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The concept of cause & causal association

Association: An association exists if **two variables** appear to be **related**

with each other; that is, a change of one appears to be related to the
change in the other.
e.g. association between obesity and diabetes mellitus

Cause: a **factor** (e.g., attributes and exposures) the **presence** of which,

at some time during an individual's life, inevitably **result in disease** in

that individual.

e.g. smoking is a cause of cerebrovascular diseases The risk factors may be acting individually, in sequence, or together that result in disease in an individual. These pathways are often different with different sets of risk factors for individuals in different situations. **e.g. Age sex occupation family history diet …etc**

Negative Association (Inverse Relationship):

The magnitude of one variable appears to move in the opposite

direction of the other associated variable. If the relationship is causal,

 higher levels of the risk factor are protective against the outcome.

e.g. regular physical exercise and ischemic heart diseases

Positive Association (Direct Relationship):

The magnitudes of both variables appear to move together up or down.

 If the relationship is causal, higher levels of the risk factor cause more

of the outcome. e.g. hypertension and ischemic heart diseases

Types of Factors in Causation:

1.Predisposing factors : i.e. age, sex, previous illness it may **create**

a state of "**susceptibility** " to a disease agent.

2.Enabling factors : may **favor the" development**" of the disease i.e. Low

income , poor nutrition , bad housing .

3.Precipitating factors : **associated with the "Onset"** of a disease i.e.

exposure to a specific disease agent, noxious agent .

4.Reinforcing factors : may "aggravate" an established disease i.e.

repeated exposure, hard work .

Some risk factors are associated with multiple diseases e.g. smoking & some diseases are associated with multiple risk factors. e.g. CHD

Interaction:

 The effect of two or more causes acting together which is more than

simple adding of their individual effects . e.g. bad housing , malnutrition

 and Mycobacterium tuberculosis interact to produce tuberculosis

Criteria of causal association

In order to establish a causal association of a factor, the following criteria

should be fulfilled:

1. strength of association:

The greater the magnitude of association , the greater the possibility that this association is a causal one, this doesn't mean that the association of a small magnitude is not a causal one.

e.g. RR of exposure to heavy smoke & developing lung Ca =20 so it is more to the side of the causal association .

2. Biological credibility:

A knowledge or postulated mechanism between exposure & outcome will greatly support a causal association. e.g. physiology biochemistry….etc.

3. Consistency with other investigations :

When a no. of studies conducted by different investigations at various times , using different methodology, in different geographical or culture setting & among different populations all show similar results support a causal association.

e.g. In a meta analysis of selected randomized totals of beta-blockers in the prevention of deaths following a myocardial infarction.

4. Time –sequence (temporal relationship):

The cause should precede the outcome by a period of time consistent with the biological mechanism.

e.g. lung Ca due to smoking develops after many years from the start point of smoking.

5. Dose –response relationship " Risk Gradient ":

Increasing the amount of risk of outcome is associated with increasing the exposure. e.g. Increased alcohol intake leads to more liver damage

6. Reversibility :

Removal of the exposure leads to removal or decreased risk of outcome

e.g. . stop smoking leads to decreased risk of CHD.

7. Study design :

The best evidence comes from a well designed studies such as: randomized controlled trial.

To put the studies in order according to power:

Type of study	Ability to " prove causation
Randomized controlled trial	Strong
Cohort studies	Moderate
Case-control studies	Moderate
Cross-section studies	Weak
Ecological studies	Weak