

Toward a standardized evaluation of imputation methodology

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Simulation studies as a tool

Simulation studies have become an easy and flexible tool for evaluating new statistical methodology. Unfortunately, there is no consensus on **how to perform simulation studies** for the evaluation of missing data methodology, such as imputation.

In our review paper, Oberman & Vink (2024), we suggest a course of action for simulating and evaluating missing data problems. This poster presents the **checklist for reporting** on simulation studies for imputation methodology that we developed (2022), based on the ADEMP framework by Morris et al. (2019).

Invitation to interact

Our suggested course of action is by no means meant to serve as a complete cookbook. Rather, it is meant to **incite critical thinking** and a move to objective and fair evaluations of imputation methodology.

Since our review and recommendations, others have engaged with the topic. See for example Siepe et al.'s (2024) preregistration template for simulation studies. We invite the audience to **take part in the discussion**, contribute to our proposed simulation checklist, and imagine how this may relate to (pre)registration for simulation studies.

Suggested workflow for statistical simulation studies

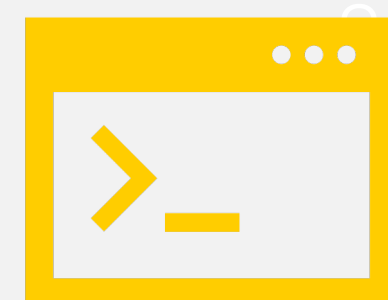


Plan

&



Register



Run



Report

&



Check

what do
you
think?

how could we
integrate
with other
initiatives?

Reporting checklist for the evaluation of imputation methodology

- ☐ Aims
 - e.g. simulation scope
 - ☐ simulation design (incl. pseudo-code or flow diagram)
 - ☐ required level of precision (incl. number of simulation repetitions)
- ☐ Data-generating mechanisms
 - e.g. data generation and missingness generation
 - ☐ data source (incl. model-based or design-based, sampling variance)
 - ☐ data characteristics (incl. multivariate relations and data structures such as clustering)
 - ☐ missingness mechanisms (incl. type or functional form of the missing data model)
 - ☐ missingness patterns (incl. missingness proportion)
- ☐ Estimands
 - e.g. complete data target
- ☐ Methods
 - e.g. missing data methods and analytic method
 - ☐ imputation methods (incl. parameters such as the number of imputations)
 - ☐ estimation method (incl. reference methods such as complete case analysis)
- ☐ Performance measures
 - e.g. evaluation of estimates and imputed values
 - ☐ statistical properties (incl. comparative performance, if applicable)
 - ☐ validity of imputations (incl. imputation model fit and distributional characteristics)

what
is
missing?

what
is
obsolete?

References

1. Morris, T. P., White, I. R., & Crowther, M. J. (2019). Using simulation studies to evaluate statistical methods. *Statistics in Medicine*, 38(11), 2074–2102. <https://doi.org/10.1002/sim.8086>
2. Oberman, H. I. (2022). Checklist for reporting on imputation methodology evaluations. *ResearchEquals*. <https://doi.org/10.53962/rs4bk-0805>

3. Oberman, H. I., & Vink, G. (2024). Toward a standardized evaluation of imputation methodology. *Biometrical Journal*, 66(1), 2200107. <https://doi.org/10.1002/bimj.202200107>
4. Siepe, B. S., Bartoš, F., Morris, T.P., Boulesteix, A-L, Heck, D.W. & Pawel, S. (2024). Simulation Studies for Methodological Research in Psychology: A Standardized Template for Planning, Preregistration, and Reporting. *Psychological Methods*. <https://doi.org/10.1037/met0000695>



this
poster
(and
more!)