MBBS Philosophy Block
Probability and Knowledge in Clinical Medicine

"The best doctor is also a philosopher" Galen[1]

Block rationale

What can Philosophy do for Medicine? Philosophy is above all about being reflective and critical regarding our reasoning processes. Philosophy can therefore help doctors reason more carefully when they make a diagnosis or recommend a treatment. Doctors are consumers of vast quantities of scientific and other information. Philosophers can help doctors think more reflectively about where this information has come from. How was it produced and how reliable is it? When can we use it to make a judgment about what works and what doesn't in clinical medicine? Much of this information is probabilistic, but human reasoning, including that of physicians, is notoriously prone to error when thinking about probabilities. What errors are we liable to make and how can we avoid them? How should we make decisions when faced with only probabilities? And what if we do not even know what the probabilities are? We need to be reflective not only about the reasoning processes but also about the purposes of that reasoning. In making a diagnosis and recommending a treatment, is a doctor aiming to identify an disease and a cure? If so, what is a disease? And how does disease relate to the goals of health and well-being?

Background reading (selection)

Alexander Bird (2011) "The epistemological function of Hill's criteria" *Preventive Medicine* 53.

Christopher Boorse (1977) "Health as a theoretical concept" *Philosophy of Science* 44.

Havi Carel (2008) *Illness* Chesham: Acumen.

Rachel Cooper (2002) "Disease" *Studies in History and Philosophy of Biological and Biomedical Sciences* 33.

Stephen N. Goodman (1999) "Toward evidence-based medical statistics. 1: The *P* value fallacy" *Annals of Internal Medicine* 130.

Elselijn Kingma (2007) "What is it to be healthy?" *Analysis* 67.

Sven O. Hansson (2005) *Decision Theory: A brief introduction*, Stockholm: Royal Institute of Technology (KTH).

Austin B. Hill (1965) "Environment and disease: Association or causation?" *Proceedings of the Royal Society of Medicine* 58.

Jeremy Howick (2011) *The Philosophy of Evidence-Based Medicine* Oxford: Wiley–Blackwell.

David Wootton (2007) *Bad Medicine: Doctors Doing Harm Since Hippocrates*, Oxford: OUP.

John Worrall (2007) "Evidence in medicine and evidence-based medicine" *Philosophy Compass* 2.

Also recommended as a resource for the history of the assessment of interventions:
The James Lind Library <http://www.jameslindlibrary.org>

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[1] *That the Best Doctor is Also a Philosopher*, in *Galen: Selected Works*, P. N. Singer ed. (1997) Oxford University Press, pp. 30–34.

Topics

1. Concepts of Health: The nature of disease and illness, health and well-being

What is disease? And what is health? How are these related? Are these biological concepts? Or do they have a subjective, social, or value-dependent component? Do these concepts differ in their application to somatic and to psychiatric conditions? We look also at diagnosis and classification of disease and the relationship of symptoms and disease, in somatic and psychiatric diseases.

Intended learning outcomes:

- Understanding the goal of philosophical analysis.
- Understanding what necessary and sufficient conditions are and how they relate.
- Understanding how a naturalistic account of disease and a value-laden account differ.
- Understanding the basic ideas of the accounts of Boorse and Cooper.
- Being able to demonstrate that understanding in applying these ideas to particular cases.
- Being able to think reflectively about the aim of medicine.

Required reading:

Piece by Sherri Roush on KEATS

Suggested additional reading:

Boorse, Christopher (1977) "Health as a theoretical concept" *Philosophy of Science* 44: 542–73.
http://www.journals.uchicago.edu/doi/abs/10.1086/288768
Cooper, Rachel (2002) "Disease" *Studies in History and Philosophy of Biological and Biomedical Sciences* 33: 263-282.
http://www.sciencedirect.com/science/article/pii/S0039368102000183
Carel, Havi (2006) "Can I be Ill and Happy?" *Philosophia* 35: 95-110.
http://www.springerlink.com/content/6246685672j455g1/

2. Knowledge of Causes: Causation and causal inference

In medicine we often want to know what causes what. Does this new pharmaceutical bring about an improved health outcome? Does this environmental exposure cause that disease? What then is causation? It is often said that causation in medicine is multi-factorial. But what does that mean? How does it differ from polygenic causation. We look at the distinction between singular and general causation. Next, how do we know what causes what? We examine the philosophical foundations of causal inference in medicine: Mill's method of difference. How does Mill's method relate to the design of clinical trials? Can it be applied to observational studies, such as cohort or case-control studies?

Intended learning outcomes:

- Understand the following distinctions and concepts:

    - Singular and general causation
    - Multifactorial causation
    - Polygenic causation
    - Distal versus proximal cause
- Understand Mill's method of difference and how it allows causal inference, and its relationship to the randomized clinical trial (RCT).
- Know what kinds of bias a randomized clinical trial can suffer from, and what measures are taken to combat them
- Understand the existence of random error and the role of significance tests
- Appreciate the epistemological differences between RCTs and observational studies:
    - Correlation is not causation
    - The need to rule out confounders (possible common causes)
- Be able to reflect on how Hill's 'criteria' assist in causal inferences.

Required reading:

"Knowledge of Causes" by Alexander Bird, on KEATS

Suggested additional reading:

Rothman, Kenneth and Sander Greenland (2005) "Causation and causal inference in epidemiology" *American Journal of Public Health* **95** S144–50. http://ajph.aphapublications.org/cgi/reprint/95/S1/S144

Susser, Mervyn (1991) "What is a cause and how do we know one?" *American Journal of Epidemiology* **133** 635–48. http://aje.oxfordjournals.org/content/133/7/635.abstract

Hill, Austin B. (1965) "The environment and disease: Association or causation?" *Proceedings of the Royal Society of Medicine* 58. http://journals.sagepub.com/doi/full/10.1177/0141076814562718

Bird, Alexander (2011) "The epistemological function of Hill's criteria" *Preventive Medicine* 53. http://www.sciencedirect.com/science/article/pii/S0091743511002738

3. What is Evidence-Based Medicine? Evidence-based medicine and its debates

In the last lecture we examined and compared RCTs and observational studies, looking in particular at Hill's criteria of causation and the problem of distinguishing causation from correlation. Different sources of evidence seem to provide evidence of differing quality. The Evidence-Based Medicine (EBM) movement aims to formalise some of these ideas, for example in its hierarchy of evidence. We look at the motivations for EBM in past failures to use good evidence to support clinical decisions and reliance on what it claims to be poor sources of evidence, such as unsystematic intuition and experience. And we ask what the implications of knowledge of general causal truths are for the care of individual patients.

Intended learning outcomes:

- Knowledge of the motivations for and aims of Evidence-Based Medicine
- Acquaintance with the idea of a hierarchy of evidence

- Ability to think reflectively on the arguments for and against Evidence-Based Medicine.
- An understanding of the issues surrounding the connection between general causal truths and individual patient care.

Required reading:

"Evidence-Based Medicine" by Alexander Bird, on KEATS

Suggested additional reading:

Cartwright, Nancy (2011) "A philosopher's view of the long road from RCTs to effectiveness" *The Lancet* 9775. http://dx.doi.org/10.1016/S0140-6736(11)60563-1

Greenhalgh, Trisha, and Jeremy Howick, and Neal Maskrey (2014) "Evidence based medicine: a movement in crisis?" *BMJ* 2014;348:g3725. http://www.bmj.com/content/348/bmj.g3725

Sackett, David, and William Rosenberg, and Muir Gray, and Brian Haynes, and Scott Richardson (1996) "Evidence based medicine: what it is and what it isn't" *BMJ* 1996;312:71 https://doi.org/10.1136/bmj.312.7023.71

Worrall, John (2007) "Evidence in medicine and evidence-based medicine" *Philosophy Compass* 2. http://onlinelibrary.wiley.com/doi/10.1111/j.1747-9991.2007.00106.x/abstract

4. Reason and Chance: Probabilistic thinking in medicine

We will have learned that much of our knowledge in clinical medicine is probabilistic. How should we reason with probabilities? And given widespread proneness to erroneous probabilistic reasoning, how should we *not* reason with probabilities? We look at classical frequentist and Bayesian approaches to probability and to statistical inference in medicine. And we examine common errors such as base-rate neglect and the *p*-value fallacy.

Intended learning outcomes:

- Understanding of the classical frequentist and the Bayesian approaches to probabilistic and statistical reasoning.
- Awareness of some of the biases and fallacies of probabilistic reasoning, including:
    - the *p*-value fallacy;
    - the fallacy of base-rate neglect.

Required reading:

"Probability and scientific inference" by Alexander Bird, on KEATS (from my very old book, *Philosophy of Science*, Routledge 1998; I'm not sure I believe everything here still.)

Suggested additional reading:

Roush, Sherri "Belief under Uncertainty", on KEATS.

Westover, M. Brandon, Kenneth Westover, and Matt Bianchi (2011) "Significance testing as perverse probabilistic reasoning" *BMC Medicine* 9. https://bmcmedicine.biomedcentral.com/articles/10.1186/1741-7015-9-20

5. Decision, Risk, and Uncertainty: Deciding with incomplete knowledge

Given that so much of our knowledge in medicine is probabilistic, how should we decide what to do, for example what treatments to recommend? We look at decision theory, and at approaches to decision making, such as maximising expected utility. The importance of *values* in decision-making is emphasized, and ask where these values should come from (patient, doctor, society?). Sometimes we do not even know what the probabilities are. We distinguish decision-making under *risk*, under *uncertainty*, and under *ignorance*, and look at rules such as maximin and their application.

Intended learning outcomes:

- Understanding of the idea of maximising expected utility (MEU), and how to make decisions using MEU.
- Awareness that 'utility' can include any values (not just selfish ones).
- Ability to differentiate risk and uncertainty and how this difference can affect decision making.

Required reading:

"Decision Under Uncertainty" by Sherri Roush, on KEATS.