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Quantitative Research Methods

The Bradford Hill Criteria of Causality

Sir Austin Bradford Hill's (1897-1991) Criteria of Causality

English epidemiologist and statistician, economics degree at London University, later studying the field of public health

Famous for pioneering the randomized clinical trial (RCT)

Less known outside of epidemiology and statistics is his contribution of the *Bradford Hill Criteria of causality*

https://joshualoong.com/2018/01/25/Applying-the-Bradford-Hill-Criteria-to-Economics-and-Policy/
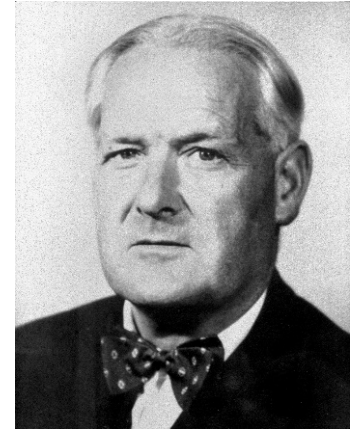
Significance of Causal Research

- Association A - B
    - Knowing what to expect if A or B is observed

- Causality A → B
    - Recommendation in terms of A possible
        - Avoid A if B is something undesirable
        - Encourage A if B is something desirable

- Criteria (Trochim)
    - Temporal Precedence (of the cause)   *in most cases easy to argue*
    - Covariation of the Cause and Effect (association)   *easy to assess*
    - No Plausible Alternative Explanations   hardest to demonstrate

                                                      → experiment (RCT; randomized controlled/clinical trial)
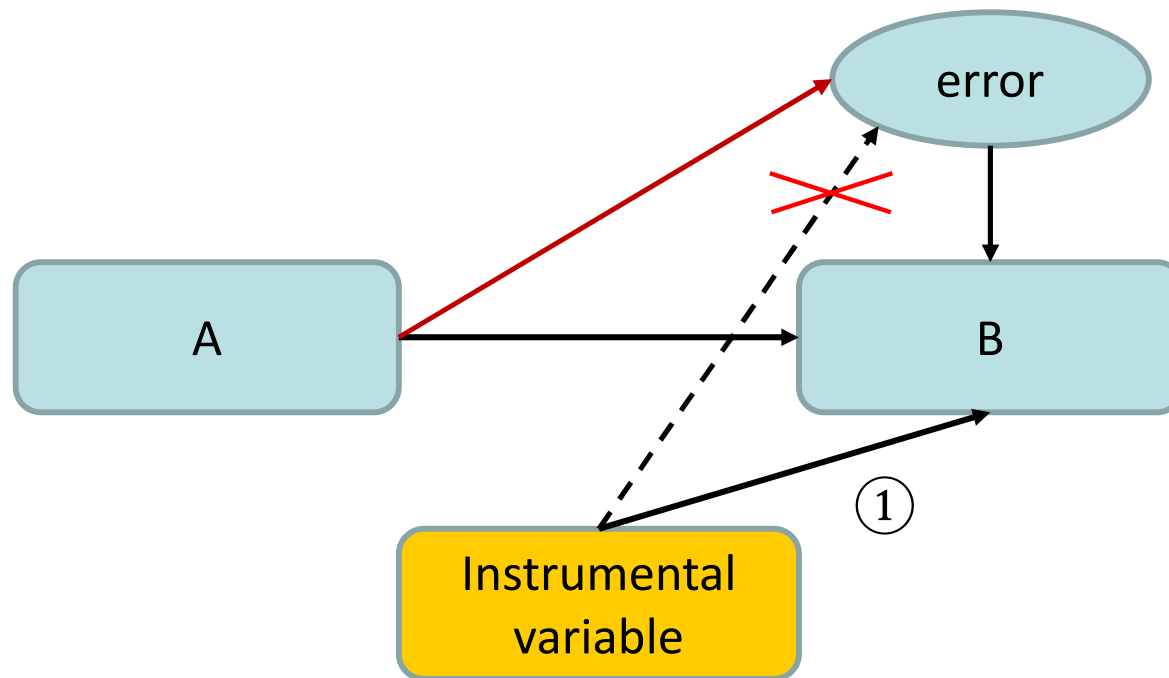
Causality in the Absence of RCT

- Instrumental variables
    - In observational studies, the presumed cause A might be related to the error term of the effect B (red arrow), *endogeneity, omitted variable bias*
   - This introduces a bias in the estimation of A→B
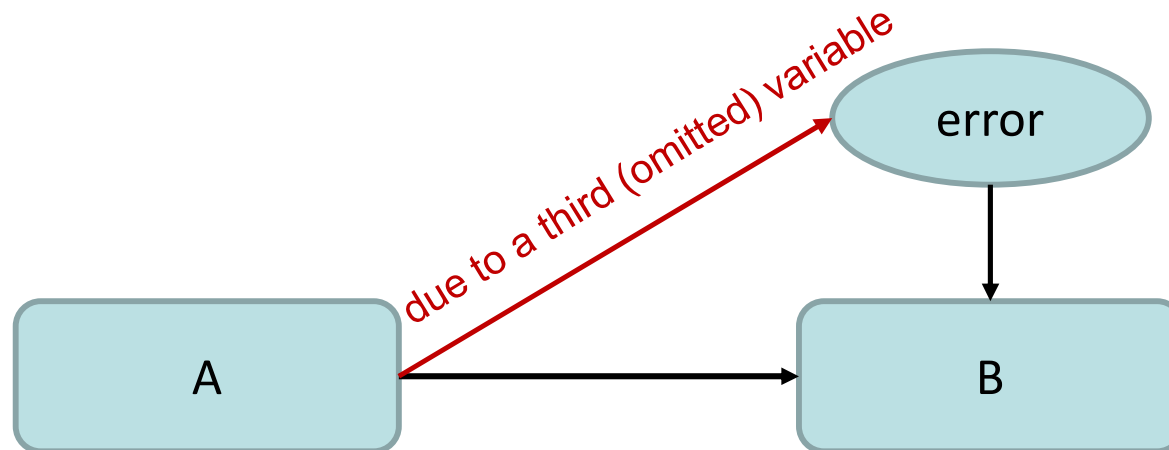
Causality in the Absence of RCT

- Instrumental variables
    - Instrumental variable predicts the endogenous variable B but is unrelated to the error term (has to be argued cocneptually)
    - At stage 1, B is regressed onto the instrumental variable
    - B as predicted by the instrumental variable is saved and used in stage 2

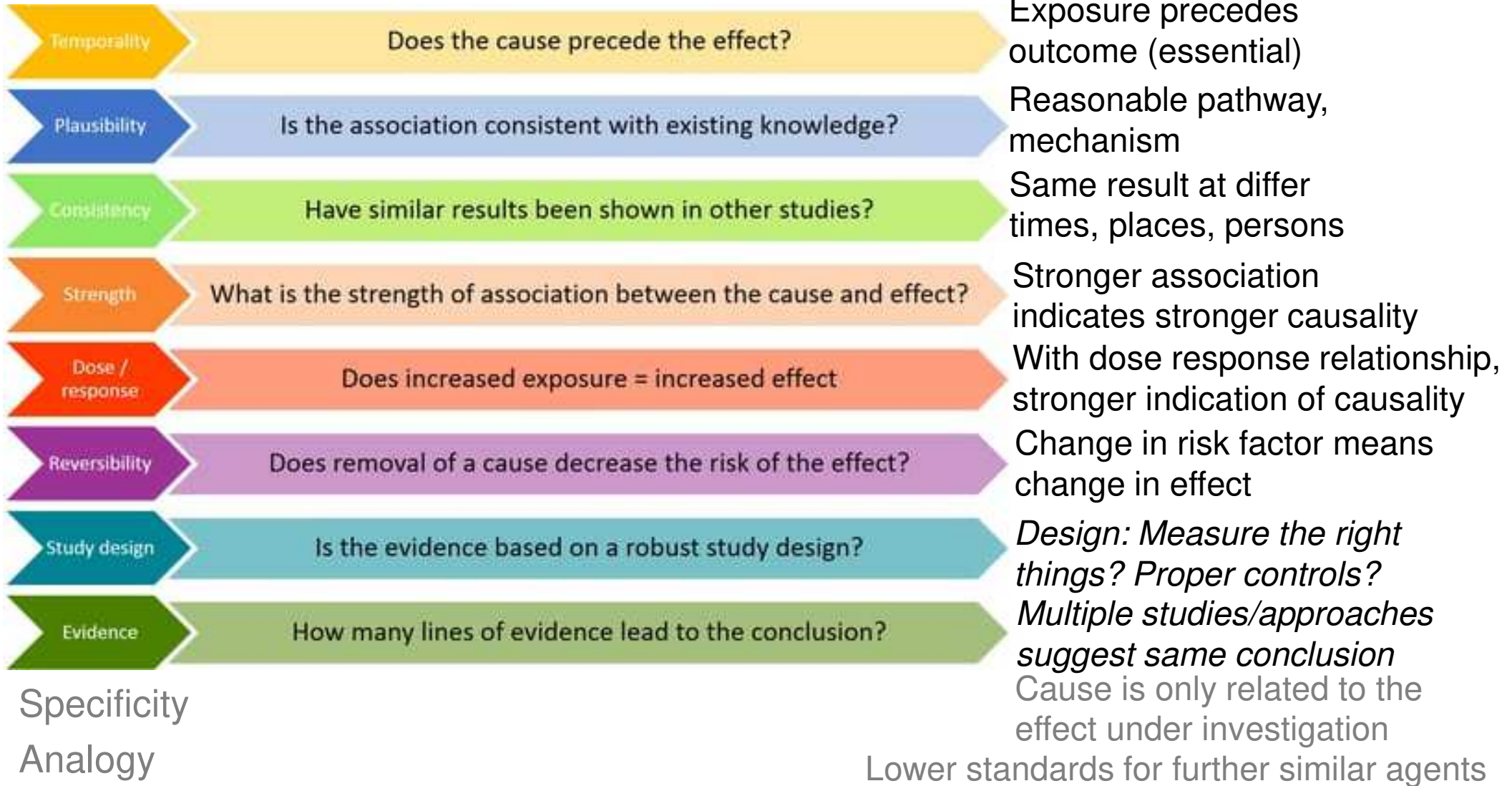# Causality in the Absence of RCT

- Instrumental variables
  - Stage 2 estimates the regression of B as predicted by the instrumental variable onto A
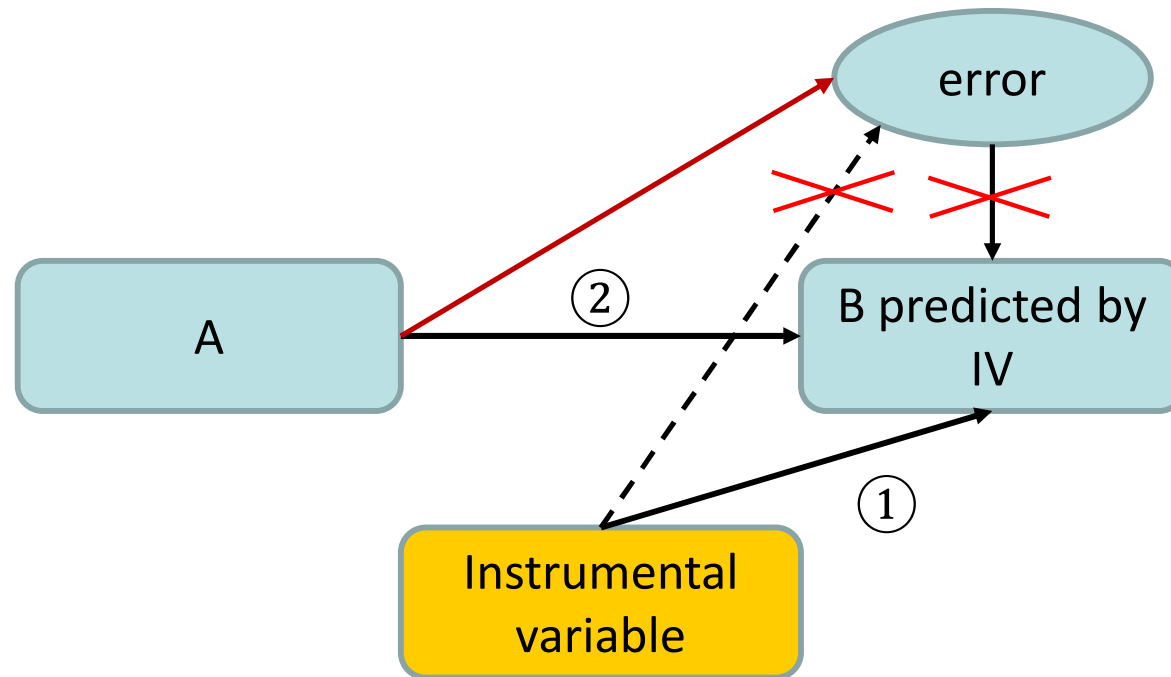
- See course page for some links to papers and videos by John Antonakis (section topic 6 design)

Bradford Hill Criteria (not all need to be met)

Adaptation of the criteria to the world of policy/economics

Temporality	Does the cause precede the effect?	Exposure precedes outcome (essential)
Plausibility	Is the association consistent with existing knowledge?	Reasonable pathway, mechanism
Consistency	Have similar results been shown in other studies?	Same result at differ times, places, persons
Strength	What is the strength of association between the cause and effect?	Stronger association indicates stronger causality
Dose / response	Does increased exposure = increased effect	With dose response relationship, stronger indication of causality
Reversibility	Does removal of a cause decrease the risk of the effect?	Change in risk factor means change in effect
Study design	Is the evidence based on a robust study design?	*Design: Measure the right things? Proper controls?*
Evidence	How many lines of evidence lead to the conclusion?	*Multiple studies/approaches suggest same conclusion*

Specificity

Analogy

Cause is only related to the effect under investigation

Lower standards for further similar agents