

Quality Standards for Simulation Studies in Psychometrics

Björn S. Siepe^{*}, František Bartos, Tim P. Morris, Anne-Laure Boulesteix, Daniel Heck, Samuel Pawel

^{*} Psychological Methods Lab, Department of Psychology, University of Marburg

IMPS 2024. Slides available at <https://bsiepe.github.io>

“Statisticians ... often pay too little attention to their own principles of design”(Hoaglin & Andrews, 1975)

The Reporting of Computation-Based Results in Statistics

DAVID C. HOAGLIN* and DAVID F. ANDREWS**

STATISTICS IN MEDICINE

Statist. Med. 2006; **25**:4279–4292

Published online 31 August 2006 in Wiley InterScience

(www.interscience.wiley.com) DOI: 10.1002/sim.2673

The design of simulation studies in medical statistics

Andrea Burton^{1,2,*}, Douglas G. Altman¹, Patrick Royston^{1,3} and Roger L. Holder⁴

TUTORIAL IN BIostatISTICS

WILEY **Statistics**
in *Medicine*

Using simulation studies to evaluate statistical methods

Tim P. Morris¹ | Ian R. White¹ | Michael J. Crowther²

“Statisticians ... often pay too little attention to their own principles of design”(Hoaglin & Andrews, 1975)

This project:

The Reporting of Computation-Based Results in Statistics

DAVID C. HOAGLIN* and DAVID F. ANDREWS**

STATISTICS IN MEDICINE

Statist. Med. 2006; **25**:4279–4292

Published online 31 August 2006 in Wiley InterScience

(www.interscience.wiley.com) DOI: 10.1002/sim.2673

The design of simulation studies in medical statistics

Andrea Burton^{1,2,*}, Douglas G. Altman¹, Patrick Royston^{1,3} and Roger L. Holder⁴

TUTORIAL IN BIostatISTICS

WILEY Statistics
in Medicine

Using simulation studies to evaluate statistical methods

Tim P. Morris¹ | Ian R. White¹ | Michael J. Crowther²

“Statisticians ... often pay too little attention to their own principles of design”(Hoaglin & Andrews, 1975)

This project:

- Review of 100 recent simulation studies in psychology

The Reporting of Computation-Based Results in Statistics

DAVID C. HOAGLIN* and DAVID F. ANDREWS**

STATISTICS IN MEDICINE

Statist. Med. 2006; **25**:4279–4292

Published online 31 August 2006 in Wiley InterScience

(www.interscience.wiley.com) DOI: 10.1002/sim.2673

The design of simulation studies in medical statistics

Andrea Burton^{1,2,*}, Douglas G. Altman¹, Patrick Royston^{1,3} and Roger L. Holder⁴

TUTORIAL IN BIostatISTICS

WILEY Statistics
in Medicine

Using simulation studies to evaluate statistical methods

Tim P. Morris¹ | Ian R. White¹ | Michael J. Crowther²

“Statisticians ... often pay too little attention to their own principles of design”(Hoaglin & Andrews, 1975)

The Reporting of Computation-Based Results in Statistics

DAVID C. HOAGLIN* and DAVID F. ANDREWS**

STATISTICS IN MEDICINE

Statist. Med. 2006; 25:4279–4292

Published online 31 August 2006 in Wiley InterScience

(www.interscience.wiley.com) DOI: 10.1002/sim.2673

The design of simulation studies in medical statistics

Andrea Burton^{1,2,*}, Douglas G. Altman¹, Patrick Royston^{1,3} and Roger L. Holder⁴

TUTORIAL IN BIostatISTICS

WILEY Statistics
in Medicine

Using simulation studies to evaluate statistical methods

Tim P. Morris¹ | Ian R. White¹ | Michael J. Crowther²

This project:

- Review of 100 recent simulation studies in psychology
- Psychological Methods, Behavior Research Methods, Multivariate Behavioral Research

“Statisticians ... often pay too little attention to their own principles of design”(Hoaglin & Andrews, 1975)

The Reporting of Computation-Based Results in Statistics

DAVID C. HOAGLIN* and DAVID F. ANDREWS**

STATISTICS IN MEDICINE

Statist. Med. 2006; **25**:4279–4292

Published online 31 August 2006 in Wiley InterScience

(www.interscience.wiley.com) DOI: 10.1002/sim.2673

The design of simulation studies in medical statistics

Andrea Burton^{1,2,*}, Douglas G. Altman¹, Patrick Royston^{1,3} and Roger L. Holder⁴

TUTORIAL IN BIostatISTICS

WILEY Statistics
in Medicine

Using simulation studies to evaluate statistical methods

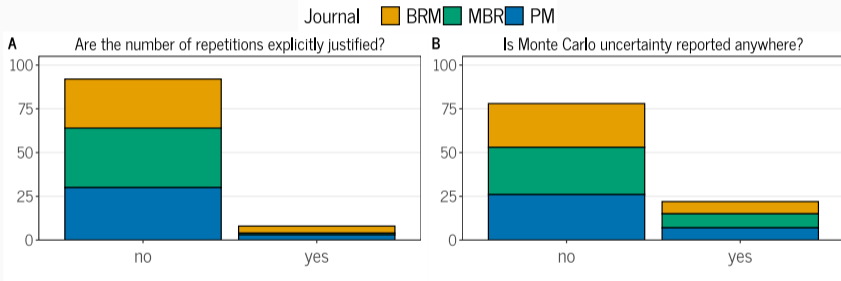
Tim P. Morris¹ | Ian R. White¹ | Michael J. Crowther²

This project:

- Review of 100 recent simulation studies in psychology
- Psychological Methods, Behavior Research Methods, Multivariate Behavioral Research
- Coding of various aspects of reporting

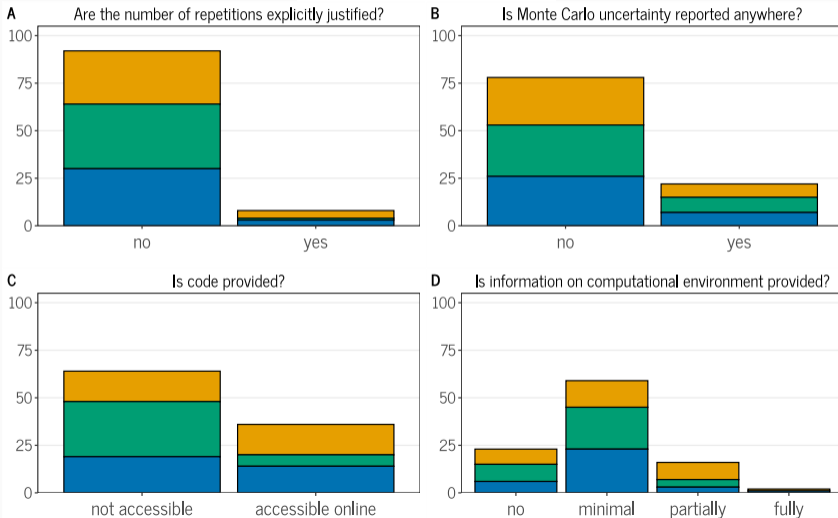
Main Results

Main Results



Main Results

Journal BRM MBR PM



ADEMP-PreReg Template for Simulation Studies

Version: 0.1.0

Last updated: 2023-10-31

Preregistration template designed by

Björn S. Siepe, František Bartoš, Tim P. Morris, Anne-Laure Boulesteix, Daniel W.
Heck, and Samuel Pawel

ADEMP-PreReg Template for Simulation Studies

Version: 0.1.0

Last updated: 2023-10-31

Preregistration template designed by

Björn S. Siepe, František Bartoš, Tim P. Morris, Anne-Laure Boulesteix, Daniel W.
Heck, and Samuel Pawel

- Protocol template based on **ADEMP structure** (Morris et al., 2019) + **open science** + **reproducibility** aspects

ADEMP-PreReg Template for Simulation Studies

Version: 0.1.0

Last updated: 2023-10-31

Preregistration template designed by

Björn S. Siepe, František Bartoš, Tim P. Morris, Anne-Laure Boulesteix, Daniel W.
Heck, and Samuel Pawel

- Protocol template based on **ADEMP structure** (Morris et al., 2019) + **open science** + **reproducibility** aspects
- **Different versions:** L^AT_EX, Overleaf, MS/Libre office, Google docs

ADEMP-PreReg Template for Simulation Studies

Version: 0.1.0

Last updated: 2023-10-31

Preregistration template designed by

Björn S. Siepe, František Bartoš, Tim P. Morris, Anne-Laure Boulesteix, Daniel W.
Heck, and Samuel Pawel

- Protocol template based on **ADEMP structure** (Morris et al., 2019) + **open science** + **reproducibility** aspects
- **Different versions:** L^AT_EX, Overleaf, MS/Libre office, Google docs
- **Living document:** <https://github.com/bsiepe/ADEMP-PreReg>

The ADEMP-PreReg template

Purposes

The ADEMP-PreReg template

Purposes

- **Preregistration**

The ADEMP-PreReg template

Purposes

- **Preregistration**
- **Planning** of simulation studies

The ADEMP-PreReg template

Purposes

- **Preregistration**
- **Planning** of simulation studies
- Blueprint for **reporting**

The ADEMP-PreReg template

Purposes

- **Preregistration**
- **Planning** of simulation studies
- Blueprint for **reporting**
- **Reviewing** of simulation studies

Limitations

The ADEMP-PreReg template

Purposes

- **Preregistration**
- **Planning** of simulation studies
- Blueprint for **reporting**
- **Reviewing** of simulation studies

Limitations

- Preregistration could be **faked**

The ADEMP-PreReg template

Purposes

- **Preregistration**
- **Planning** of simulation studies
- Blueprint for **reporting**
- **Reviewing** of simulation studies

Limitations

- Preregistration could be **faked**
- May **slow down** exploratory research



[doi:10.5281/zenodo.7994221](https://doi.org/10.5281/zenodo.7994221)

**Simulation Studies for Methodological Research in Psychology:
A Standardized Template for Planning, Preregistration, and Reporting**

Björn S. Siepe^{*1}, František Bartoš^{*2}, Tim P. Morris³, Anne-Laure Boulesteix⁴, Daniel W.
Heck¹, and Samuel Pawel^{*5} * contributed equally

**Simulation Studies for Methodological Research in Psychology:
A Standardized Template for Planning, Preregistration, and Reporting**

Björn S. Siepe^{*1}, František Bartoš^{*2}, Tim P. Morris³, Anne-Laure Boulesteix⁴, Daniel W.
Heck¹, and Samuel Pawel^{*5} * contributed equally

- Simulation studies can have **big impact**, should be **conducted carefully**

**Simulation Studies for Methodological Research in Psychology:
A Standardized Template for Planning, Preregistration, and Reporting**

Björn S. Siepe^{*1}, František Bartoš^{*2}, Tim P. Morris³, Anne-Laure Boulesteix⁴, Daniel W.
Heck¹, and Samuel Pawel^{*5} * contributed equally

- Simulation studies can have **big impact**, should be **conducted carefully**
- **Protocols** could improve quality of simulation studies

**Simulation Studies for Methodological Research in Psychology:
A Standardized Template for Planning, Preregistration, and Reporting**

Björn S. Siepe*¹, František Bartoš*², Tim P. Morris³, Anne-Laure Boulesteix⁴, Daniel W.
Heck¹, and Samuel Pawel*⁵ * contributed equally

- Simulation studies can have **big impact**, should be **conducted carefully**
- **Protocols** could improve quality of simulation studies
- **ADEMP-PreReg template** helps in preregistration, planning, reporting, reviewing of simulation studies

References i

- Hoaglin, D. C. and Andrews, D. F. (1975). The reporting of computation-based results in statistics. *The American Statistician*, 29(3):122–126. doi:10.1080/00031305.1975.10477393.
- Morris, T. P., White, I. R., and Crowther, M. J. (2019). Using simulation studies to evaluate statistical methods. *Statistics in Medicine*, 38(11):2074–2102. doi:10.1002/sim.8086.
- Pawel, S., Kook, L., and Reeve, K. (2023). Pitfalls and potentials in simulation studies: Questionable research practices in comparative simulation studies allow for spurious claims of superiority of any method. *Biometrical Journal*, (e2200091):1–19. doi:10.1002/bimj.202200091.
- Siepe, B. S., Bartoš, F., Morris, T. P., Boulesteix, A.-L., Heck, D. W., and Pawel, S. (2023). Simulation studies for methodological research in psychology: A standardized template for planning, preregistration, and reporting. doi:10.31234/osf.io/ufgy6.