Introduction to the Online Variance Almanac

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Opening Remarks
Question and Answer
What is the Variance Almanac?

• The variance almanac is a compendium of information useful for designing educational evaluation studies

• The information is about design parameters that researchers must know to create evaluation designs that have adequate statistical power and precision to detect effects

• These design parameters include
  – Between/within school variance decomposition (measured by the intraclass correlation or ICC)
  – Effectiveness of covariates at explaining variation (measured by the $R^2$ values at student and school level)
Why Do We Need a Variance Almanac?

• In designs that use **simple random samples**, precision and statistical power depend on
  – Level of statistical significance required
  – Total sample size
  – Effectiveness of covariates in explaining outcome variation

• A bigger sample size is always better

• Unfortunately, simple random samples are rare in education

• Many of our samples use two stage cluster samples:

  *We sample clusters (schools or classrooms) first, then sample students within clusters*
Why Do We Need a Variance Almanac?

• In designs that use two-stage cluster sampling, statistical power and precision depend on:
  – Level of statistical significance required
  – The sample size at each level (e.g., schools/students)
  – Effectiveness of covariates in explaining outcome variation at each level (e.g., schools/students)
  – The school/student variance decomposition

• A bigger total sample size is not always better
Why Do We Need a Variance Almanac?

- In designs that use two-stage cluster sampling, statistical power and precision depend on:
  - Level of statistical significance required
  - The sample size \textit{at each level} (e.g., schools/students)
  - Effectiveness of covariates in explaining outcome variation \textit{at each level} (e.g., schools/students)
  - The school/student variance decomposition

- A bigger total sample size is \textit{not} always better
Why Do We Need a Variance Almanac?

• The variance almanac is designed to provide a database of empirical information about:
  – The school/student variance decomposition (in the form of intraclass correlations)
  – The effectiveness of covariates at explaining outcome variation at school and student levels

• The information comes from national surveys with representative (probability) samples
Objectives for this Webinar

1. Provide an introduction to using the online variance almanac resource
2. Provide an introduction to power analysis macros in STATA that we have developed
3. Demonstrate the use of these power analysis macros with information from the variance almanac to compute statistical power for studies that assign groups (schools) to treatments
The Online Variance Almanac (Web VA)

• Compendium of thousands of intraclass correlations and $R^2$ values based on national probability samples

• Kindergarten through 12$^{th}$ grade in U.S. schools

• Reading and mathematics achievement
The Samples

• The Early Childhood Longitudinal Program (ECLS) (http://nces.ed.gov/ecls/)
• The Longitudinal Study of American Youth (LSAY) (http://lsay.msu.edu/)
• The National Education Longitudinal Study (NELS) (http://nces.ed.gov/surveys/nels88/)
Analysis

• Our analyses considered many aspects of possible research designs
  – Achievement domain
  – Geographic subgroups
  – School subsamples
  – Different covariates
Achievement Domain

• Mathematics achievement
• Reading achievement
## Geographic Subgroups

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<th>Urbanicity</th>
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School Subsample

• All schools
• Low achieving schools
• Low SES schools
Different Covariates

• Group centered student level variables
• Group mean school level variables
• 4 models
  – None (unconditional model)
  – Pretest covariates model
  – Demographic covariates model
  – Pretest and Demographic covariates model
## Data source and grade

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* Math only
Using the Web VA

• Go to: https://arc.uchicago.edu/reese/variance-almanac-academic-achievement

• Next: a live demonstration
Question and Answer
Experiments that assign intact groups to treatment conditions are increasingly common in social research. In educational research, the groups assigned are often schools. The design of group-randomized experiments requires knowledge of the intraclass correlation structure to compute statistical power and sample sizes required to achieve adequate power. This article provides a compilation of intraclass correlation values of academic achievement and related covariate effects that could be used for planning group-randomized experiments in education. It also provides variance component information that is useful in planning experiments involving covariates. The use of these values to compute the statistical power of group-randomized experiments is illustrated.


Experiments that assign intact groups to treatment conditions are increasingly common in educational research. The design of group-randomized experiments requires knowledge of the intraclass correlation structure to compute statistical power and to determine the sample sizes required to achieve adequate power. The intraclass correlation structure of academic achievement is shown to be somewhat different in rural schools than in all schools in the nation. This article provides a compilation of intraclass correlation values of academic achievement and related covariate effects that could be used for planning group randomized experiments in rural schools. The use of these values to compute statistical power of group randomized experiments involving rural schools is illustrated.

Finding the *Web VA*

- Go to [https://arc.uchicago.edu/reese/variance-almanac-academic-achievement](https://arc.uchicago.edu/reese/variance-almanac-academic-achievement)
- Google “ARC Variance Almanac”
Center for Advancing Research and Communication in Science, Technology, Engineering, and Mathematics (ARC)

https://arc.uchicago.edu

NORC at the University of Chicago