At first I was afraid, I was petrified...

Issues and possible solutions to the problem of extrapolating survival curves from limited trial data

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ISPOR Europe 2021, Spotlight Session 3

2 December 2021

The problem with survival analysis in HTA

Time-to-event data constitute the main outcome in a large number of HTAs (e.g. for cancer drugs)

Data

1. (Tori's part): The trial data have a very limited follow up, which implies large amount of censoring
   - This is often OK(-ish!) for "medical stats" analysis. But **HORRIBLE** for economic evaluation! \ (\Rightarrow\) Extrapolation
2. We may (or may not!) access **individual level data** for "our" trial, but not for the competitors'
   - Naturally leads to NMA-like models
3. Often the data are manipulated by the stats team within the sponsor and the economic modellers only get summaries/estimates
   - It is **ALWAYS** good to leave things to statisticians. But the modellers can (should?!) be statisticians too, so they could handle the data!...

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Models

1. Which model is the "best fit" – how to judge that?
2. Is modelling even enough? (How to make the most of "external data")
3. Should you be Bayesians about this?
   - (Spoiler alert: the answer is *always* Yes!... 😉)

To be or not to be (a Bayesian)?...

Frequentist ("standard") Bayesian

- A

Bayesian only speaks one language: probability distributions to describe
– Sampling variability (relevant for observ*ed* data)
– Epistemic uncertainty (relevant for *un*observ*able* parameters + yet *un*observ*ed* future data)

- Contextual (="prior") information to be formally included in the construction of the model
  – Almost irrelevant when evidence is "definitive" (large and consistent data)
  – Crucial when data are sparse! (... But this isn't preposterous, is it?...)

To be or not to be (a Bayesian)?...

In HTA

Frequentist ("standard")

Bayesian

Bayesian survival analysis in HTA

- We can specify "minimally informative" priors (eg like `survHE` does by default)
  – In many ways, that's the "lazy" option...
- Similarly, we can try the various models suggested in the guidelines and see what happens...

- We probably *know* something more about the likely shape of the hazard function
  – Likely to be monotonically increasing?
  – Definitely unlikely to be constant over time?...
- These considerations should drive the choice of models **over and above** testing all the options!

- What else do we know?
  – Likely average survival time
  – Chances of surviving after \(t^*\) units of time (eg >75 years old)
  – Population data to "anchor" the extrapolated survival curves
  – \(\ldots\)

Need ways to leverage the (limited) information in the observed data and underlying/context matter!