**Meta-regression with DisMod-MR: how robust is the model?**

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**Abstract**

**Background** The Global Burden of Disease, Injuries, and Risk Factors Study 2010 (GBD 2010 Study) required age-specific prevalence estimates for over 300 outcomes for all countries. Results of systematic reviews were often very sparse and noisy, so DisMod-MR was often used to combine all available data and create estimates. We investigated the robustness of this approach by comparing the negative binomial rate model to alternative rate models using out-of-sample predictive validity.

**Methods** We compared all disease and injury models analyzed with DisMod-MR from the GBD 2010 Study with more than 4 prevalence data points in Western Europe. For each disease/injury model, we generated 1000 replicates with the Western European prevalence data partitioned into a random 75/25% train/test split. We fit an age-specific rate model to the training data and used the results to predict values for the test data. We compared the bias, median absolute error (MAE), and percent coverage for each replicate to determine if the negative binomial, binomial, normal, or lognormal rate model was superior for each condition.

**Findings** Each metric has its own superior rate model. The lognormal model had the most replicates with smallest bias. The binomial model had the most with minimum MAE. The negative binomial model had the percent coverage closest to the target coverage of 95%.

**Interpretation** Depending on the metric, different rate models are superior. The negative binomial model provides an appealing balance of accuracy, precision, and calibration.

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**Disclosure of conflicts of interest** ADF developed the DisMod-MR software, BMB developed the offset lognormal model

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