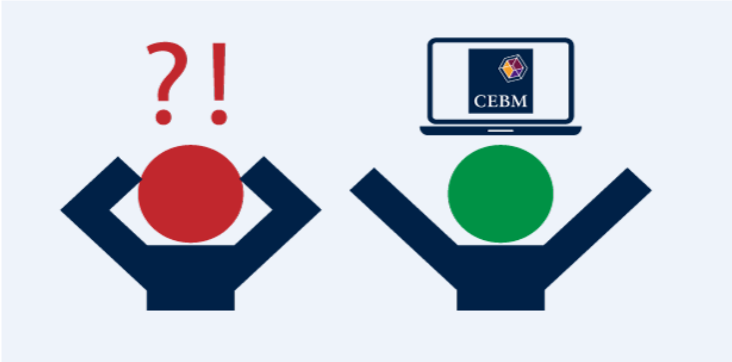
Tip for data extraction for meta-analysis – D2



What can I do when a study reports a beta coefficient instead of a hazard ratio?

Kathy Taylor

Last time, in post D1, I showed how to rescale hazard ratios (HRs), relative risks (RRs) and odds ratios (ORs) that express the change in risk associated with a specific change in a predictor variable. I gave two examples of studies which reported HRs for cardiovascular mortality associated with increases in 24-hour systolic blood pressure variability. I rescaled the HR from the first study from an increase of 15.6mmHg (1-SD) of blood pressure variability to an increase of 5mmHg (HR 1.01, 95% CI 0.94 to 1.03), so that the data could be pooled with the HR that was reported for a 5mmHg increase by the second study (HR 1.17, 95% CI 0.64 to 2.13).

Some studies may report risks in terms of a beta coefficient. This beta coefficient is simply the natural log-transformed (see post G8 for information about log-transformations) HR for a unit increase in the predictor variable:

$$beta \ = ln(HR_1)$$

In fact, log-transforming any HR will produce a beta coefficient. So in general, a beta coefficient for an increase in the predictor variable by x units is

$$\beta_x = ln(HR_x)$$

A bit of maths (see below if you're interested) shows us:

$$e^{\beta_y} = HR_y$$

And rescaling beta coefficients from a change of x units to y units in the predictor variable

$$\beta_y = \frac{y}{x} \times \beta_x$$

$$\beta_y = y \times beta$$

Let me show you an example. A study reports a beta coefficient of -0.0184 with SE of 0.033 for the association between systolic blood pressure variability and cardiovascular mortality. This beta coefficient is equivalent to a HR of $e^{-0.0184}$ which is 0.98 for an increase of 1mmHg of blood pressure variability. Using the equations I gave previously, in post D1, this rescales to a HR of $(0.98)^5$ or 0.912 for an increase of 5mmHg. This HR could be pooled with the HRs of the two examples I gave before. They were 1.01 and 1.17. However HRs, RRs and ORs have to be log-transformed before entering into meta-analysis software i.e. entered as beta coefficients.

Pooling for an increase in 5mmHg in the predictor variable, the beta coefficients for the three studies would be

$$ln(1.01) = 0.01$$
$$ln(1.17) = 0.16$$
$$-0.0184 \times 5 = -0.092 = ln(0.912)$$

Pooling for an increase in 1mmHg the beta coefficients for the three studies would be

$$\frac{ln(1.01)}{5} = 0.002$$
$$\frac{ln(1.17)}{5} = 0.31$$
$$-0.0184$$

Here's a tip….

Beta coefficients are just

log-transformed hazard ratios

Beta coefficients are entered into meta-analysis software with their standard errors (SEs). In the next blog post I'll show how to calculate these SEs.

Where did the equations come from?

(You can skip this if you are only interested in carrying out the calculations)

The natural logarithm (ln) and exponential (e) functions are the opposite of each other and therefore, when they are applied together they cancel out.

$$\beta_y = ln\left(HR_y\right)$$

Taking exponentials

$$e^{\beta_y} = e^{ln\left(HR_y\right)} = HR_y$$

Looking at the equations that I gave in the previous post (<link>EBHC KT blog post 4</link>)

$$HR_y = (HR_x)^{\frac{y}{x}}$$

Taking natural logs and remembering that $\beta_x = ln(HR_x)$

$$\Longrightarrow \beta_y = ln(HR_x)^{\frac{y}{x}}$$

Applying the 3rd law of logarithms i.e. $log(A)^n = n \times log(A)$

$$\Longrightarrow \beta_y = \frac{y}{x} \times ln(HR_x) = \frac{y}{x} \times \beta_x$$

For x=1

$$\beta_y = y \times beta$$

Dr Kathy Taylor teaches data extraction in Meta-analysis, https://www.conted.ox.ac.uk/courses/meta-analysis</link> This is a short course that is also available as part of our MSc in Evidence-Based Health Care https://www.conted.ox.ac.uk/about/msc-in-evidence-based-health-care, MSc in Medical Statistics https://www.conted.ox.ac.uk/about/msc-in-ebhc-medical-statistics, and MSc in Systematic Reviews https://www.conted.ox.ac.uk/about/msc-in-ebhc-systematic-reviews

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