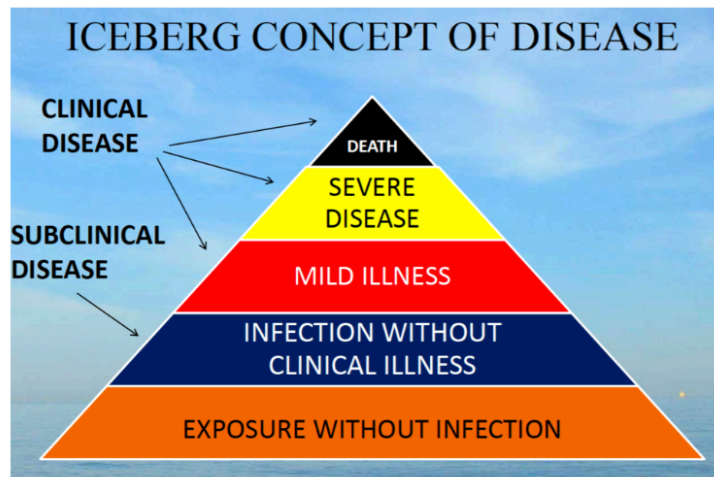
In the middle of spectrum lie illnesses ranging in severity from **mild to severe**.

These different manifestations are the result of **individuals' different states of immunity and receptivity**.



Iceberg of disease:

يلا، ملك ضرر ما نء ةرابع جلتا
يلا عزجا اذه تيوملا تحت
اهقوف يلاو ضرر ما نم هفوشنام
يلاو، ضرر ما ضار عأ يذ
clinical horizon مهنيب



Spectrum of disease

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.**

Prevention of disease

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

Why is it important? 1- Individual benefit: increases the survival rates and productivity of the person.

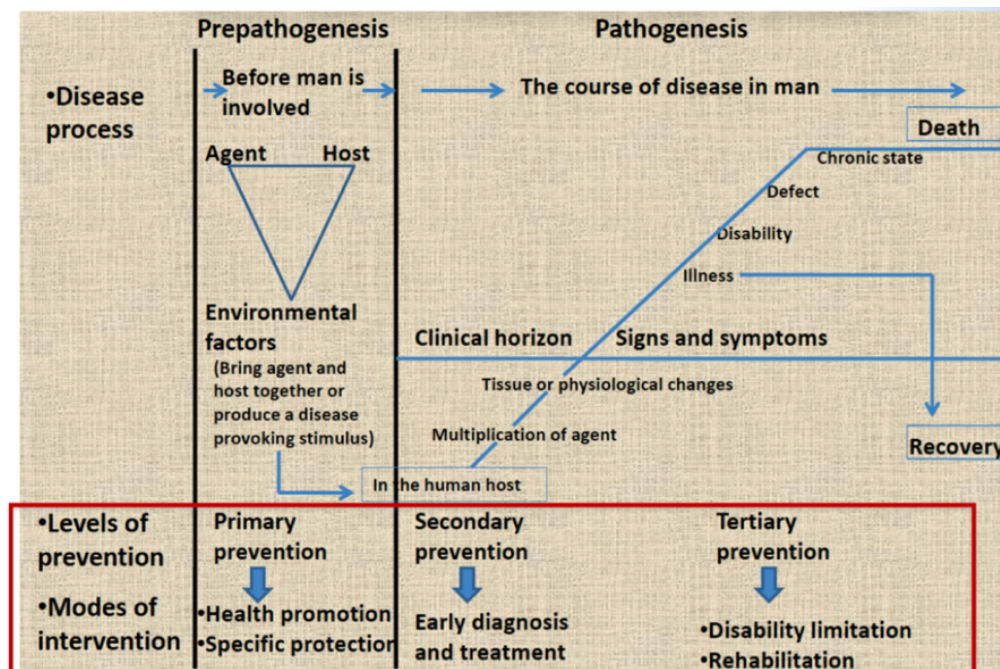
2- Economical benefit: preventing the disease is less costly than treating the complications of it (referring the patient to more than one clinic).

Successful prevention depends on:

1. Knowledge of causation
2. Dynamics of transmission
3. Identification of risk factors (smoking, Hypertension, physical in activity) and risk groups (Family history of colon cancer, you'll do a check-up for the family to reduce the incidence of the disease)
4. Availability of prophylactic or early detection and treatment measures
5. Organization to apply these measures
6. Continuous evaluation

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.

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.) **so the prevalence of HTN and obesity will reduce when they get older.**

The main intervention in primordial prevention is through **individual and mass education.**

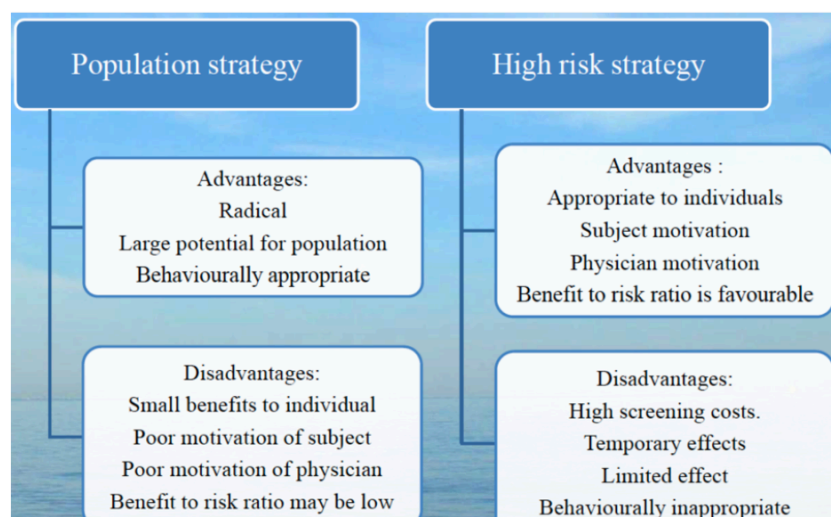
Primary Prevention

It can be defined as “ **action taken prior to the onset of disease**, which removes the possibility that a disease will ever occur. **They are at high risk but they don't have the disease yet, so we interfere with this stage to prevent the disease from happening.** Elimination or modification of “**risk factors**”

It signifies **intervention in the pre-pathogenesis** phase of a disease.

The concept of primary prevention is now being applied to the prevention of **chronic diseases** such as coronary heart disease, hypertension and cancer based on **elimination or modification of "risk-factors"** of disease.

Two types of strategies	
Population (mass) strategy	High risk strategy
<ul style="list-style-type: none"> directed at whole population irrespective of the individual risk levels. directed towards socio-economic, behavioral and lifestyle changes 	<ul style="list-style-type: none"> 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 **reduces** the prevalence of the disease by shortening its duration.

It may also **protect others in the community** from acquiring the infection and thus provide, a once, **secondary prevention for the infected individuals** and **primary prevention for their potential contacts**.

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:

1. **prevent or delay death, Ex. chemotherapy treatment for cancer patients.**
2. **reduce or limit the impairments and disabilities,**
3. **minimize suffering and**
4. **promote the subject's adjustment to incurable conditions.**

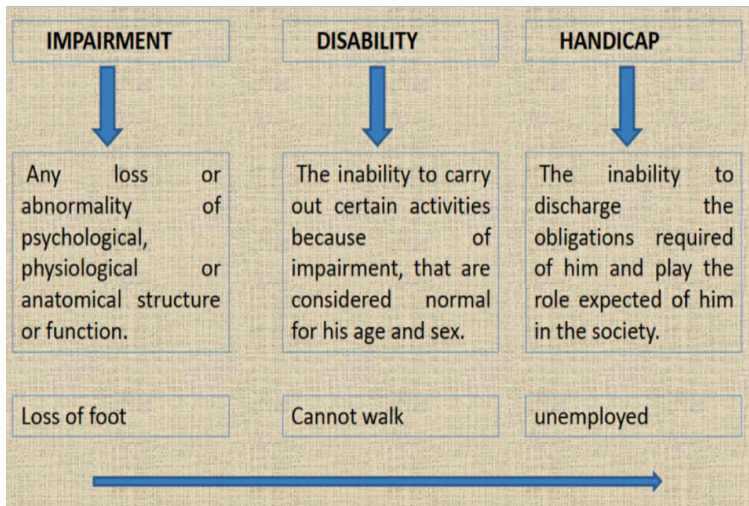
Tertiary prevention has two types of approaches

Disability Limitation

These include all measures **to prevent the occurrence of further complications, impairments, disabilities and handicaps** or even death.

- 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

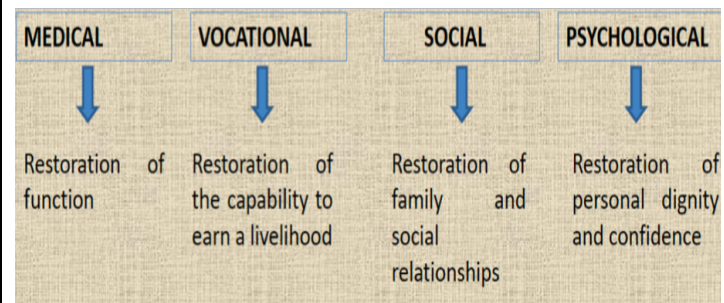
This picture is for your reading only.



Rehabilitation

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.**

- Establishing schools for blinds
- Provision of aids for the handicapped
- Reconstructive surgery in leprosy
- Muscle re-education and graded exercises in neurological disorders



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	patient

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 **host** and an **environment** in which host and agent are brought together, causing the disease to occur in the host
- 3) **Epidemiological Tetrad:** In addition to HOST, AGENT and ENVIRONMENT, one more factor **TIME** factor is added.
- 4) **“BEINGS” Model:** A complex interplay of nine different factors
- 5) **“Web of Causation”:** The various factors are like an interacting web of a spider, that cause the disease and modify the effect of each other each other.
- 6) **Wheel theory:** To explain such relative contribution of **genetic** and **environmental** factors

Natural History of Disease

- ◆ Is the progress of a disease process, in an individual over time in the absence of intervention.
- ◆ Without medical intervention, the process ends with:
 - 1) Recovery. 2) Disability. 3) Death.
- ◆ The natural history of disease is best established by **cohort studies**

Schematic Diagram of the Natural history of disease in a patient

Phases	Pre-pathogenesis phase	Pathogenesis phase
Definition	the period preliminary to the onset of disease in man.	the disease progresses through the period of incubation and later through the period of early and late pathogenesis.
Begins	When the factors already existing in the environment.	entry of the disease “agent” into the human
Ends	When the disease agent enters the human	Ends with death, disability or recovery

Spectrum of disease:

- ◆ It is a graphic representation of variations in the manifestations of disease

Prevention of disease

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

Levels Of Prevention	Definition	Intervention
Primordial prevention	It is the prevention of the emergence or development of risk factors in population groups in which they HAVE NOT yet appeared .	individual and mass education
Primary Prevention	action taken prior to the onset of disease	Through: <ul style="list-style-type: none"> ◆ Population strategy ◆ High risk strategy
Secondary prevention	“action which stop the progress of a disease at its initial stage and prevents complications”	Early diagnosis and treatment.
Tertiary prevention	all measures undertaken when the disease has become clinically manifest or advanced	Through: <ul style="list-style-type: none"> ◆ disability limitation ◆ rehabilitation



THE END
