Abstract Title Page
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Title: A simple effect size estimator for single case designs using WinBUGS

Authors and Affiliations:

David Rindskopf
Educational Psychology
CUNY Graduate Center
365 Fifth Avenue
New York, NY 10016
drindskopf@gc.cuny.edu

William Shadish
University of California, Merced
School of Social Sciences, Humanities and Arts
5200 N. Lake Rd
Merced CA 95343
209-228-4372
wshadish@ucmerced.edu

Larry Hedges
Institute for Policy Research
Northwestern University
2040 N. Sheridan Road
Evanston, IL 60208
Telephone: (847) 491-8899
FAX: (847) 467-2459
l-hedges@northwestern.edu

Abstract Body
Limit 4 pages single-spaced.

Background / Context:
Description of prior research and its intellectual context.

Data from single case designs (SCDs) have traditionally been analyzed by visual inspection rather than statistical models. As a consequence, effect sizes have been of little interest. Lately, some effect-size estimators have been proposed, but most are either (i) nonparametric, and/or (ii) based on an analogy incompatible with effect sizes from group-based studies.

Purpose / Objective / Research Question / Focus of Study:
Description of the focus of the research.

As part of a research program conducted by Shadish, Hedges, and Rindskopf, this paper reports a beginning step to fill the gap between effect sizes in SCDs and in group-based designs. When, as is typically the case, an SCD involves multiple participants, it is possible to use variation among participants as a denominator in an effect size measure, as is done in between-group research. A simple estimator of this type can easily be implemented using WinBUGS, a Bayesian program that has extreme flexibility.

Setting:
Description of the research location.
(May not be applicable for Methods submissions)

 (Not applicable)

Population / Participants / Subjects:
Description of the participants in the study: who, how many, key features, or characteristics.
(May not be applicable for Methods submissions)

(Not applicable)

Intervention / Program / Practice:
Description of the intervention, program, or practice, including details of administration and duration.
(May not be applicable for Methods submissions)

(Not applicable)

Significance / Novelty of study:
Description of what is missing in previous work and the contribution the study makes.

As far as we know, there is no previous work that is comparable. Other approaches to this problem have used within-subject variation as the denominator in computing effect sizes.

Statistical, Measurement, or Econometric Model:
Description of the proposed new methods or novel applications of existing methods.

It is becoming well-known that when an SCD involves at least a small group of participants, multilevel models provide a useful statistical framework for the analysis of data. Overviews of this include several papers by van den Noortgate and Onghena (2003a, 2003b, 2007, 2008). One problem with the usual methods of estimation (e.g SAS MIXED, HLM, SPSS Mixed) is that they rely on large samples in order for the estimates to have good statistical properties. Fully Bayesian (as opposed to empirical Bayesian) methods do not have this limitation, and are more appropriate for most SCDs. The WinBUGS software (Spiegelhalter et al., 2002) will easily fit these models using fully Bayesian estimation, through the Markov Chain Monte Carlo (MCMC) sampling procedure.

In addition to being fully Bayesian, WinBUGS has enough programming facilities that we can write code to calculate an effect size estimate, and, just as importantly, to estimate its standard error. This will make it possible for SCD researchers to have their results included in meta-analyses and other quantitative research syntheses. As a practical issue, the lack of this capability has prevented SCD results from being included in most What Works Clearinghouse (WWC) reports.

Usefulness / Applicability of Method:
Demonstration of the usefulness of the proposed methods using hypothetical or real data.

The paper includes an example from a published SCD research study, with WinBUGS code.

Research Design:
Description of the research design (e.g., qualitative case study, quasi-experimental design, secondary analysis, analytic essay, randomized field trial).
(May not be applicable for Methods submissions)

(not applicable)

Data Collection and Analysis:
Description of the methods for collecting and analyzing data.
(May not be applicable for Methods submissions)

(not applicable)

Findings / Results:
Description of the main findings with specific details.
(May not be applicable for Methods submissions)

(not applicable).

Conclusions:
Description of conclusions, recommendations, and limitations based on findings.

These methods should be useful for SCD researchers who wish to have their results included in research syntheses. We intend to extend the method in several ways, including adding an autocorrelation to account for serial dependency.

Appendices
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Appendix A. References
References are to be in APA version 6 format.

Spiegelhalter, D., Thomas, A., Best, N., and Lunn, D. (2002). *WinBUGS User Manual Version 1.4*, Cambridge, UK: MRC Biostatistics Unit

Van den Noortgate, W. & Onghena, P. (2003a). Combining single-case experimental data using hierarchical linear models. School Psychology Quarterly, 18(3), 325-346.

Van den Noortgate, W. & Onghena, P. (2003b). Hierarchical linear models for the quantitative integration of effects sizes in single-case research. Behavior Research Methods, Instruments, & Computers, 35(1), 1-10.

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