

Babylon University – College Of Medicine
Department of Community Medicine

*Lectures in Community Medicine
For 4th Stage Students
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Lecture 9

Causal Association

Important issue in epidemiology concerned with the study of the relationship between the presumed causative factor and the outcome and to ascertain whether the relation is causal or not.

In medicine we observe an association between a factor and an outcome, but this does not necessarily mean that the association is causal so we need further study.

In medicine each relationship between a factor and an outcome may be a chance or bias or confounder.

In the absence of these factors, the only possible explanation is direct relation which means causal.

- A **cause**: is defined as any factor that if it is increased or reduced lead to increase or reduction in the outcome.
E.g. Smoking → Ischemic Heart Disease
- **Chance**: associations appear in the study due to role of chance, to exclude the chance we must do the right statistical test.
If P value is more than 5% this means that association is not significant.
- **Bias**: systematic errors in the design of the study, it should be dealt with before implementing the study.
- **Confounder**: it could be itself the causative agent or not, it accompanies the factor under the study. The confounder if it enters the study it can be controlled unlike the bias.

So if the study proved that there is no role of chance, the conduct of the study design is correct, the biases are excluded and the confounder factors are controlled there is no reason to think that presumed agent is not a cause.

Types of associations

1- Direct

E.g. measles could not result in any way without the virus.

$A \rightarrow B$

This is called direct association

2- Direct association with intervening

Heavy alcohol \rightarrow cirrhosis \rightarrow hepatoma
 $A \rightarrow B \rightarrow C$

A is the presumed cause and C is the outcome.

B is not a confounder because it can not occur without A, and C will not occur without B. so C will not occur without A.

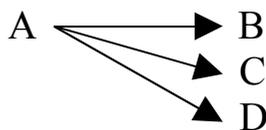
3- A plus B \rightarrow C

e.g. TB bacilli plus immunity deficiencies \rightarrow pulmonary TB .

4- Multi-effect relationship

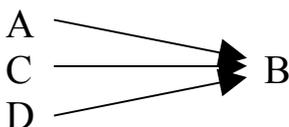
And it is a direct association e.g.

Smoking \rightarrow IHD
 \rightarrow Cancer
 \rightarrow Chronic bronchitis



5- Multi factorial relationship: e.g.

Hypertension \rightarrow IHD
 Smoking \rightarrow IHD
 Hyperlipidemia \rightarrow IHD



Criteria of causal association

1- The strength of association:

This is the most important one measured by the relative risk, the higher the relative risk the greater the probability that the agent is a causative one.

2- Consistency of the association:

The association is evident in different study designs in different populations all over the world i.e have similar results been shown in other studies.

3- Temporality of association:

The factor to be causal must precede the outcome.
Does the cause precede the effects ? (essential)

4- Dose response effect:

When the dose of exposure increase the effect will increase.
e.g lung cancer in heavy smokers versus light smokers, the level of noise and hearing loss.

5- Specificity of the association:

Tobacco smoke cause lung cancer and IHD but the relative risk with lung cancer is much higher than that with IHD, because IHD is caused by factors other than smoking like hypertension, hyperlipidemia, diabetes mellitus, obesity, sedentary life style...

6- Reversibility:

When you remove or reduce the presumed causative agent the effect should be decreased, such as cessation of smoking reduces lung cancer as compared with people who continue to smoke.

7- Biologic Plausibility:

It refers to coherence with the current body of biologic knowledge.
Is the association consistent with other knowledge? Mechanism of action evidence from experimental animal.
As association is plausible, and thus more likely to be causal.
The study of health effects of low level lead exposure, animal experiments indicate an effect of lead on central nervous system