Around meta-analysis (6): heterogeneity vs. quality

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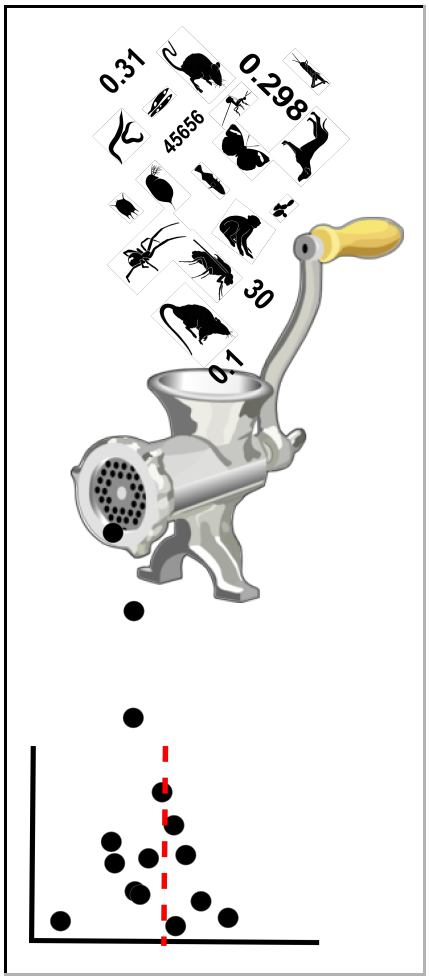

In my last blog post, I was writing about a tool developed to assess the quality of meta-analytical papers. This time, I am going to focus on the quality of the data that goes into such papers. Data quality is very hard to define. It does not necessarily equal to the paper quality or risk of bias in the data, although they are often assumed to be the same. I probably will write more about this problem next time, but for now I will use the above terms interchangeably.

There were numerous approaches in medical sciences to design tools for assessing study and data quality. These approaches usually use checklists and scales, which have a problem of being either too general (and can not capture crucial differences between studies in a data set) or too specific (applicable only to a very narrow type of studies). Using scales that result in a single score number for measuring study quality is discouraged the by Cochrane Handbook of Systematic Reviews. Cochrane Handbook recommends using their own tool instead, which produces a risk of bias graph and a simplistic overall risk of bias score (low, medium and high risk). However, Cochrane reviews usually deal with quite homogenous data - mostly randomized controlled trials on humans and testing for a very specific intervention only. Therefore, the Cochrane tool is mostly irrelevant to the non-medical research (e.g. "blinding the participants" when working on plants and animals), which faces many different problems.

In ecology and evolution, general and broad questions are the most interesting ones (i.e. looking for general patterns). Trying to answer such questions also means having to deal with highly heterogeneous data sets: multiple species, experimental designs and conditions. We can argue that this means that data from such heterogeneous studies will differ in its quality (or reliability). I think that, if we have enough data points and get robust results from our meta-analysis, that's actually a good thing - meaning that there is (or is not) some sort of general pattern out there, despite all the "noise". Moreover, I would argue that the best way to deal with the heterogeneity in experimental data is by coding or quantifying the key differences between studies and using them as moderators in the meta-regression (e.g. field - lab or experimental - observational study, degree of manipulation, biologically relevant background conditions, study species). Then you have the added benefit of learning more about what are the actual factors affecting the investigated pattern, which might be even more interesting than the main effect.

Heterogeneity is unavoidable. And there are few more layers to the whole question of how to deal with it, which I should write more about in the next blog post.

Details

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