Statistics Informing Litigation

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Defective Products or Services, and Impact of Medico-Legal Claims on Insurance Industry: examples.

- What is the life expectancy of a 17 year girl with severe spinal cord injury?
- Are metal-on-metal hip replacements are defective?
- Does drug A minimise hayfever symptoms?

I aim to highlight general statistical principles, in order to encourage you to consider what you can offer to the legal systems in your countries.

This is not a technical talk, but I am happy to provide technical articles.

What are the statistical issues?

- What is the life expectancy of a person with severe spinal cord injury?

- Are metal-on-metal hip replacements are defective?

- Does drug A minimise hayfever symptoms?

To my mind, these are informally expressed.
I would first clarify the issues.

- Phrasing of the questions

- Specificity for a particular case

- Relevant data

Compensation award for car crash girl sets personal injury record at £23m

Agnes Collier suffered spinal injuries of utmost severity and her mother was killed in accident in Gloucestershire in 2009

▲ Karen Hood was killed by the careless driving of Anthony Norton, then a BMW executive. Photograph: Picasa

A teenage girl paralysed in a car crash in which her mother was killed is to receive £23m compensation, thought to be record damages.

Life expectancy of a person with severe spinal cord injury?

What are the statistical issues?

Questions Life expectancy: mean or median or life table?

Specific case Girl, 17 year, four limb paralysis, years since injury, high IQ, social class . . .

Relevant data What data are collected? Available? Quality?

Big data? 50,661 people with spinal cord injury.

Life expectancy of a person with severe spinal cord injury?

Relevant data What data are collected? Available? Quality?
50,661 or 49,241 with spinal cord injury . . . results on 31,531

- A few completely lost: 12%
- Of 49,241 people, 36% excluded for five reasons.

    1. the person was older than 10 years
    2. the level of neurological injury
    3. the ASIA grade
    4. person was not ventilator dependent
    5. lived ≥ 2.0 years since injury

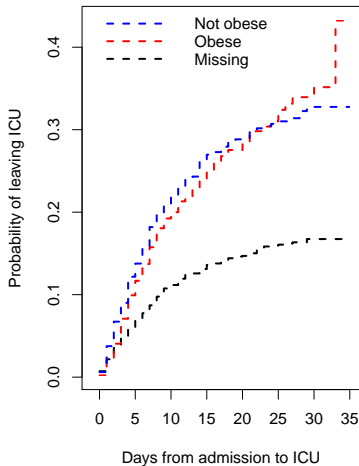What can we assume from data on 62% of people with spinal cord injury?

Deaths in ICU by obesity
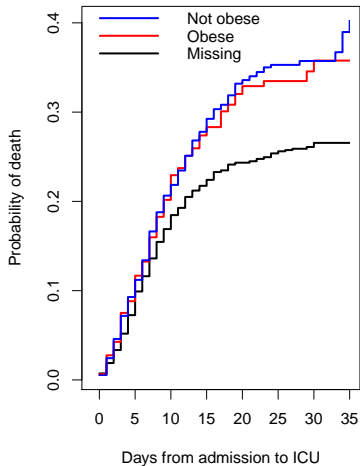
Leaving ICU by obesity

What are the statistical issues?

Questions
- What does defective mean?
- What is reasonable to expect from a hip replacement?
- What comparisons are relevant?

Specific cases Age, sex, reason for hip replacement, BMI, physical activity, diagnosis of ARMD . . .

Relevant data 'National' joint registers and informed consent

Medical Ethics and Statistics, Statistics Reference Online, 2014 - 2017 John Wiley & Sons, Ltd.

What are the statistical issues?

The XYZ study did not achieve significant results or a clear dose response effect.

- Study protocol: patients exposed to an average concentration 3500 ± 500 grains/^{3}
- Several measurements, 5 samplers, several times
- $\geq 3/5$ samples out of range 58% of times
- Perhaps the drug does not work?
- Quality of experimental control irrelevant?

What are the statistical issues?

- Simple measurement error attentuates slope
- Errors over time unpredictable bias
- Missing data can be informative
- Non-linear effects
- Summary statistics can obscure effects

Communicate this to solicitors, advocates, judges, jurors

Let pollen concentrations $X_i, i = 1, \ldots, n$ be $X_i \sim N(3500, 500)$, and symptom scores $Y_i = 10 + X_i/1000 + \epsilon_i$, where $\epsilon_i \sim N(0, 2)$. Let $W_i = X_i + \xi_i$, $\xi_i \sim N(0, 500)$ be with-error pollen concentration; $W_i \sim N(3500, 1000)$, are similar to observed

Measurement error example
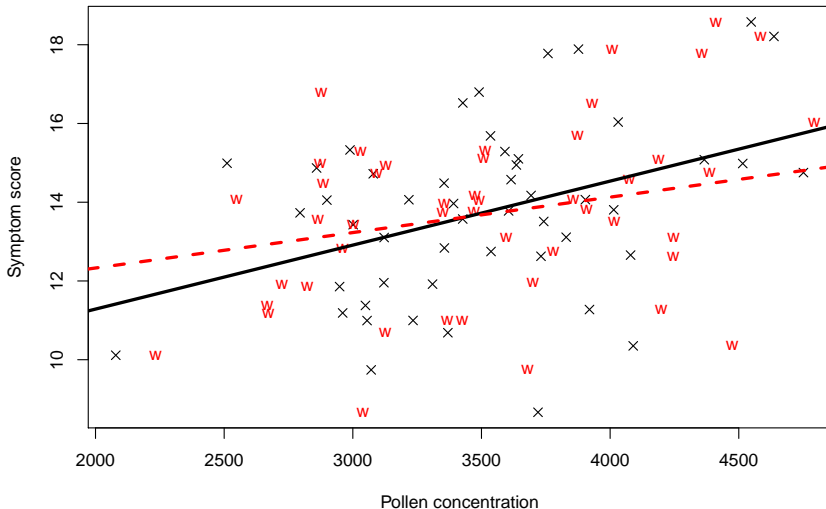
The use of statistics in legal proceedings

A PRIMER FOR COURTS

THE ROYAL SOCIETY

RSE
The Royal Society of Edinburgh
KNOWLEDGE MADE USEFUL

Statistics and probability for advocates: Understanding the use of statistical evidence in courts and tribunals

Forensic Science Regulator

Codes of Practice and

Conduct

Development of Evaluative Opinions

FSR-C-118

Credit is due to colleagues for these guides shown

Which mathematics experts do you prefer:
theory or applications?

Which mathematics experts do you prefer:

• An expert who gives a single answer with no uncertainty or alternatives?

• An expert who gives several answers, and tries to indicate uncertainty, and how different assumptions might suggest different decisions?

What are our individual and collective responsibilities in relation to the law and legal processes?