EPIDEMIOLOGY IN DECISION-MAKING

David Coggon

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RISK MANAGEMENT

- Applied in decisions between two or more possible courses of action
- Weighs benefits, risks and costs, taking account of uncertainties
- Depends on value judgements as well as science

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HAZARD

A hazard is a potential adverse effect of exposure to an agent, activity or stressor.

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RISK

Risk is the probability that a hazard will be realised, given the circumstances of exposure to an agent, activity or stressor

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QUANTIFICATION OF RISK

- Relative risk
- Attributable risk
- Population attributable risk

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RISK AND UNCERTAINTY

- Risks in individuals correspond to rates in populations
- Risk estimates are subject to uncertainty because of incomplete scientific information
- Unlike risk, uncertainty cannot be quantified empirically. It can only be characterised in terms of subjective beliefs.

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SOURCES OF UNCERTAINTY

- Relevant scientific questions not addressed
- Limitations of study design
- Statistical uncertainty
- Extrapolation from in vitro to in vivo
- Extrapolation between species
- Extrapolation within species

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SUMMARISING UNCERTAINTY

- Transparency v utility
- Quantitative v qualitative questions
- Assessment factors

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STEPS IN RISK ASSESSMENT

- Hazard identification
- Hazard characterisation
- Exposure characterisation
- Quantification of risk
- Characterisation of uncertainties

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SOURCES OF INFORMATION

- Inference from background knowledge
- Experiments in vitro
- Animal experiments in vivo
- Observations in humans and epidemiology
- Experiments in humans

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WHY DO ESTIMATES OF RISK DIFFER?

- Differences in exposure
- Differences in health outcome
- Bias
- Chance
- Confounding
- Effect modification

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DIFFERENCES IN EXPOSURE

- Exposure metric
- Definition of exposure categories
- Distribution of exposures within categories

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DIFFERENCES IN HEALTH OUTCOME

- Case definition
- Case-mix within definition

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BIAS

Bias is a systematic tendency to under-estimate or over-estimate a parameter of interest because of a deficiency in the design or execution of a study

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SOURCES OF BIAS

- Selection
  - eligibility criteria
  - incomplete participation or ascertainment
- Information
  - incomplete
  - inaccurate

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POSSIBLE OUTCOMES OF THREE COIN TOSSES

HHH	THH
HHT	THT
HTH	TTH
HTT	TTT

HYPOTHESIS TESTING

A p-value is the probability of obtaining an outcome as extreme as that observed in the study sample if the null hypothesis is true for the population from which the sample was derived

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CONFIDENCE INTERVALS

Assuming there is no bias, a confidence interval is a range within which the true value for a population parameter might be expected to lie

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ASSESSING THE POTENTIAL IMPACT OF CHANCE

- Hypothesis testing (p-values)
- Confidence intervals
- Weight of evidence from other sources (including biological plausibility)

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CONFOUNDING

A confounding factor is associated with the exposure of interest and independently determines risk of the health outcome

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ASSESSMENT OF POTENTIAL CONFOUNDING

- Restriction
- Matching
- Statistical adjustment
- Magnitude of relative risk
- Exposure-response relationship
- Biological plausibility of causation

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EFFECT MODIFICATION

The risk associated with the risk factor of interest varies according to the level of exposure to another variable (the effect modifier)

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