A Parallel Literature: Causation in Medicine

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Modelling causation in epidemiology - I
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• Broadly, epidemiologists use similar methods to philosophers of science
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  – Structural equation modelling / directed acyclic graphs
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  – Counterfactuals
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- 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…
Modelling causation in epidemiology - II

• But some methods might be less familiar to philosophers…
  – Sufficient-component cause model
Rothman and sufficient-component causes

Rothman and sufficient-component causes


- Causes in medicine are generally insufficient components of sufficient cause complexes.
Sufficient-component cause diagrams for coronary heart disease

X: Smoking; Y: Hypertension; Z: Hypercholesterolaemia
Rothman and sufficient-component causes


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Mackie and Rothman


- There is a strong resemblance between Rothman’s sufficient-component cause model and Mackie’s notion of *inus* conditions.
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
Mackie and Rothman


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  – Causal overdetermination
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- Might we gain ground by applying Mackie’s philosophy to the sufficient-component model?
  - Causal overdetermination
  - (Causal factor selection and relevance)
Causal overdetermination - I

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Causal overdetermination - I

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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
Causal overdetermination - II

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

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

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
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  – Difference in levels
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• 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
