

# Natural History of Disease & Concept of Prevention & Control

## Objectives

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

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# What is Health?

“Health is a state of **complete** physical, mental and social well-being and **not merely the absence** of disease or infirmity”

## Theories of Disease Causation

Diseases can be caused by multiple factors and agents and there can't be one theory that represents the causation of all diseases.



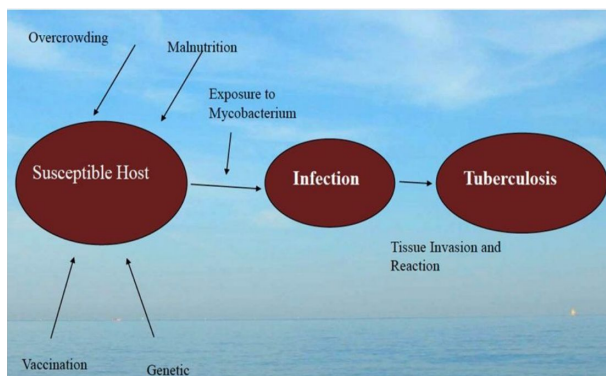
### 1- Germ Theory:

- After the discovery of bacterial culture by Louis Pasteur
- Robert Koch designed his postulates and came with the **germ theory** in the second half of the 19th century
- Germ theory 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.
- Germ theory showed a one to one relationship between causal agent and disease



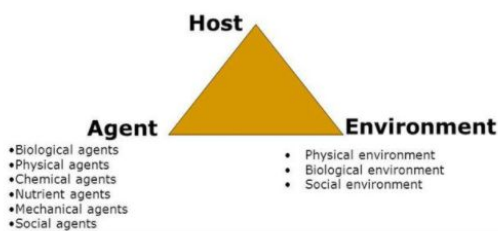
### 2- Epidemiological Triad:

- The germ theory didn't cover the causation of all diseases.
- One exception is TB (Tuberculosis)
- 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**.
- The second theory for disease causation is the epidemiological triad.
- Unlike the germ theory which takes the agent as a sole factor, the epidemiological triad considers the host and environmental factors
- It explains why some exposed people get symptoms while others don't



#### Epidemiologic triad

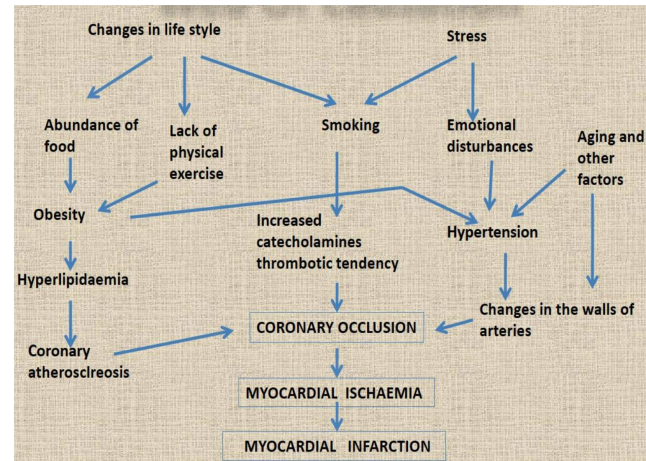
- Demographic characteristics
- Biological characteristics
- Socioeconomic characteristics



# Theories of Disease Causation

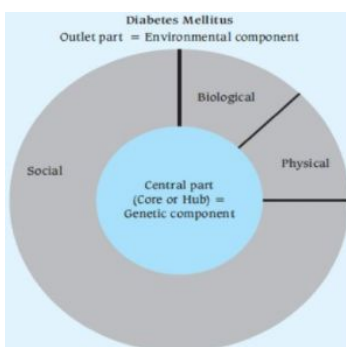
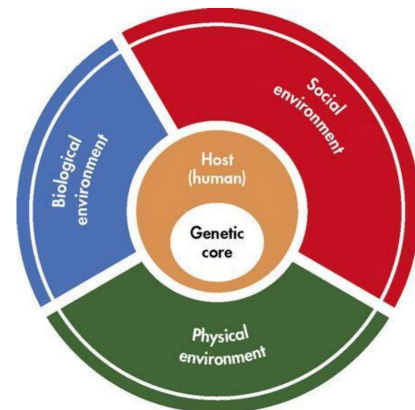
## 3- “Web of Causation”

- The web of causation was suggested by McMohan and Pugh
- The various factors are like an interacting web of spider.
- It considers all predisposing factors of any type and their complex interrelationship with each other.
- 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 suite **chronic diseases (no agent is there)** and disease is the outcome of interaction of multiple factors
- One example is **AMI (Acute Myocardial Infarction)**

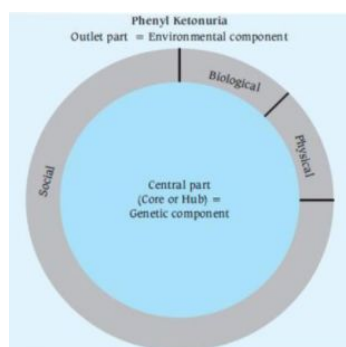


## 4- Wheel Theory

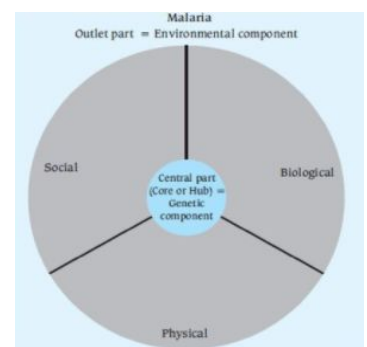
- As medical knowledge advanced, an additional aspect of interest that came to play is the comparative role between **genetics** (host) and the **environmental** (i.e. extrinsic factors outside the host) factors in causation of disease
- Both the triad and web theory don't cover this aspect thoroughly
- To explain such a relative contribution of genetic and environmental factors, the “**wheel theory**” has been postulated
- The core of the wheel represents the genetic component
- The outer part represents the environment divided into physical, social and biological



- Notice that the genetic core and the environment are equal.
- Main environment component is social (lifestyle and behavioral habits)



- Notice that the genetic core is larger (more important) than environmental factors



- Notice that the environmental factors are more important than the genetic component

# Natural History of Disease:

## Definition:

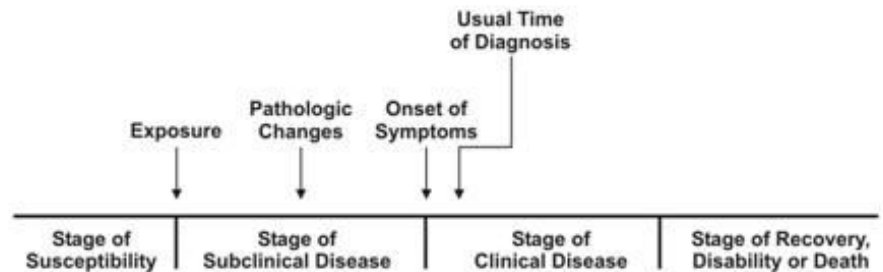
- Natural history of disease refers to the **progress** of a disease process in an individual over time, in the **absence of intervention**.
- The process begins with **exposure** to or accumulation of factors capable of causing **disease**.

## Results: with no medical intervention

- Recovery
- Disability (ex. Diabetic foot resulting in amputation)
- Death

## Stages:

1. Pre-disease stage
2. Latent (asymptomatic) stage
3. Symptomatic stage



## Pre-disease Stage

- Before a disease process begins in an individual.
- The individual can be seen as possessing various factors that promote or resist disease.



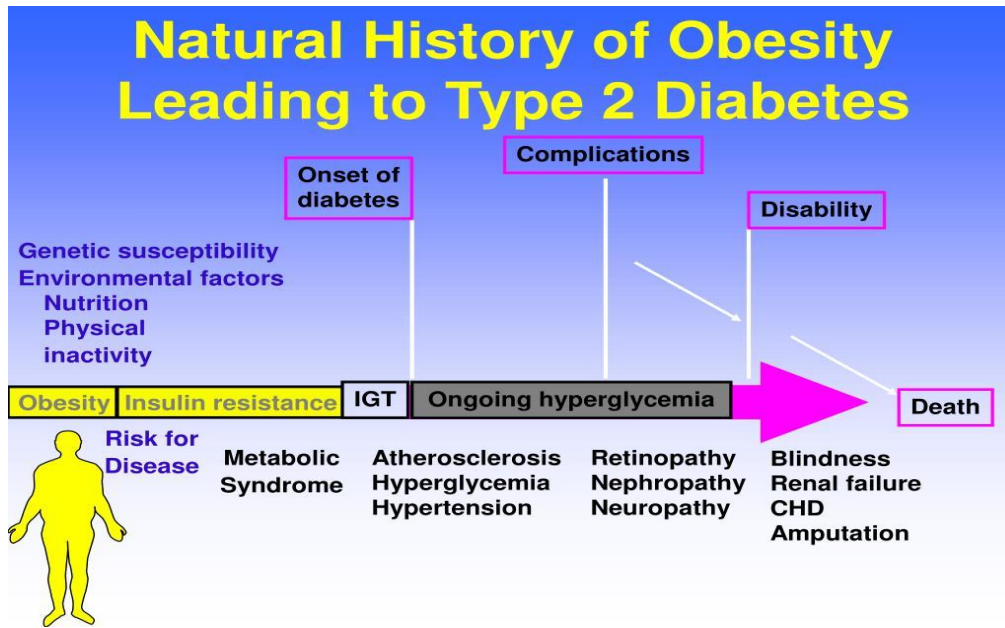
## Latent Stage (asymptomatic)

- If the disease-producing process is underway, but no symptoms of disease have become apparent
- Patient was exposed and the disease-producing process is underway (**no symptoms**)
- **Screening** may be feasible

## Symptomatic Stage

- When the disease is advanced enough to produce clinical manifestations
- The earlier the condition is diagnosed and treated, the more likely the treatment will delay death or serious complications, or at least provide the opportunity for effective rehabilitation.

# Natural History of T2D

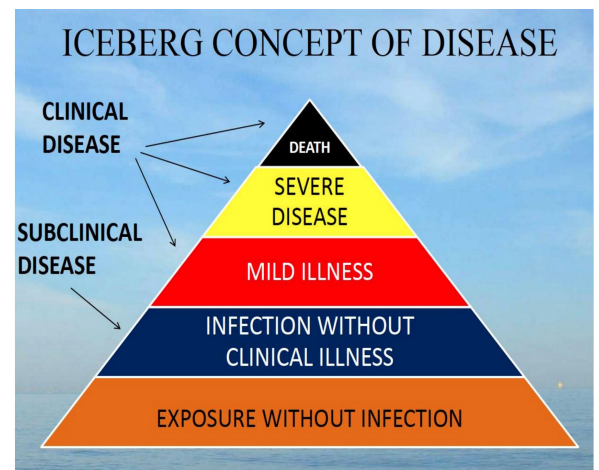


- Predisease Stage: **obesity**, genetic susceptibility and other environmental factors
- Latent Stage: ongoing hyperglycemia and insulin resistance
- Symptomatic Stage: atherosclerosis, retinopathy, neuropathy, nephropathy...etc.
- If disease persisted it'll lead to potential **disabilities** and **death**



## Iceberg Phenomenon

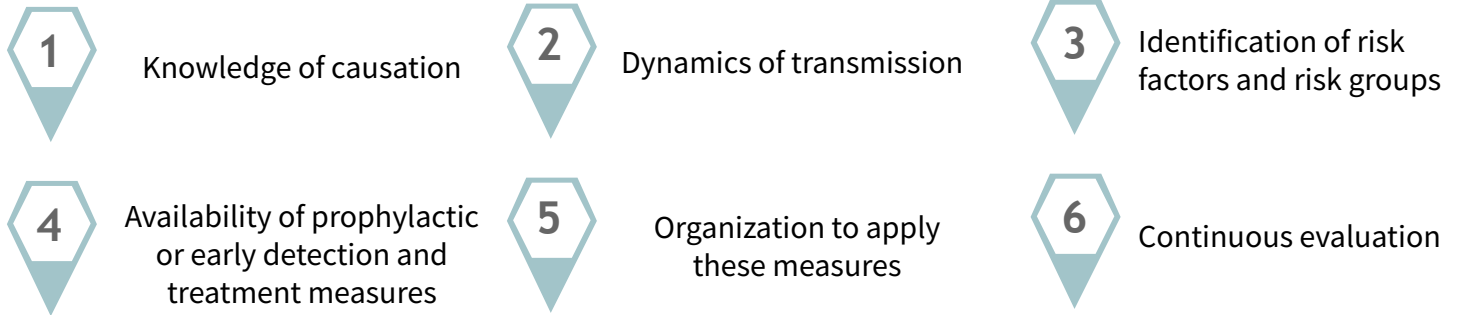
- The iceberg phenomenon represents the biological spectrum of diseases
- Ranging from subclinical disease (asymptomatic) to clinical disease (symptomatic)
- The floating tip of the iceberg represents the clinical disease while the submerged part represents the subclinical disease
- Different manifestations of the disease is based on the host's immunity and receptivity



# Disease Prevention

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

Successful prevention depends on:



## Levels of Prevention

1 Primary Prevention

2 Secondary Prevention

3 Tertiary Prevention

Leavell's Levels of Prevention			
Stage of Disease and Care		Level of Prevention	Response
Predisease Stage	No known risk factors	Primary Prevention	Health promotion (lifestyle, nutrition & environment)
	Disease Susceptibility		Specific Protection (immunization, safety measures)
Latent Disease	Hidden Stage (Asymptomatic)	Secondary Prevention	<b>Screening</b> (for population) & case finding (for individual)
Symptomatic Disease	Initial Care	Tertiary Prevention	Disability limitation
	Subsequent Care		Rehabilitation



# Levels of Protection

## 1 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.
- Keeps the disease from being established by **eliminating the cause** of the disease (clean water to kill cholera) or by **increasing resistance** to disease (vaccination)
- It signifies intervention in the **pre-symptomatic** phase of a disease.
- Two types of strategies:
  1. Health promotion (in positive health people with no known risk factors)
  2. High risk strategy (specific protection for high risk groups)

## Health Promotion:

- Health-promoting activities usually contribute to the primary prevention of a variety of diseases and enhance a positive feeling of health
- Activities consist of **non-medical efforts** such as changes in **lifestyle, nutrition** and **environment**.

Health promotion in infectious disease

→ **reduces the frequency and seriousness of infectious diseases** and it includes:

Clean water

Appropriate waste disposal

Manage crowding

Control the animal vectors  
of disease

Adequate housing and  
working environment

## Example of Primary Prevention

- For example primary prevention of cardiovascular disease we need to address **modifiable risk factors**, they include:
  - Smoking
  - Unhealthy diet
  - Physical Activity
  - Dyslipidemia
  - Hypertension
  - Diabetes Mellitus
  - Obesity
- You cannot control non-modifiable risk factors, so you cannot change them.

# Levels of Protection

## 2 Secondary Prevention:

- It can be defined as “action which stops the progress of a disease at its initial stage”
- Interrupts the disease process before it becomes symptomatic.
- It is applied in the **latent stage** of disease (asymptomatic)
- The specific interventions used is early diagnosis and treatment (**screening**), for example:
  1. Mammography to screen for breast cancer
  2. Pap smear to screen for cervical cancer

## 3 Tertiary Prevention:

- Limits the physical and social consequences of symptomatic disease
- 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
  - Promote the subject’s adjustment to incurable conditions

### Approaches to Tertiary Prevention

	Disability Limitation	Rehabilitation
Stage of Care	Initial care	Subsequent care
Description	Measures to prevent the occurrence of further complication, impairments, disabilities and handicaps or even death	Identify and teach methods to reduce physical and social disability
Example	<ul style="list-style-type: none"> <li>• Complete rest, morphine, oxygen and streptokinase is given to patient of <b>Acute MI</b> to prevent death or complications like <b>arrhythmias / CHF</b></li> <li>• Application of plaster cast to a patient who suffered <b>Colles’ fracture</b> is done to to prevent <b>complications and further disability like mal-union or non-union.</b></li> </ul>	<ul style="list-style-type: none"> <li>• Helping a car accident victim regain the use of his legs</li> </ul>



# Quiz

## MCQ

1- At which stage of a disease's natural history do we apply screening as a method of prevention?

- A- Pre-disease Stage      B- Susceptible Stage      C- Latent Stage      D- Symptomatic Stage

2- Which of the following theories of disease causation best describes the transmission of COVID-19?

- A- Germ Theory      B- Epidemiological Triad      C- Web of Causation      D- Wheel Theory.

3- The floating tip in the iceberg phenomenon represents which of the following?

- A- Clinical Stage      B- Exposure      C- Subclinical Stage      D- Healthy population

4- Administration of Alteplase (fibrinolytic) for the treatment of STEMI is considered a preventive method to fatal ventricular arrhythmia. Which of the following approaches describes this method?

- A- Disability Limitation      B- High risk strategy      C- Screening      D- Rehabilitation

5- A friend of yours came to you at the clinic for a regular check up. Family history showed that his father was diagnosed with T2D recently. After a general examination you found out that your friend is healthy and has a normal blood glucose level. Which stage of T2D natural history is your friend's currently at?

- A- Pre Disease Stage      B- Latent Stage      C- Symptomatic Stage      D- Positive Health

6- Which of the following best describes the "Wheel Theory"?

- A- The outlet represents social factors only  
B- The Core represents biological factors  
C- Physical Factors include lifestyle and activities  
D- The inner part resembles the genetic core

## Answers

Q1	Q2	Q3	Q4	Q5	Q6
C	B	A	A	A	D



Thank You and  
Good Luck



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