Meta-Regression: The Gap Between Theory and Practice

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At the beginning of the development of meta-analysis, understanding the role of moderators was given the highest priority, with meta-regression provided as a method for achieving this goal. For example, some of the earliest meta-analyses by Glass and colleagues focused not on the average, but on explaining variation in effect sizes using regression. In a review of over 40 years of the history of meta-regression methods, Tipton, Pustejovsky, and Ahmadi (2019a) found that there has been considerable progress on many parts of meta-regression methodology during this time. In our summary of this review, we identified five consensus points regarding best practice

Given these developments, one would expect meta-regression methods to be widely used in practice. However, in a complementary paper, Tipton, Pustejovsky, and Ahmadi (2019b) found that in the fields of education, psychology, and medicine, meta-regression practices are out of sync with best practices methodologically. These conclusions are based on reviews of published meta-analyses in *Psychological Bulletin*, the *Journal of Applied Psychology*, *Review of Education Research*, and the *Cochrane Library* in the year 2016.

In this talk, we will begin by briefly summarizing these 5 consensus points from the methods literature and the evidence of use of these consensus points found in the review of practice (see Table 1 below). The remainder of the talk will focus on questions regarding how we, as a society, can close this gap. In our paper, we discussed possible ideas such as: building connections between SRSM and other professional associations (e.g., APA), building relationships between journals and our community (e.g., including tutorials on best practice in journals such as Psychological Bulletin), and improving defaults and options found in widely used software. Our hope is to raise awareness of these problems and to generate ideas and momentum for improving practice.

References

Tipton, E., Pustejovsky, J. E., & Ahmadi, H. (2019a). A History of Meta-Regression: Technical, Conceptual, and Practical Developments between 1974 and 2018. *Research synthesis methods*.

Tipton, E., Pustejovsky, J. E., & Ahmadi, H. (2019b). Current Practices in Meta-Regression in Psychology, Education, and Medicine. *Research synthesis methods*.

Table 1: Comparison between best and current practice

Type	Result from historical review of literature	Result from study of current practice
Consensus Point	MR models should use Knapp-Hartung corrections for hypothesis tests.	91% of MA use large-sample tests for MR (software defaults).
	It is now possible to include all relevant ES in a single model.	10% of MA include a model with all ES included (e.g., MLM, RVE).
	MR can include both continous and categorical moderators.	Most MA use ANOVA for categorical moderators and only use MR for continuous moderators.
	MR models should control for confounders.	17% of MA include models with more than one covariate.
	Hypothesis tests should be divided into confirmatory and exploratory and corrections for multiple comparisons should be used.	88% of MA don't report using any MC correction.
Research Needs	Methods for missing covariate data are needed.	45% of studies report missing data problems. Only 3% of these studies use multiple impuation.
	Covariate selection help for how to approach confounding is needed.	Confounders are rarely referenced in practice. 83% of MR models include a single covaiate.
	Model selection and model building guidelines needed.	When referenced, the most common approach is forward-backward selection, only including significant predictors, or including all.