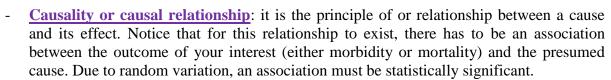
Unit I – Problem 11 – Epidemiology: Causal Association and Measures of Association





Direct causal association	A factor shows its effect in absence of intermediary factors	
Indirect causal association	A factor shows its effect through intermediary factors	

- What is non-causal association?

• The relationship between two variables is statistically significant, but no causal relationship exists because the temporal relationship is incorrect (the presumed cause comes after, rather than before, the effect of interest) or because another factor is responsible for the presumed cause and the presumed effect.

- Austin Bradford Hill's criteria of causation:

Strength of association	A strong association is more likely to have a causal component than is a modest association			
Consistency	A relationship is observed repeatedly			
Specificity	A factor influences specifically a particular outcome or population			
Temporality	The factor must precede the outcome it is assumed to affect			
Biological gradient	The outcome increases monotonically with increasing dose of exposure or according to a function predicted by a substantive theory			
Plausibility	The observed association can be plausibly explained by substantive matter (e.g. biological) explanations			
Coherence	A causal conclusion should not fundamentally contradict present substantive knowledge			
Experiment	Causation is more likely if evidence is based on randomized experiments			
Analogy	For analogous exposures and outcomes an effect has already been shown			

- What are the steps followed in determination of a cause and its effect?

• Investigation of the statistical association:

- ✓ The risk factor (the cause) must be present more often in persons with the disease of interest (the outcome) than in persons without the disease.
- ✓ OR the protective factor (for example: a vaccine against a specific disease) must be present less often in persons with the disease than in persons without it.

• Investigation of the temporal relationship:

✓ This is sometimes difficult to establish (why?) → for example, obesity can cause osteoarthritis (due to increased load on weight-bearing joints) that results in inactivity which in turn makes obesity worse (a cycle!).

• Elimination of all known alternative explanations.

- What are the measures of association?

Types of study designs	Measures of association	
Prospective cohort study	Relative risk, attributable risk	
Case-control study	Odds ratio	
Cross sectional study	Odds ratio	



Table 6-I Standard 2×2 Table for Showing Association between a Risk Factor and a Disease



Disease Status					
Risk Factor	Present	Absent	Total		
Positive	а	b	a + b		
Negative	с	d	c + d		
TOTAL	a+c	b + d	a+b+c+d		
Interpretation of the Cells					
a = Participants with both the risk factor and the disease $b = Participants$ with the risk factor, but not the disease $c = Participants$ with the disease, but not the risk factor $d = Participants$ with neither the risk factor nor the disease $a + b = All$ participants with the risk factor $c + d = All$ participants without the risk factor $a + c = All$ participants without the disease $b + d = All$ participants without the disease $a + b + c + d = All$ study participants					

- What are the types of Attributable Risk (AR)?

Attributable risk/ risk difference	(Incidence of a disease in exposed persons – incidence of the disease in non-exposed persons) / 1000
Attributable risk (%)	(Incidence of disease in exposed persons – incidence of disease in nonexposed persons) incidence of disease in exposed persons It indicates the extent to which disease can be attributed to the risk factor
Population attributable risk	It suggests the % of cases that can be avoided in a population if the risk factor was removed