Practical 4. Cost-effectiveness analysis with individual-level data

Tuesday, 21 June 2022

Lecture 4 PDF version

1. Cost-effectiveness analysis with individual-level data

1. Work through the script `IPD_analysis.R` to run the model included in the file `normal-mod.txt`. The relevant data are stored in the file `cost-data.txt`.
    - Load the data into `R` using the `source(...)` function. Inspect the loaded data. Note that costs are in £1000, so that `OpenBUGS` does not "overflow" during calculations with large numbers.
    - Run the model using `BUGS` through `R`. Make sure you understand how to use the `bugs(...)` function in `R`.

      NB: The script `IPD_analysis.R` sets the initial values to `NULL` for this part. This means that we are instructing `R` to generate the initial values automatically. This would be the equivalent to clicking the button `gen inits` in the `OpenBUGS` interface. However, you can also use some deterministic values stored in the files `normal-inits1.txt`, `normal-inits2.txt` and `normal-inits3.txt`. You can simply open them and copy the code onto the `R` terminal. Or see later in the script (lines 65-67), for `R` code to load up the values into the `R` workspace.

    - Plot the posterior distribution of the costs. This can be plotted either as the joint posterior distribution of the cost in each arm of the posterior distribution of the cost differential.
    - Find the mean cost in each arm and mean difference in costs between arms. Compare these with the figures in the slides.
2. In the file `normal-mod.txt`, some code is included to calculate the deviance, a measure of model fit. The quantity -2 × log likelihood of a normal distribution is written out in `BUGS` model code.
    a. What is the deviance of the model, using this method?
    b. Find the deviance using the monitor set by BUGS automatically.
    c. Find the deviance using the DIC. *(Hint: See lecture slides)*.

    Make sure the answers from methods a, b and c match.

    This part requires you to work from the results produced by the model.

3. Continuing through the script `IPD_analysis.R`, run the model contained in the file `cgeg-mod.txt`.
    - Load the data stored in the file `cost-util-data.txt`. Inspect the loaded data. Set the initial values for three Markov chains within `BUGS` — you can use the values stored in the files `cgeg-inits1.txt`, `cgeg-inits2.txt` and `cgeg-inits3.txt`.

      NB: you don't necessarily need to use 3 chains (and so 3 sets of initial values). In general, it is good practice to select at least 2 parallel chains, so that you can (more) easily assess convergence.

    - Run the model using `BUGS` through `R`.
    - Draw a scatter plot of the difference in costs and effects.
    - Compare the incremental mean costs and effects with the figures in the slides in the lecture. In the slides, do the point estimates and the sizes of the confidence ellipses from this model agree (roughly) with statistics for `delta.e` and `delta.c` you have calculated?
4. Using the model contained in `cgeg-mod.txt`, investigate the cost-effectiveness results for a number of willingness-to-pay thresholds
    - For a willingness-to-pay of £500, calculate the mean incremental net benefit. Which treatment should we implement? Calculate the 95% credible interval for the incremental net benefit and investigate its distribution. Are we uncertain about which treatment is optimal? What is the probability of cost-effectiveness for a willingness-to-pay of £500
    - Calculate the cost-effectiveness acceptability curve using the CEAC variable in the `BUGS` model. Which treatment should be implemented?