Lec=8

The concept of cause and causal association

What we observe in medicine in association between factor and outcome dose not necessary mean that the association is a causal one . so causal association have to following this criteria .

1-The association observed should be statically significant .

2-Excluding the factor that produce a false- association which are a- chance   b- bias c- confounder .

In absence of these 3 factors , the only causable explanation is direct , which means (causal) .

Q/ Are association and causation the same thing ?

A/ NO , An association is a statistical relationship between two or more events .

But in causation , an additional level of evidence is required to support causation .

A cause : Is a event , condition , characteristic , that if it is reduced or increased leads to reduction or increased of the outcome .

e.g --- smoking ---- IHD

CHANCE ; That the association appear in the study due to the rule of chance . so chance by statistic we can reduce by decrease P- Value less than 0.05 --- so association is significant .

But rule of chance can not be excluded .

BIAS : mean that the result obtained from the study due to systematic error in the course of the study .

CONFOUNDER : It is a 3rd factor which is association with exposure and independent of this association is a risk factor for outcome (not causal) .

Confounders (confounding variables): These are variables, which confuse an association between some sort of apparent exposure and outcome. Suppose an apparent association exists between factor A and a disease B. But this association is false . A third (confounding) factor X is the cause of the disease. This is true if:

a. Factor X is a known risk factor for the disease B.

b. Factor X is associated with but not the result of factor A.

Example.

Coffee ═══════ **smoking**

MI
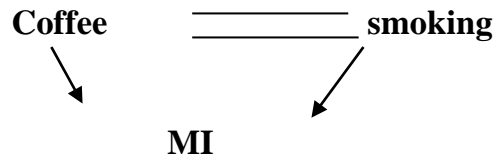
Confounding is not a true error but is mixing of the effects of an extraneous variable with the effects of the exposure and disease of interest. It may lead to mistaken conclusions or inferences on association

Association: A statistical (quantitative) dependence between two or more variables. Variables are said to be associated if they tend to occur together more frequently than could be explained by chance. The degree of association is determined by statistical tests.

Types of statistical association
a. Non causal when the apparent association is due to confounding process, when a third factor is related both to the risk factor (the cause) and the outcome or effect (the disease).
b. Causal which is either direct   (A ⟶ B)
**   or indirect   (A ⟶ B ⟶ C).**

1-Spurious (false , factious) association , no association between factor and outcome , or association results from error or bias in the study design , implementation , or analysis .
2-Real association (true) .
** a- direct .**
** b- indirect . (intermediate steps)**
** Type of causal relation .**
A- Necessary and sufficient .
**   A----------B**

B-necessary but not sufficient .
**   More than one factor is required , usually in a temporal sequence .**
** A+B+C----------D**
A   T.B bacilli
B   mal nutrition
C   low immunity

C-sufficient but not necessary .

   A specific factor can cause a disease process . but other factors by themselves can cause the same disease .

   e.g ---vit b12 deficiency ---anemia . but other factors can result in anemia as well .

D- neither sufficient nor necessary .

   This is a causal model observed in chronic disease for e.g ---- multipal risk factors for development of IHD are neither sufficient nor necessary .   hypertension
            Smoking
            Hyperlipidemia

   Criteria of causal association

A statistical association is likely to be causal if the following criteria are fulfilled

1-Strength of association .
2-Temporal association .
3-Consistency of the association .
4-Specificity of the association .
5-Coherence with exec sting knowledge .
   These are the major criteria .
Additional criteria .
    -- Biological visibility .
    -- Dose- response effect .
    -- Reversibility .
    -- Analogy .
1- Strength of association .
   Association is measured by magnitude of relative risk (RR) . The greater or increase in (RR) increase in the magnitude of association . The greater the probability is that association is a causative one .

2- Temporal – relation ship (time- sequence) .
   The cause should preceed the outcome by a period of time consistent with the biological mechanism .
e.g --- ca lung due to smoking develops after many years .
   But some times , it is difficult to a certain which criteria preceed the other . coronary atherosclerosis presceed low physical activity or low physical activity superimposed the MI .
So the cause must preceed the effect in time other wise a higher suspension that associated is causal .

3- Consistency .

When a number of studies conducted by different investigator at various , using different methodology , in different geographical or cultural settings and among different population all show similar results .

4-Specificity of association .

Specific exposure associated only with one disease --- e.g – smoking is more specific for causation of ca lung .

So, when the outcome is related to a factor and the factor can cause other outcome beside the outcome of interest , here we find lack of specificity .

e.g – smoking – lung ca is 6 times and for CHD is 1.5 times .

because CHD is caused by other factors ---- smoking is specific for lung ca .

5-Coherence of association with excisting knowledge and biological plausibility .

A known or postulated biological mechanism between exposure and outcome will greatly enhance causal concept .

Absence of biological mechanism dose not necessary mean that the relation ship is not causal .

6-Dose-response relation ship .

Dose and response ------ causal association .

Heavy smoker and heavy alcohol ------ increase risk of IHD .

7- Reversibility :

Removal of the exposure ------ decrease risk of outcome .

Decrease blood pressure , decrease smoking , decrease lipid ----- decrease coronary atherosclerosis .

8-Analogy :- Weak evidence of causality when there is a model for disease . e.g—a mechanism for sub acute measles disease , measles virus cause neurological manifestations ------slow virus disease .

(this means generalized the model for slow virus disease) .

So matter of association is a matter of judgment , it is not confined to the statistical test . When we see association that are beyond the rule of chance . P-value is less than 0.05 , it dose not mean that this association is a causal one , it needs further judgment , for it to for fill the criteria the more criteria you for fill , the more the likelihood the relation ship is a causal one .