Causation

- Successful prevention of disease depends on :
  - Knowledge **of the causation**
  - Dynamics of transmission
  - Identity risk factors and risk groups
- <mark>Preventable</mark> causes of disease (<mark>BEINGS</mark>)
  - **Biological** and **Behavioural** factors
  - **Environmental**
  - **Immunological**
  - **Nutritional**
  - **Genetic** factors
  - **Service** , **social** , **spiritual** factors
- **Epidemiologic Triad** → Agent , host , environment
- Agent can be → **biological, physical, chemical, nutritional , mechanical, social .**
- **<mark>Hazard → sth with potential to cause harm</mark>**
- **<mark>Harm</mark> → death and major injury and any form of physical or mental ill health**
- **Risk → a <mark>measure</mark> of the probability(likelihood of an event occurring)**
- **Risk types :**
  - **Absolute → <u>incidence</u> of disease in <u>any population</u>**

  - **Relative → <u>ratio</u> of incidence rate <u>in group exposed</u> to hazard to the incidence rate in the <u>non exposed group</u>**
  - **Attributable → <mark>difference</mark> in incidence rates between exposed and non exposed groups**
- **Cause → antecedent <u>event / condition / characteristic</u> that is necessary for disease occurs**
- **Association → occurrence of two variables more frequently than expected**
- **Types of association :**
  - **Spurious → when the observed association between the suspected cause and the effect <u>may not be real</u>**
  - **Indirect → statistical association**
  - **Direct (causal)**
    - **One to one**
    - **<u>Multifactorial</u> → *sufficient&necessary cause* / <u>web of causation</u>(interaction)**
- **Two variables called to causally related if → any change in one is followed by a change in the other**
- **This initial criteria used by <mark>Henle&koch</mark>**
- **Hills criteria**
  - **<u>Strength of association</u>**

- ○ **Temporal relationship**
- ○ **Distribution of disease**
- ○ **Gradient (dose-response effect)**
- ○ **Consistency**
- ○ **Specificity**
- ○ **Biological plausibility**
- ○ **Experimental models**
- ○ **Preventive trials**
- **Temporal relationship** → exposure to the causative factor must occur before the onset of disease (more likely to acute communicable disease)
- **Strength of association** → the larger the relative risk the more likely the association is causal → strengthened if there's dose and duration response relationship
- **Dose response** relationship:
  - ○ **More intense and longer exposure → more frequent and severe disease**
- **Dose duration** relationship:
  - ○ **Cumulative effect**
- **Specificity** of association → one to one relationship between the cause and the effect
- **Consistency** of association → an association has to be replicated and confirmed by different investigators (y3ni single study not enough enu n7ki fe causal association)
- **Biological plausibility** → causal association is substantiated if biological plausibility (معقولية) .
- **Confounding (fundamental problem of causal interfere)** → **bias** due to inherent (unobservable) differences in risk between exposed and underexposed population → lack of comparability
- **Confounding** → Mixing the effect of the exposure on disease with the effect of another factor that's associated with the exposure
- **3 criteria for a variable to be a confounder :**
  - ○ **C must be a risk factor for D in the unexposed population**
  - ○ **C must be associated with E (exposure)**
  - ○ **The association between C and E must not be due entirely to the effect of E on C → C can't be intermediate between E and D**

- **Predominantly Genetic or Environmental**
    - **Genetic → stable incidence + clustered in families**
    - **Environmental → incidence varies rapidly :**
        - **Over time**
        - **Between genetically similar population**
- **Pyramid of association :from head to base**
    - **Causal and mechanisms understood**
    - **Causal**
    - **Noncausal**
    - **Confounded**
    - **Spurious / artefact**
    - **Chance**
- **Core of epidemiology → association between disease and postulated causal factors**
- **Difficulty in demonstrating causality :**
    - **Complexity and long history of many human disease**
    - **Ethical restraints of human experimentation**
- **Judgments of cause and effect are → tentative**
- **Causal models broaden causal perspectives**
- **Cause → genetic / environmental**
- **Cause :**
    - **Sufficient : its presence always leads to disease development**
    - **Necessary : without it the outcome never develops**
    - **Component : can't itself develop disease → supportive**
- **Collectively →**
    - **Necessary + component → sufficient cause**
- **Conditions**
    - **Necessary → if not found , the outcome doesn't occur**
    - **Sufficient condition**
- **Necessary cause must always precede the effect**
- **Sufficient → inevitably initiates or produces an effect**