

Association does not imply causation

How to tell the difference between an association and a causal relationship.

In research, we often find that two factors are related. But this does not automatically mean that one causes the other.

*More questions.
Healthier choices.
Tomorrow.*

We observe:



X is associated with Y

This means there is an observed relationship between the two, but it could be due to different reasons.



An association is an observation. Causation is a conclusion that requires more evidence.

Possible explanations:

1 X may cause Y



X leads to a change in Y. This requires stronger evidence, such as interventional studies (e.g. randomised controlled trials), when feasible and ethical.

2 Y may cause X

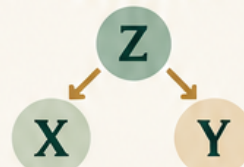


The direction of the relationship may be the reverse of what we expect.

Example:

Poor health may lead to lower physical activity, rather than the other way around.

3 A third factor may influence both



Z is associated with both X and Y, which can create an observed relationship between them without X causing Y (e.g. age, lifestyle, socio-economic factors).

4 The association may be due to bias or chance



The observed association may be influenced by how the study was conducted (e.g. selection bias, measurement bias), a small sample size or random variation.



Associations are valuable

Observational studies can provide important information, generate hypotheses and identify patterns for future research. They simply have limitations when it comes to causal conclusions.



Key takeaway:

„Associated with“ does not mean “causes”. But it also does not mean the relationship is unimportant. It is essential to understand what the data can – and cannot – tell us, and to interpret the results correctly.

When you read “X is associated with Y”, ask:

- ☐ What is the study design?
- ☐ Which comes first – X or Y?
- ☐ Are there possible confounding factors?
- ☐ How large and consistent is the association?
- ☐ Is there other evidence that supports a causal relationship?

*Critical questions today.
A healthier tomorrow.*

