How do you run a Monte Carlo power analysis for simple, serial, and parallel mediation models?

Authored by

stats writer

June 30, 2024

Monte Carlo power analysis is a statistical method used to determine the power of a study, which is the likelihood of detecting a true effect. This analysis is useful in determining sample size for a study and ensuring that the study has enough statistical power to accurately detect the intended effects. In the context of simple, serial, and parallel mediation models, Monte Carlo power analysis is used to determine the minimum sample size needed to detect a significant indirect effect.

To run a Monte Carlo power analysis for simple, serial, and parallel mediation models, the following steps are typically followed:

1. Identify the variables and effects of interest in the mediation model: The first step is to clearly define the variables and effects that are being studied. This includes identifying the independent variable, mediator(s), and dependent variable, as well as the direct and indirect effects that are being examined.

2. Specify the model: Next, the mediation model needs to be specified, including the specific path coefficients and error variances. This is necessary for accurately simulating data for the power analysis.

3. Determine the desired power level: The desired power level should be determined based on the acceptable risk of Type II error (false negative). Typically, a power level of 0.80 is considered acceptable in most research studies.

4. Simulate data: Using statistical software, data is simulated based on the specified mediation model and sample size. This is typically done multiple times (e.g. 1000 simulations) to ensure robustness of the results.

5. Conduct mediation analysis: The simulated data is then analyzed using a mediation model to obtain the indirect effect estimate and its corresponding p-value.

6. Repeat for varying sample sizes: Steps 4 and 5 are repeated for different sample sizes, starting from a small sample size and gradually increasing to the desired sample size. This allows for the determination of the minimum sample size needed to detect a significant indirect effect.

7. Determine minimum sample size: Based on the results of the power analysis, the minimum sample size needed to detect a significant indirect effect with the desired power level can be determined.

In summary, running a Monte Carlo power analysis for simple, serial, and parallel mediation models involves simulating data, conducting mediation analysis, and repeating for varying sample sizes to determine the minimum sample size needed to detect a significant indirect effect. This method helps researchers make informed decisions about sample size and ensures that their study has enough statistical power to accurately detect the intended effects.

FAQ: How do you run a Monte Carlo power analysis for simple, serial and parallel mediation models?

Schoemann et al. created an easy to use web app that allows you to use Monte Carlo simulation to calculate sample size based on target power for the following models:

Access the web app here: https://schoemanna.shinyapps.io/mc_power_med

Citation

Schoemann, A. M., Boulton, A. J., & Short, S. D. (2017). Determining power and sample size for simple and complex mediation models. Social Psychological and Personality Science, 8(4), 379-386. https://doi.org/10.1177/1948550617715068