A Parallel Literature: Causation in Medicine

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Modelling causation in epidemiology - I

- Broadly, epidemiologists use similar methods to philosophers of science
  - Structural equation modelling / directed acyclic graphs
  - Counterfactuals
  - Bayesian networks

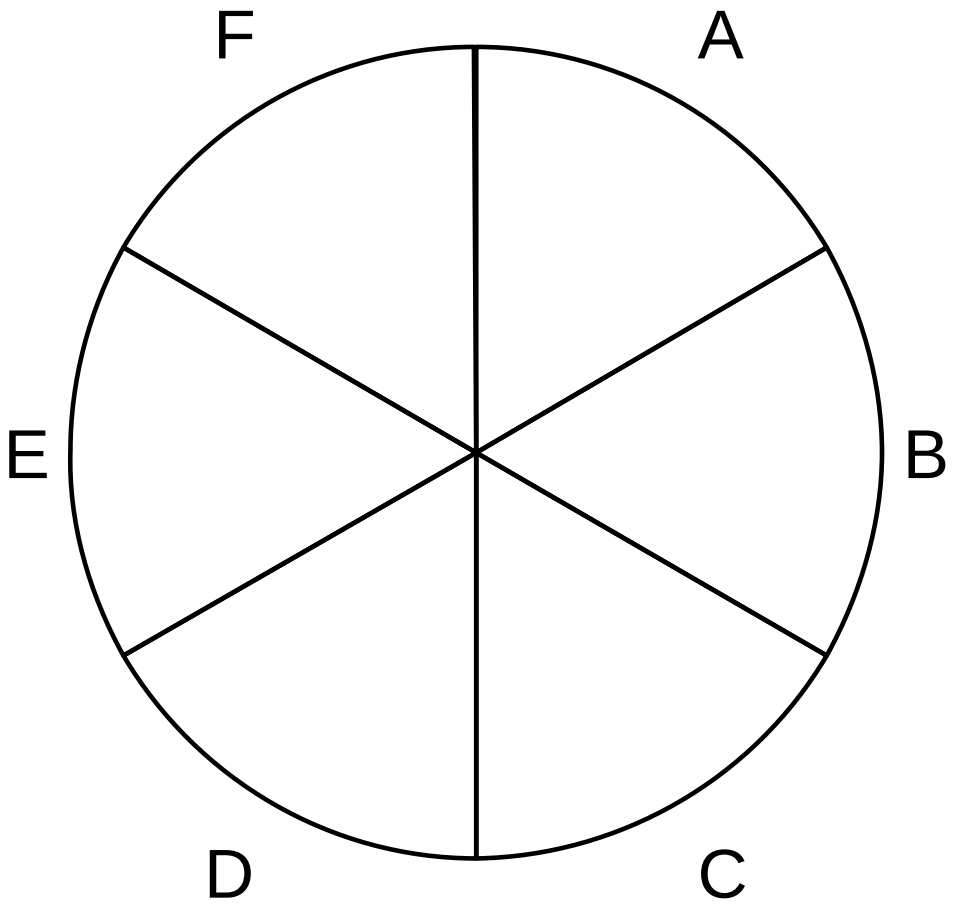
Modelling causation in epidemiology - II

- But some methods might be less familiar to philosophers…
  - Sufficient-component cause model

Rothman and sufficient-component causes

K.J. Rothman. 1976. “Causes,” *American Journal of Epidemiology*, **104**(6): 587—92.

- Causes in medicine are generally insufficient components of sufficient cause complexes
- We can formulate these examples based on research on the general case
- We can use them to explain the nature of disease causation
  - Synergy and antagonism between causal factors
  - ??Explaining individual cases of disease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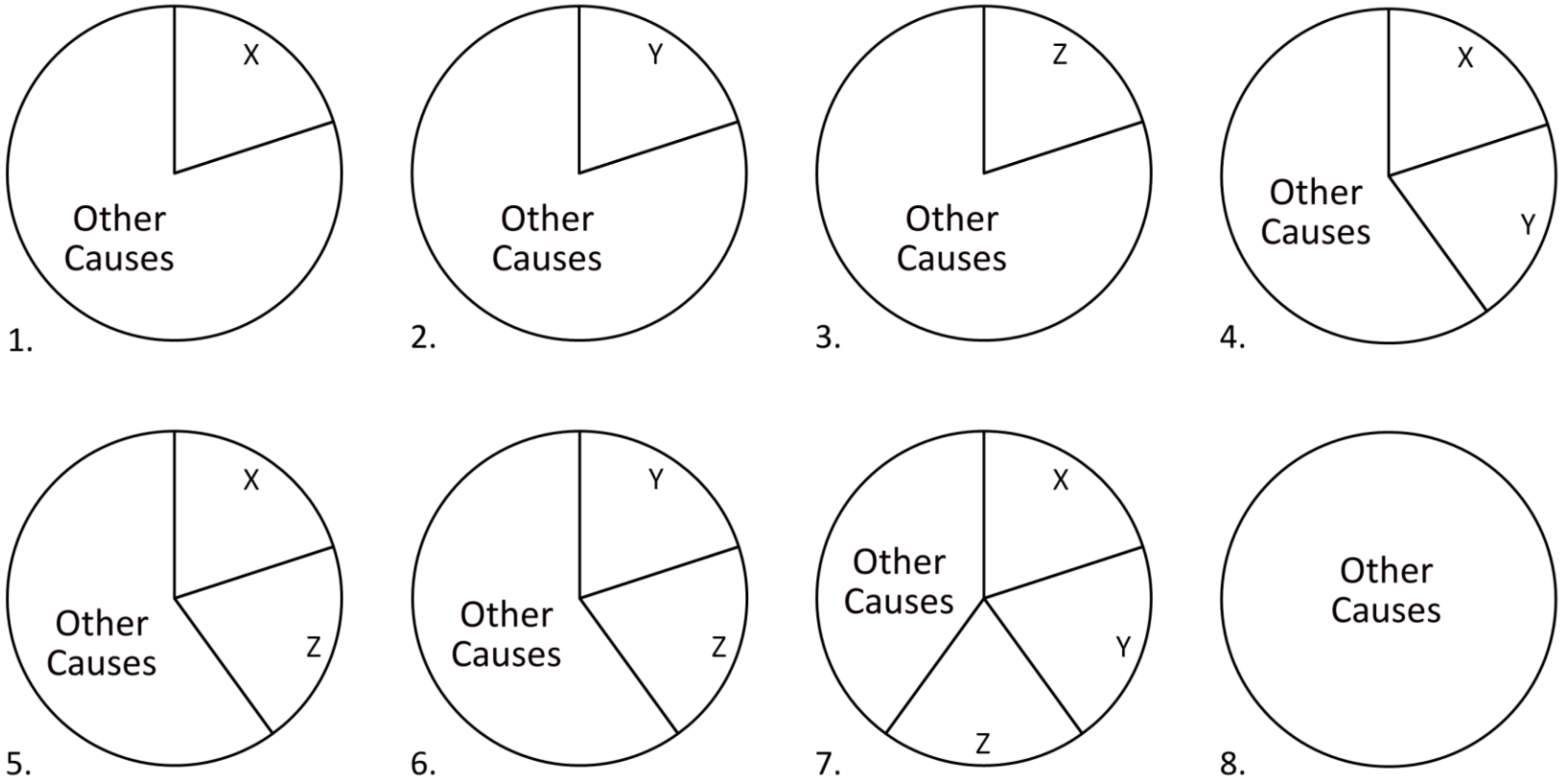
Sufficient-component cause diagrams for coronary heart disease



X: Smoking; Y: Hypertension; Z: Hypercholesterolaemia

Mackie and Rothman

J.L. Mackie. 1974. *The Cement of the Universe: A Study of Causation*. Oxford: Clarendon Press.

- There is a strong resemblance between Rothman's sufficient-component cause model and Mackie's notion of *inus* conditions
- Might we gain ground by applying Mackie's philosophy to the sufficient-component model?
  - Causal overdetermination
  - (Causal factor selection and relevance)

inus conditions

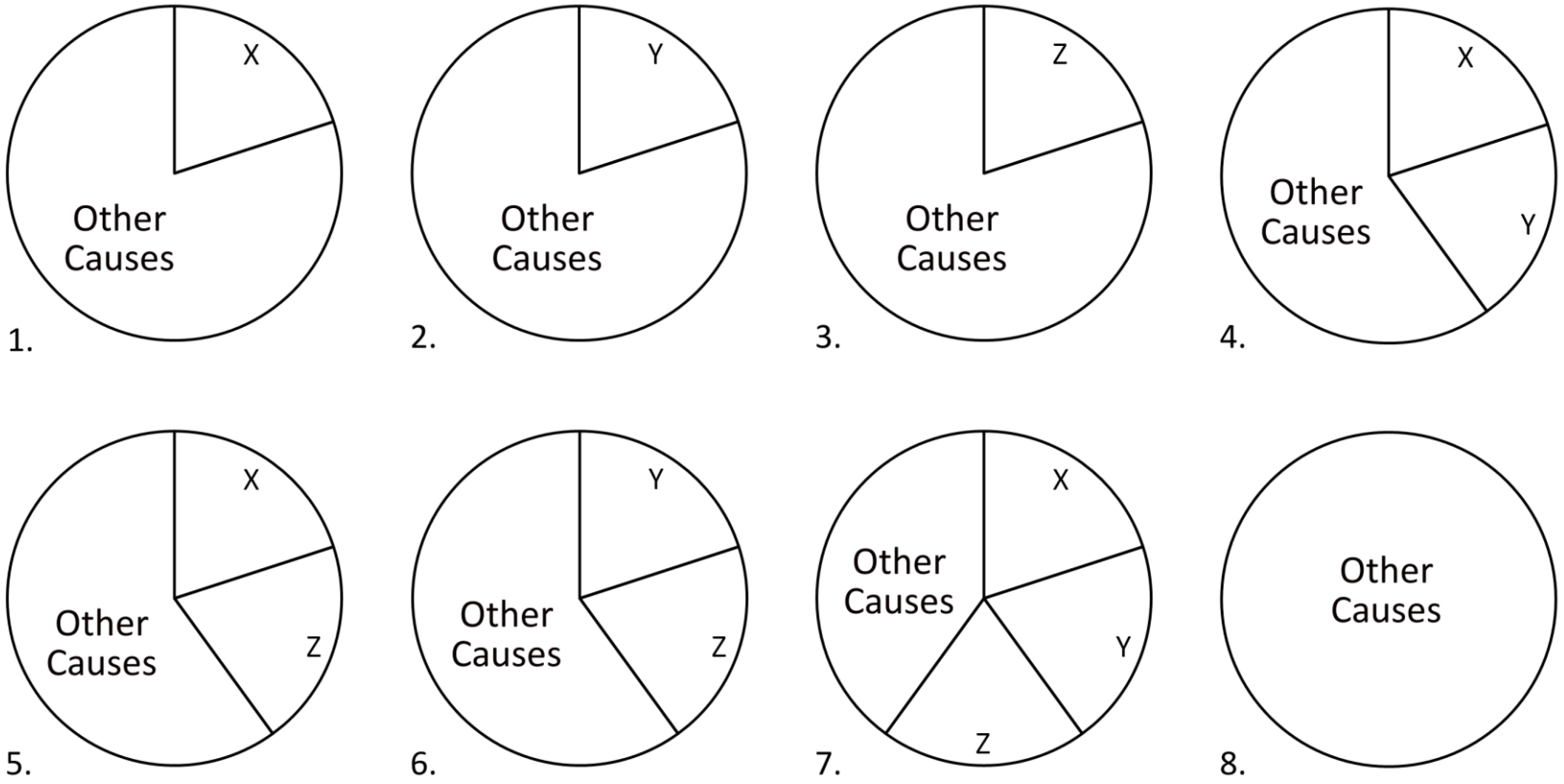
"(*ABC* or *DGH* or *JKL*)' represents a condition which is both necessary and sufficient for *P*: each conjunction, such as '*ABC*', represents a condition which is sufficient but not necessary for *P*. Besides, *ABC* is a *minimal* sufficient condition: none of its conjuncts is redundant: no part of it, such as *AB*, is itself sufficient for *P*. But each single factor, such as *A*, is neither a necessary nor a sufficient condition for *P*. Yet it is clearly related to *P* in an important way: it is an *insufficient* but *non-redundant* part of an *unnecessary* but *sufficient* condition: it will be convenient to call this...an *inus* condition."

Mackie, 1974: 62

Causal overdetermination - I

- There are often multiple causes for a given disease
- We can give estimates of effect size from observational studies
- But we may not be able to tell which cause is responsible in a particular case

Sufficient-component cause diagrams for coronary heart disease



X: Smoking; Y: Hypertension; Z: Hypercholesterolaemia

Causal overdetermination - II

- Mackie suggests that we can solve overdetermination by giving an account of events "*...as they come about*" (Mackie, 1974: 46)
- This is helpful in cases where our effect of interest results from causes with persistently distinguishable aetiologies

Causes with persistantly distinguishable aetiologies

- Community-acquired pneumonia
  - Streptococcus pneumoniae
  - Influenza virus
  - Mycobacterium pneumoniae
  - Legionella spp
  - Haemophilus influenzae

Ledingham and Warrell, 2000: 371.

Causal overdetermination - II

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- This is helpful in cases where our effect of interest results from causes with persistently distinguishable aetiologies
- But this is not the case with CHD, where the pathology gives no clue to the aetiology

- "*...if no more detailed correct account would provide the desired discrimination, this question has no answer.*" (Mackie, 1974: 47)

Final thoughts

- We can, in some cases, gain (medical) ground by applying problems with *inus* to the SCC model
- There are benefits to philosophy too
  - Methodological corroboration
  - Insight into scientific practice
  - Provision of examples and counterexamples
- But we are not in a position to conflate both models. There are important conceptual differences
  - Single versus multiple causation
  - Difference in levels
  - Different purpose

- J.G.G. Ledingham and D.A. Warrell, eds. 2000. *Concise Oxford Textbook of Medicine*. Oxford: Oxford University Press.
- J.L. Mackie. 1974. *The Cement of the Universe: A Study of Causation*. Oxford: Clarendon Press.
- K.J. Rothman. 1976. “Causes,” *American Journal of Epidemiology*, **104**(6): 587—92.