

The Network Relative Model Accuracy (NeRMA) Score: A Method to Quantify the Accuracy of Prediction Models in a Concurrent External Validation

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Abstract : Background: Network meta-analysis (NMA) quantifies the relative efficacy of 3 or more interventions from studies containing a subgroup of interventions. This study applied the analytical approach of NMA to quantify the relative accuracy of prediction models with distinct inclusion criteria that are evaluated on a common population ('concurrent external validation'). Methods: We simulated binary events in 5000 patients using a known risk function. We biased the risk function and modified its precision by pre-specified amounts to create 15 prediction models with varying accuracy and distinct patient applicability. Prediction model accuracy was measured using the Scaled Brier Score (SBS). Overall prediction model accuracy was measured using fixed-effects methods that accounted for model applicability patterns. Prediction model accuracy was summarized as the Network Relative Model Accuracy (NeRMA) Score which ranges from $-\infty$ through 0 (accuracy of random guessing) to 1 (accuracy of most accurate model in concurrent external validation). Results: The unbiased prediction model had the highest SBS. The NeRMA score correctly ranked all simulated prediction models by the extent of bias from the known risk function. A SAS macro and R-function was created to implement the NeRMA Score. Conclusions: The NeRMA Score makes it possible to quantify the accuracy of binomial prediction models having distinct inclusion criteria in a concurrent external validation.

Keywords : prediction model accuracy, scaled brier score, fixed effects methods, concurrent external validation

Conference Title : ICEMS 2021 : International Conference on Epidemiology and Medical Statistics

Conference Location : Rome, Italy

Conference Dates : December 13-14, 2021