RISK RELATIVISM AND PHYSICAL LAW

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CORNFIELD'S PRINCIPLE

- "The relative measure is helpful in… appraising the importance of an agent with respect to other possible agents inducing the same effect. …

- The absolute measure would be important in appraising the public health significance of an effect known to be causal." (Cornfield et al, 1959)

- Repeated in many places (e.g. Northridge 1995)

BACKGROUND

- Smoking associated with many diseases
- Berkson's dilemma: either (a) it causes them all, or (b) it causes some and not others (paraphrasing Berkson 1958)
- (a) is implausible, lack of specificity; (b) flies in the face of the data
- Cornfield's Principle allows Cornfield et al to take horn (b), arguing that some associations licence causal inference while others don't
- The wrong horn; yet CP remains engrained in epidemiological thinking

QUESTIONS

1. What is the relative/absolute measure distinction?
2. What significance is claimed for this distinction?
3. Is that significance claim justified?
4. If not, can it be justified?

I. RELATIVE/ABSOLUTE

- Relative Risk (RR) = Re / Ru

- Candidate for absolute measures include:

- Actual numbers (not risks)

- Risk Difference (RD) = Re - Ru

- Population Attributable Risk (PAR) = (Rt - Re) / Rt

WHAT IS THE DISTINCTION?

- Risk = new cases in time period / pop at start of time period
- So apart from actual numbers, these measures are all based proportions
- Difference vs. ratio? Then RR and PAR are relative
- Prevalence info vs. lack of? Then RR and RD are relative
- There are different measures!… but does the absolute/relative distinction reflect a real or important partition among them?
- I can't see one

2. SIGNIFICANCE

- Claimed: RR is more useful for eliminating confounders
- Argument: mathematical proof that a confounder can't explain an association unless ratio of prevalence of exposure in exposed group to that in unexposed exceeds RR

3. JUSTIFIED?

- In 2010, Charles Poole showed that a parallel result holds for RD

- (Namely, that the difference between the prevalences must exceed RD, for a potential confounder to explain an observed association)

- So this justification fails

4. CAN IT BE JUSTIFIED?

- Pragmatic and particular: lung cancer called for action
    - But from a public health perspective, the diseases excluded were far more important (e.g. CHD)
- Pragmatic and general: RR is statistically convenient
    - But that doesn't explain a *preference* for RR when other measures are available; nor does it justify Cornfield's Principle

TRANSPORTABILITY

- One might think RR is more transportable between populations
  - A factor multiplying the risk, independent of the levels of risk
- But this relies on the assumption of no multiplicative interaction
- Which implies presence of additive interaction
- Which is of great public health importance, and so should be investigated…

LAW-LIKENESS

- What is measured?
- A property of the *population*? or of the *exposure*?
- Literally, it is a property of the population
- The question is whether that guides, or can guide, an inference to a property of the exposure
  - That would be akin to a law of nature

EPIDEMIOLOGICAL LAWS?

- An epidemiological law would be a statement of the effect of an exposure suitably independent of any particular population (even if not totally general)

- Perhaps it is tempting to see RR, in particular, as capable of expressing such a law

- But it is not; nor is any other measure of "causal strength" in the current epidemiological toolkit…

WHAT IS MEASURED?

- A measure of causal strength is a measure of the net difference in outcome explained by an exposure (Broadbent 2013)

- On this view, measures of strength of association, when used as measures of causal strength, are fundamentally e*xplanations*

- This means they are not laws, for the following reason

EXPLANATIONS VS. LAWS

- A explanation may invoke a law, but will also include "initial conditions" subsuming the explanandum under the law

- Initial conditions are rolled into the epidemiological measures, meaning they can never be used to state laws directly

  - E.g. RR = Re / Ru. Both Re and Ru are statements of initial conditions - they are facts about specific populations.

  - A law states a relation between such facts; it is not a value calculated from them (cf. F = ma: clearly the law is not the value of F)

CONCLUSION

- Cornfield's Principle is not justified by the extant justifications

- Nor is it justified by transportability of RR

- The urge to identify transportable properties perhaps answers to a deeper theoretical yearning after laws of nature

- But epidemiological measures (including RR) cannot express laws of nature, since the measures include "initial conditions"