Natural History of Disease and Concepts of Prevention

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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.regarding controlling the reservoir, interruption of transmission, and the susceptible host

Session overview

- Theories of Disease Causation.
- Natural History of Disease
- Iceberg of Disease
- Concept of Prevention
- Modes of Intervention

What is Health?

"Health is a state of **complete** physical, mental and social well-being

and **not merely the absence** of disease or infirmity"

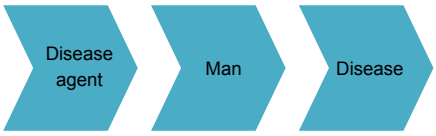
Theories of Disease Causation[1]

Diseases can be by multiple factors and agents and there can't be

one theory the represents the causation of all diseases.

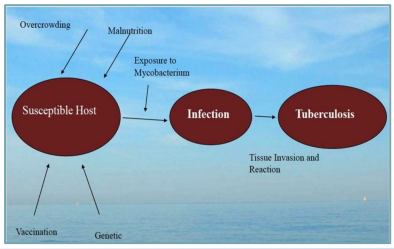
1- Germ Theory [2]:

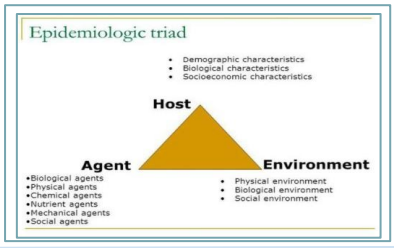
- After the discovery of bacterial culture by Louis Pasteur
- Germ theory was proposed by Robert Koch and Louis Pasteur in the second half of the 19th century
- Germ theory states that:
- Every human disease is caused by a microbe or germ, which is specific for that disease and one must be able to isolate the microbe from the diseased human being.
- Germ theory showed a **one to one relationship** between causal agent and disease



2- Epidemiological Triad [3]:

- 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





Host : (human, or animal)
Agent : are different depending on the type of disease
Ex, agent of infectious disease is microbes (bacteria fungus, virus)
Environment : (temperature, humidity)

1 For each theories we have to know the concept and when do we use .

1. Germ theory :
Health problems were believed to be the product of living organisms which entered the body through food, water, air or the bites of insects or animals. It was believed that each disease has a single and a specific cause (mono-causal approach).

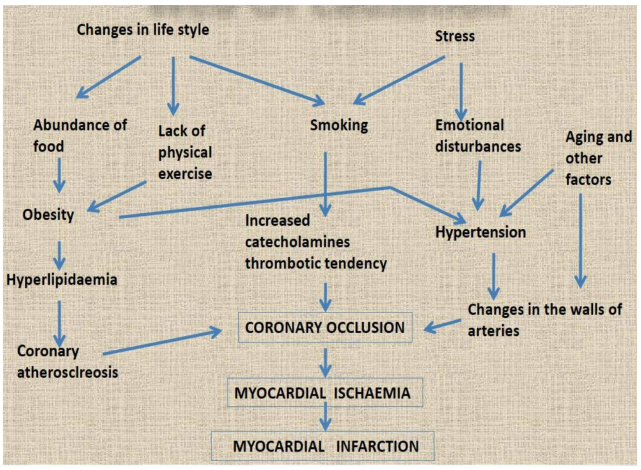
3.Epidemiological triangle : (helps to understand infectious diseases)
According to this theory, exposure to an agent does not necessarily lead to disease. It was believed that disease is the result of an interaction between agent, host and the environment.

-As a result of the epidemiological triangle theory:
It was believed that diseases can be prevented by modifying factors which influence exposure and susceptibility. This is useful in understanding infectious disorders, but less useful in dealing with chronic, degenerative diseases such as heart diseases and diabetes. For these disorders there is no specific agent that could be identified against which individual and population may be protected.

Theories of Disease Causation

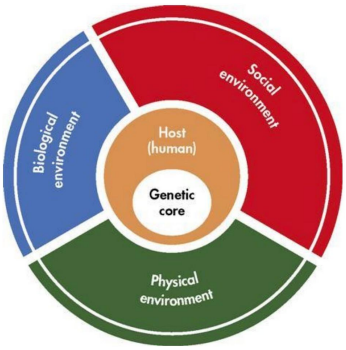
3. "Web of Causation" [3]

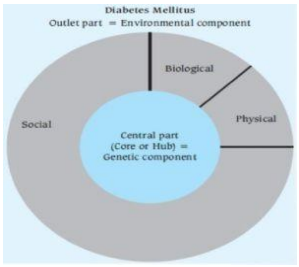
- The web of causation was suggested by MacMohan and Pugh
- The various factors are like an interacting web of spider.
- This model of disease causation considers all predisposing factors of any type and their complex interrelationship with each other.
- Each factor has its own relative importance in causing the final departure from the state of health, as well as interacts with others, modifying the effect of each other.
- Ideally suited in the study of chronic disease, where the agent is often not known and disease is the outcome of interaction of multiple factors.
- One example is **AMI** (Acute Myocardial Infarction)



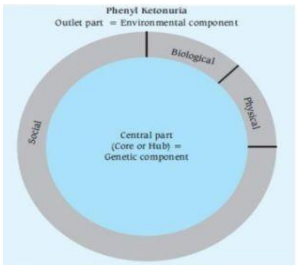
4. Wheel Theory [4]

- 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 as the wheel theory does.The "triad" as well as the "web" theory does not adequately cover up this differential.
- 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

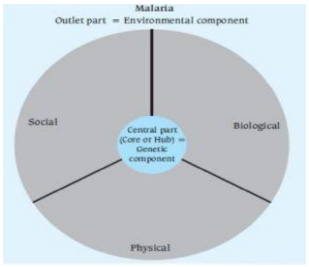




- Notice that the genetic core and the environment are equal.
- Main environment component is social (lifestyle and behavioral habits)



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



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

3. Web of causation : (helps to understand chronic diseases and it's contain a several factor which is INCREASED the risk of disease)
According to this concept, disorders are developed through complex interaction of many factors. These factors maybe biophysical, social or psychological and may promote or inhibit the disease at more than one point in the causal process. Ultimately, they determine the level of disease in a community

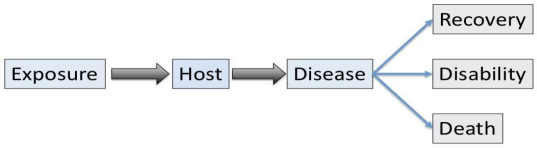
4. It can be used for genetic diseases

Natural History of Disease:

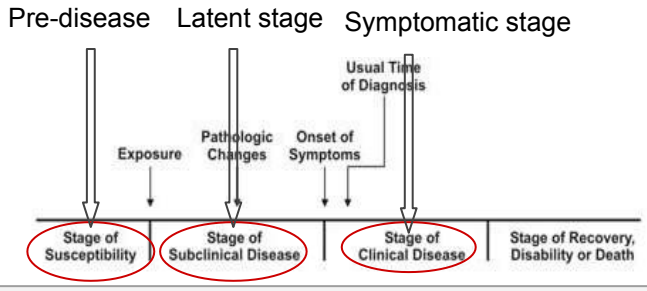
Definition:

- Natural history of disease refers to the **progress** of a disease process in an **individual** [5] over time, **in the absence of intervention** (absence of treatment) **.**
- 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:

Pre-disease Stage

- Individuals are susceptible to disease , no diseases and no pathophysiological changes
- Before a disease process begins in an individual.
- The individual can be seen as possessing various factors that promote or resist disease.
-

1-Social environment 2-Immunological capability 3-Nutritional history 4-Genetics makeup 5-environmental exposure 6-demographic characteristics (age) 7-behavioral patterns

Latent Stage (asymptomatic)

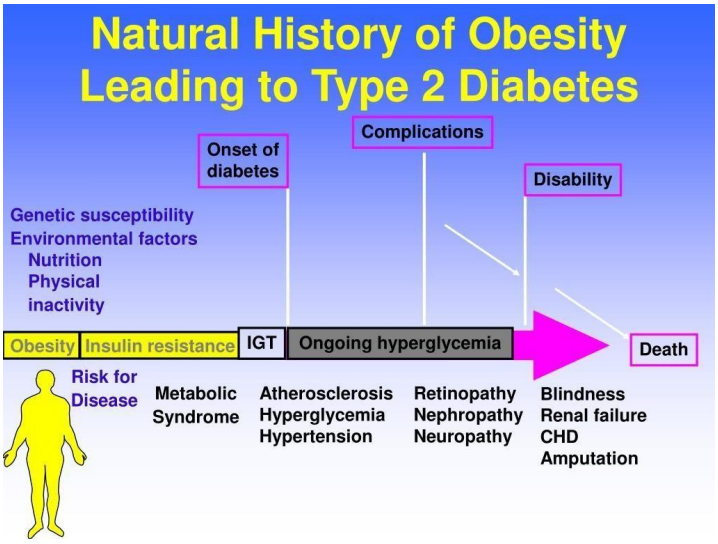
- If the **disease-producing process is underway**, but **no symptoms** of disease have become apparent
- **Screening** may be feasible

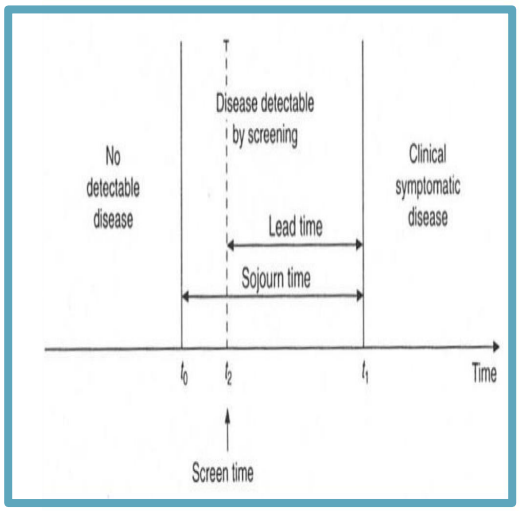
Symptomatic Stage

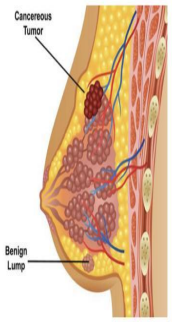
- When the disease is advanced enough to **produce clinical manifestations**
- The earlier the condition is diagnosed and treated, the more likely the treatment will delay death or serious complications, or at least provide the opportunity for effective rehabilitation.

5-so the natural history of disease can be different from person to person

Natural History of T2D







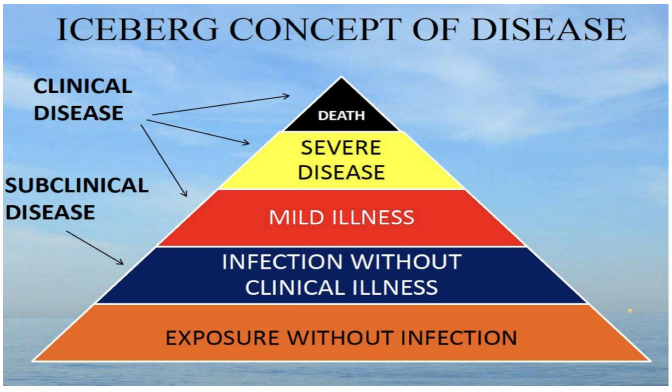
- Predisease Stage: **obesity**, genetic susceptibility and other environmental factors
- Latent Stage: ongoing hyperglycemia and insulin resistance
- Symptomatic Stage: atherosclerosis, retinopathy, neuropathy, nephropathy...etc.
- If disease persisted it'll lead to potential **disabilities** and **death**

- As long as the symptoms presented the patient will be in advance stage

Iceberg Phenomenon

- For your information

- 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:

1. Knowledge of causation
2. Dynamics of transmission
3. Identification of risk factors and risk groups
4. Availability of prophylactic or early detection and treatment measures
5. Organization to apply these measures
6. Continuous evaluation

Levels of Prevention

1. Primary prevention
2. Secondary prevention
3. Tertiary prevention

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	Screening (for population) & case finding (for individual)in medical care) and treatment if disease is found
Symptomatic stage	Initial Care	Tertiary Prevention	Disability limitation (e.g , institute medical or surgical treatment to limit damage from disease and institute primary prevention measures)
	Subsequent Care		Rehabilitation (I.e, identify and teach methods to reduce physical and social disability)

Levels of Prevention

1 Primary Prevention [6] :

- 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 [6] :

- 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 [7] :

- 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
  - Prevent complications

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	• Complete rest, morphine, oxygen and streptokinase is given to patient of **Acute MI** to prevent death or complications like **arrhythmias** / **CHF** • Application of plaster cast to a patient who suffered **Colles’ fracture** is done to to prevent **complications and further disability like mal-union or non-union.**	Help a car accident victim regain the use of his legs

PRIMODIAL stage : come before primary stage and it’s indicate people with NO risk factor.
6-Primary and secondary prevention are responsibility of preventive medicine
7-Tertiary prevention is responsibility of physicians (treatment)

Summary

What is health

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

	Epidemiological Triad	Germ theory	Web of Causation	Wheel Theory
Theories of Disease Causation	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 epidemiological triad considers the host and environmental factors	showed a one to one relationship between causal agent and disease	It considers all predisposing factors of any type and their complex interrelationship With each other	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) factorsin causation of disease

Natural history of disease refers to the **progress** of a disease process in an **individual** [5] over time, **in the absence of intervention and may result in recovery,disability or death.**

Stages

1. Pre-disease Stage Before a disease process begins in an individual.
2. Latent (asymptomatic) stage the disease-producing process is underway, but no symptoms of disease have become apparent
3. Symptomatic stage When the disease is advanced enough to **produce clinical manifestations**

Disease prevention

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

Level of prevention

1. Primary prevention
2. Secondary prevention
3. Tertiary prevention

Levels of Prevention

Primary	Secondary	Tertiary
It can be defined as "action taken prior to the onset of disease, which removes the possibility that a disease will ever occur. It signifies intervention in the **pre-symptomatic** phase of a disease	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**)	Limits the physical and social consequences of symptomatic disease. Prevent or delay death. Minimize suffering. Promote the subject's adjustment to incurable conditions.
Examples : Vaccination Smoking cessation	Examples: Pap smear Mammography	Examples: Drugs given to patient of acute MI

Strategies of primary prevention

- Health promotion (Non medical efforts)
  - -Lifestyle
  - -Nutrition
  - -Environment
- High risk strategy (specific protection for high risk groups)

Approaches to tertiary prevention

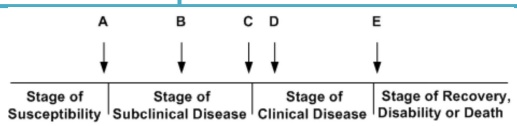
- Disability Limitation
- Rehabilitation

Practice Questions

Q1: 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

Q2: identify the letter A in the time line in Figure



A. Onset of symptoms	B. Usual time of diagnosis	C. Exposure	D. Pathological changes

Q3: Which of the following best describes the "Germ theory"?

A. showed a one to one relationship	B. Every human disease is caused by a microbe or germ	C. The various factors are like an interacting web of spider.	D. A and B

Q4: The floating tip in the iceberg phenomenon represents which of the following

A. Clinical stage	B. Exposure	C. Subclinical stage	D. Healthy population

Q5: 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

Q6: 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

Answer key:

1(C) , 2 (C) , 3 (D) , 4 (A) , 5 (A) , 6 (A)

Thanks to all leaders and members from team 439 and team 441🤍

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