

# Hume, Mill, Hill, and the *sui generis* epidemiologic approach to causal inference

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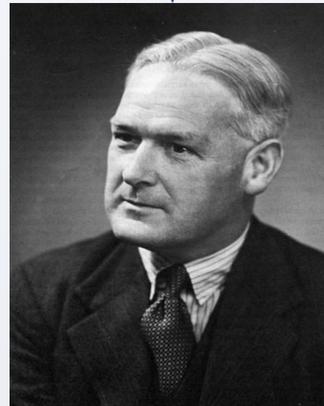
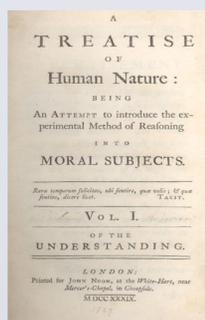
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## Let's imagine how Hume and Mill would have approached the tobacco and lung cancer association, and how their approaches would have differed from Hill's.



David HUME [1711-1776]

- “That effect, which has been the most common, we always esteem the most likely.”
- Hume reasons from one recurrent sequence of events and works to distinguish whether the recurrent sequence is causal.
- Thus, tobacco does not cause lung cancer, because lung cancer does not always occur in smokers. The “most common effect” following smoking is NO lung cancer.



Austin Bradford HILL (1897-1991)

- Hill's viewpoints refer to results of contrasting evidence.
- “Hill's viewpoints” assume the comparison of (at least) *one* recurrent sequence involving the cause with (at least) *another* sequence of events not involving the cause.
- The co-occurrence of smoking and cancer needs to be contrasted with that of non-smoking and non-cancer (i.e., non-smokers rarely get lung cancer).
- Tobacco causes lung cancer because the “frequent” co-occurrence of smoking and cancer (i.e., 10% of heavy smokers get lung cancer in their lifetime) is much more common than the co-occurrence of non-smoking and cancer (i.e., 0.5% of non smokers develop lung cancer in their lifetime).



John Stuart MILL [1806-1873]

- Analytic methods to assess the association of tobacco and lung cancer:
  - Use “cause to effect” and “effect to cause” approaches;
  - Identify “exclusive” vs. “mixed and confounded” effects;
  - Distinguish “independent” causes vs. causes “modifying the effects of one another;”
  - Distinguish “effects of the same cause” (a<-c->b) vs. “effect of [independent] causes” (a->c<-b)
- No causal inference can be made on the basis of observational studies.
- “Observation without experiment (supposing no aid from deduction) can ascertain sequences and coexistences, but cannot prove causation.”

### Conclusions

- Hume does not emphasize the need for contrasting evidence, which is central to Hill's viewpoints.
- Mill's logic rules out the possibility of inferring causal laws from non-experimental evidence.
- Hill's approach to causal inference that uses viewpoints should be considered as *sui generis* (of its own genre), still requiring a proper philosophical justification.