

UNIVERSITY OF HAMBURG

MASTER THESIS

Masterthesis_doc

Author:
Lona Frießner

Supervisor:
Prof. Dr. Simon Grund

*A thesis submitted in fulfillment of the requirements
for the degree of Master of Science*

in the

Institute of Psychology
Department of Psychology with focus on Quantitative Methods



May 05, 2026

UNIVERSITY OF HAMBURG

Abstract

Institute of Psychology

Department of Psychology with focus on Quantitative Methods

Master of Science

Masterthesis_doc

by Lona Frießner

Lorem ipsum dolor sit amet, consectetur adipiscing elit. Aliquam quis accumsan ante. Quisque lorem metus, varius id urna eget, lacinia dapibus sem. Etiam laoreet, quam ac mollis congue, arcu leo dictum neque, nec euismod sem enim luctus odio. Donec condimentum tortor sit amet mollis volutpat. Donec ornare libero vel velit malesuada consectetur. Vestibulum in sem non justo dignissim congue at quis erat. Integer quis erat vitae mi maximus fringilla tristique nec odio. Morbi non ipsum sapien. Vestibulum tortor est, ultricies in eros et, bibendum iaculis justo. Cras pellentesque enim quam, id pretium lacus lacinia non. Integer velit neque, ultrices a malesuada vel, imperdiet quis enim. Quisque eu facilisis urna, ut faucibus lorem. Donec mollis turpis sed arcu venenatis interdum. Nulla facilisis tortor ac scelerisque consequat.

Table of contents

Abstract	iii
1 Introduction	1
2 Theory	3
3 Methods	5
3.1 Data generation	5
3.2 Data-generating model	5
3.3 Missing data generation	5
3.4 Factors and simulation conditions	5
3.5 Methods of missing data handling	6
3.6 Execution of simulation	6
4 Results	7
5 Discussion	9
References	11

List of Figures

List of Tables

Chapter 1

Introduction

Chapter 2

Theory

Chapter 3

Methods

3.1 Data generation

A simulation study was conducted to compare the methods of missing data handling.
(erklären, was eine Simulationsstudie ist)

Data was generated from a parametric model with known parameters.

3.2 Data-generating model

The data-generating model was a two-level random intercept model:

$$Y_{ij} = \gamma_{10} (X_{ij} - \bar{X}_{\cdot j}) + \gamma_{01} \bar{X}_{\cdot j} + \gamma_{02} W_j + u_{0j} + e_{ij} \quad (3.1)$$

The random effects are normally distributed with

$$u_{0j} \sim N(0, \psi^2)$$

and

$$e_{ij} \sim N(0, \sigma^2)$$

and independent of each other. Y_{ij} , X_{ij} , W_j are z-standardized variables, which means that they have a mean of zero and a variance of 1. First,

3.3 Missing data generation

3.4 Factors and simulation conditions

3.4.1 Constants

3.4.2 Level-2 sample size

As the small-sample performance of the methods is of interest, three different group sizes are used: - N2 = 15 - N2 = 30 - N2 = 60 These sizes are chosen to reflect McNeish (2017) (2017) summary, that group sizes below 25 almost certainly face issues and below 50 there is a susceptibility to small sample biases. These ranges should therefore cover problematic, likely problematic and not problematic level-2 sample sizes. ### Effect size of the group-level effect { 01} The effect size of the group-level effect of X is varied between 0.0 and 0.30. This is to investigate the performance both with a null effect of the parameter of interest as well as a substantive effect.

3.4.3 ICC of X and residual Y

3.4.4 Missing data mechanism

Missing data mechanism is set to either MCAR or MAR. For MAR, the strength of relationship between W and missing of X is set to 0.4, which corresponds to $0.4^2 \%$ 100% explanation of variance in missingness through W.

3.5 Methods of missing data handling

3.5.1 Estimands

3.5.2 Performance measures

3.6 Execution of simulation

Chapter 4

Results

Chapter 5

Discussion

References

- McNeish, D. (2017). Small Sample Methods for Multilevel Modeling: A Colloquial Elucidation of REML and the Kenward-Roger Correction. *Multivariate Behavioral Research*, 52(5), 661–670. <https://doi.org/10.1080/00273171.2017.1344538>