08/09/2004 JSM 2004 1

Measuring Confounder Influence

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08/09/2004 JSM 2004 2

Meaning of an Association

An association obtained from statistics in a random sample can be:

"**Statistically significant**" if very unlikely when due solely to the influence of chance.

"**Confounder resistant**" if strongly resistant to nullification by a large confounder

Quantitative measures are needed to be useful!

08/09/2004 JSM 2004 3

"Resistance" Rules of Thumb

Sir Richard Doll: No single study is persuasive unless the lower limit of its 95% confidence level falls above a **threefold** increased risk.

"As a general rule of thumb," says Angell of the New England Journal, "we are looking for a relative risk of **three or more"** before accepting a paper.

Robert Temple, FDA Director of Drug Evaluation, puts it bluntly: "My basic rule is if the relative risk isn't at least **three or four**, forget it."

08/09/2004 JSM 2004 4

Problem of Confounding in Epidemiology

John Bailar, epidemiologist: "*There is no reliable way of identifying the dividing line*."

Epidemiologists need an abstract description of confounding that can generate confounder significance and confounder intervals for RR.

This description must handle binary data, be meaningful, useful and easy to understand.

08/09/2004 JSM 2004 5

"S Confounder" Confounder Resistant

A is predictor, B is confounder, E is effect.

* P(B) = Prevalence of the confounder.
  P(A) = Prevalence of predictor.

* RP(E:B) = Rel. Prev of effect for confounder
* RP(B:A) = Rel, Prev of confounder for predictor.

An **S confounder** is a binary confounder where **RP(B:A) = RP(E:B) = S and P(B) = P(A).**

An association is "**confounder resistant**" to a size S confounder if it withstands nullification.

08/09/2004 JSM 2004 6

Spuriousity Contours Schield & Burnham (2003)

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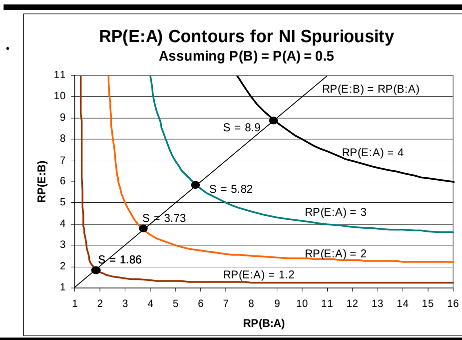


Algebraic Condition to Resist Nullification

The confounder size, S, and predictor prevalence, P(A), determine the minimum excess relative risk, XRP(E:A), that can resist nullification.

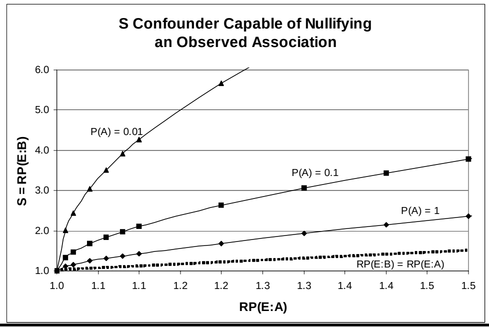
$$XRP(E:A) = P(A) \bullet (S-1)^2 / \{1 + [2P(A) \bullet (S-1)]\}$$

If the predictor prevalence is 50%, then

$$XRP(E:A) = (S-1)^2 / (2S)$$

If S = 5, RP(E:A) = 2.6; if S = 6, RP(E:A) = 3.1

Confounder Size Needed to Nullify a Relative Risk



Confounder Intervals: Influence of Confounder

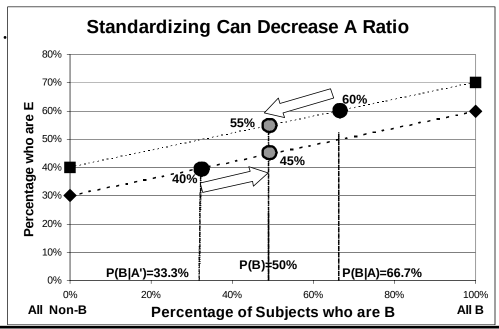
Lower limit: determined by removing the influence of a confounder where RP(B:A) = RP(E:B).

Upper limit: determined by removing the influence of a confounder where RP(B:A) = 1/RP(E:B) = 1/S.

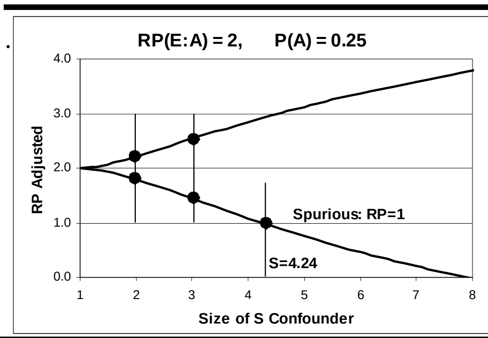
Given the size of an S confounder, the confounder influence can be determined algebraically and illustrated using a standardization diagram.

For a S confounder of size 2, the confounder interval for RP(E:A) = 2 with P(A) = 0.5 is [1.67, 3.0].

Standardizing Shows Influence of Confounder



Confounder Intervals



Recommendations

Statistical educators should find ways to teach confounder influence in the first course.

Analysts should show confounder susceptibility: either give confounder intervals or identify the S confounder needed to nullify an association.

Subject experts should set generally accepted confounder sizes for confounder resistance: e.g., S = 6 for P(A) = 50%.