DECISIONS FROM DATA

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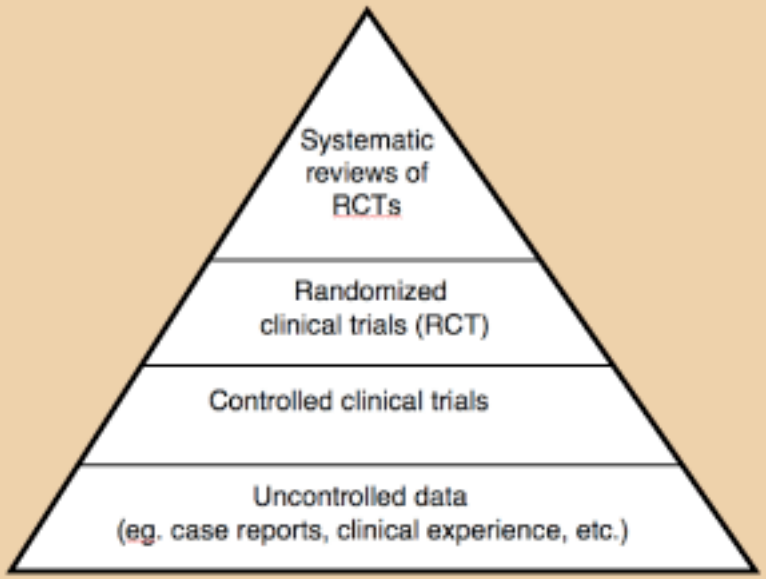
Case Study: Mangled Extremities

- Academic Trauma Unit at the RLH
  - Amputation vs. Salvage

- Complex
- Small amount of data

TRAUMA SERVICE
THE ROYAL LONDON HOSPITAL

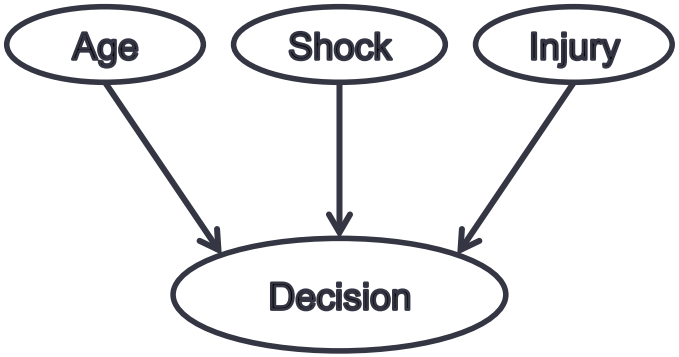
Clinical Evidence



- Limits of RCT
  - Rare conditions
  - Ethical and legal issues
  - Costs
- Generalisable?
  - Works some where vs. works every where
  - Background knowledge need
- *`Any belief that controlled trial is the only way would mean that the pendulum had swung too far but that it had come right off the hook.'* Bradford Hill, 1965

Scoring Systems

- Low clinical acceptance
  - Borderline cases
- Assumes historical decisions are perfect
- Predicts the decision
  - Data on what doctors did
  - … versus what would happen to the patient for possible decisions

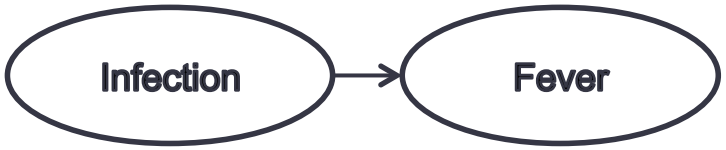


Output: Amputation!

New approach needed
- Integrate evidence
- Predict outcome

Bayesian Networks

- Network of uncertain variables



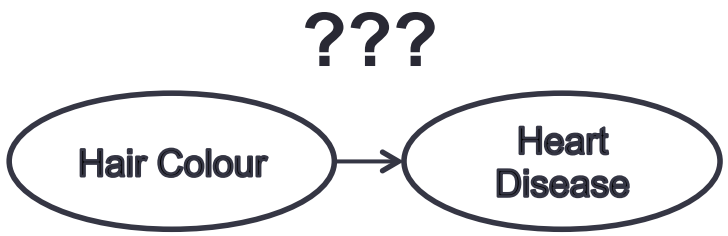
	Infection=Yes	Infection=No
Fever=Yes	0.90	0.15
Fever=No	0.10	0.85

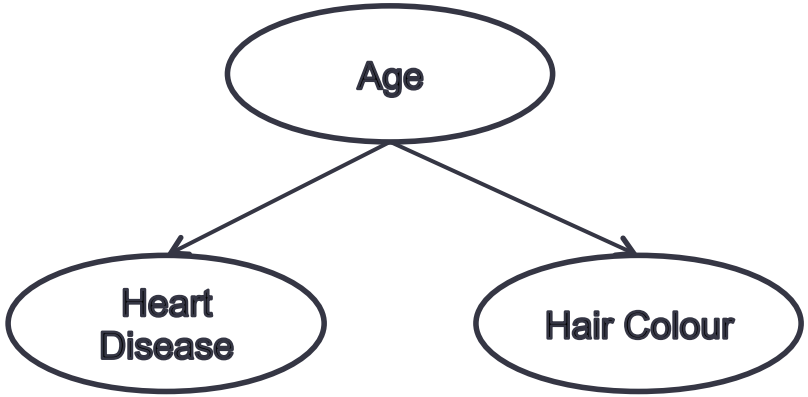
- Developed from:
  - Expert Knowledge
  - Data

- Application to clinical problems
  - Expert systems – simulate the expert
  - Analyse the data – decisions based on evidence

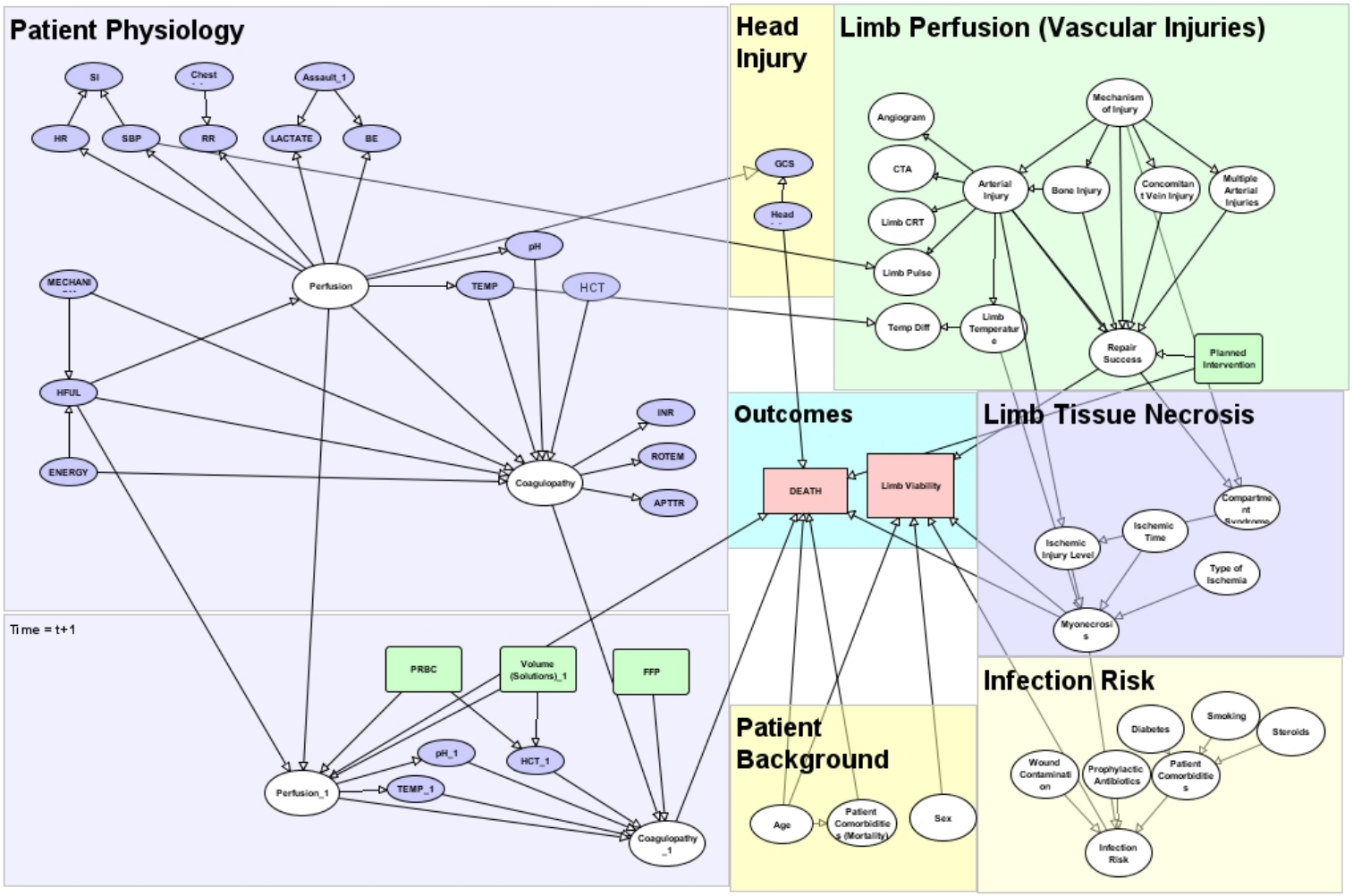
Association, Causality & Interventions

- Need for causal relations
  - Interventions → Outcomes
- Association vs. Causation
  - Grey hair predicts heart disease
  - Colouring hair to reduce risk?
- Identifying causes
  - Experiment (RCT)
  - Domain Knowledge + Observational Data



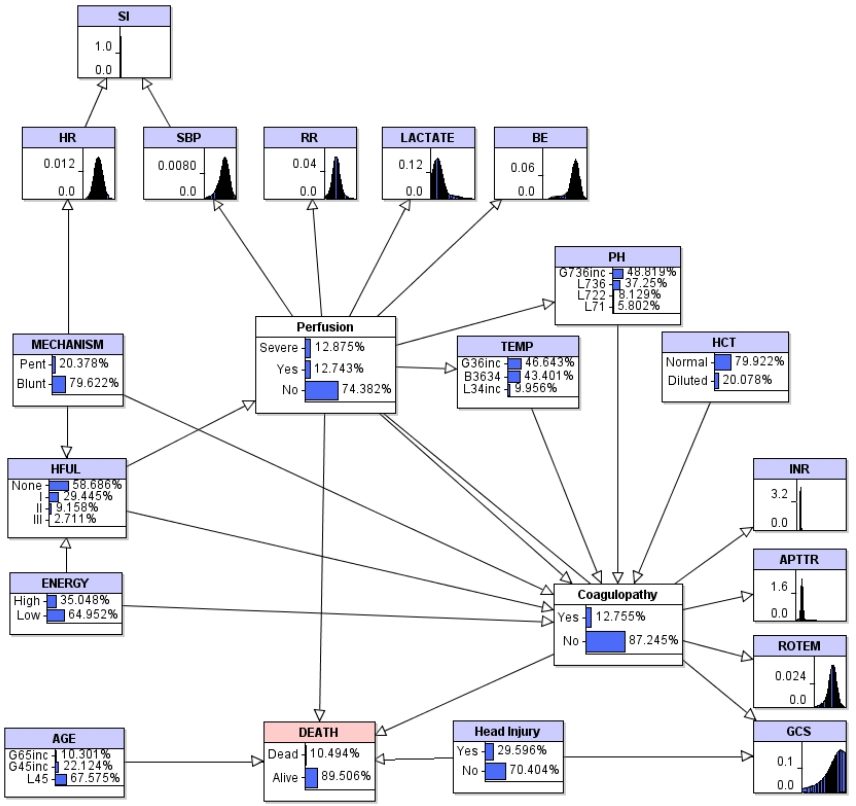


Mangled Extremity BN



Current Focus – Physiology BN

- Models patient physiology
- Predicts coagulopathy, and risk of death
- Importance in making limb salvage decisions



Summary: Vision

- Use causal Bayesian nets to
  - Integrate evidence: data, knowledge
  - Support decision making: estimate result of interventions
- Represent the evidence available
  - Source of evidence: data, literature, expert consultation
  - Uncertainty
- Use
  - Guidelines or individuals
  - Applicable where RCTs are impractical
  - Evidence for the necessity and potential benefits of a RCT

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- Trauma Academic Unit at BLH
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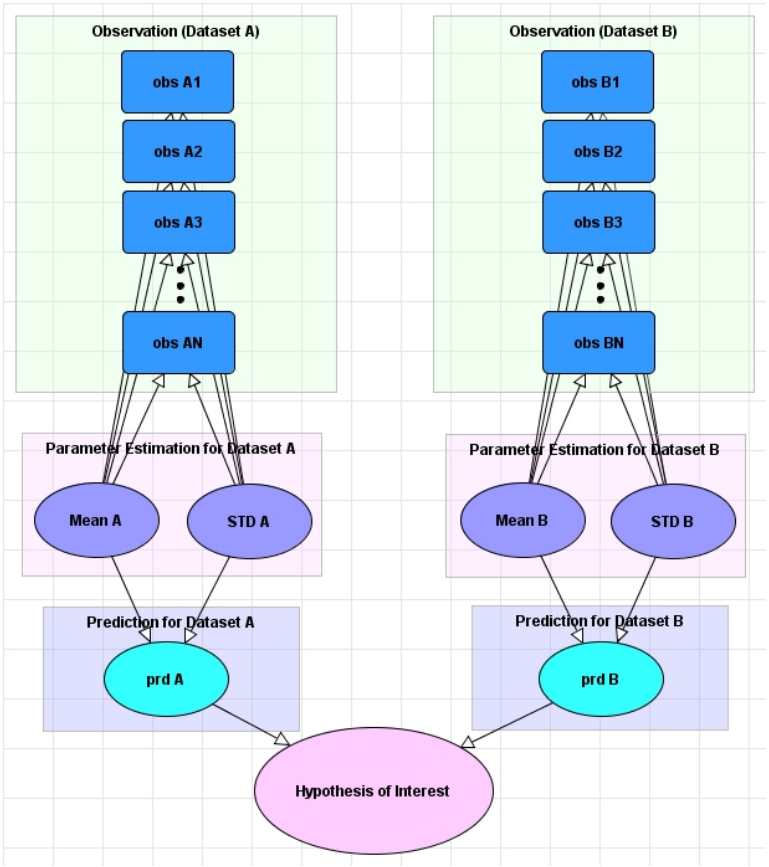
  - Barbaros Yet, PhD student
  - Nargis Pauran, PhD student

EXTRA SLIDES

Bayesian Learning and Hypothesis Testing

- Limited data and abundance of domain knowledge about many clinical subjects.
- Identifying variables and causal relations by domain knowledge.
- Bayesian Learning.
  - Parameter Learning with Expert Priors.
- Bayesian Hypothesis Testing.



Knowledge Synthesis from Models

- Difficulties in using DSS models real-time in clinical practice.
  - Time (e.g. entering data).
  - Resources (e.g. handheld devices).

- Using models to update clinical protocols.
  - Knowledge synthesis by BN models.