ASSESSING ATTRITION BIAS – ADDENDUM

A. INTRODUCTION

This document serves as an addendum to the existing attrition white paper ("Assessing Attrition Bias" version 2.1) previously used for the WWC Procedures and Standards Handbook, version 2.1. This document does not recommend any substantive changes to the version 2.1 attrition bounds. Instead, this addendum presents additional empirical information and sensitivity analyses to support the existing attrition bounds.

B. IDENTIFYING MODEL PARAMETERS USING AN ADDITIONAL STUDY

The "Assessing Attrition Bias" white paper used data from three large-scale randomized trials conducted by Mathematica Policy Research for IES. These studies examined outcomes, intervention, and populations relevant to the WWC and were thus seen as good sources from which to identify empirical model parameters to inform the attrition standard:

- Evaluation of the 21st Century Community Learning Centers

- Evaluation of Education Technologies in Reading and Mathematics[1]

- Evaluation of Supplemental Reading Comprehension Interventions

For this supplement, we also examined data from a fourth study to incorporate additional data into the empirical investigation to improve the generalizability of the attrition standard:

- Evaluation of Teachers Trained Through Different Routes to Certification[2]

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[1] This study had distinct interventions that were implemented in grades 1, 4, 6, and 9, with random assignment occurring separately by grade level. Therefore, we calculated parameter values separately by grade level in this study.

Table A.1 presents the empirical values of key quantities described in the attrition white paper. For both the treatment and control conditions, this table presents information on study response rates (P_t and P_c), respondent-nonrespondent differences in baseline scores (Δ_t and Δ_c), and the correlation coefficients between an individual's propensity to respond and his or her baseline test score (α_t and α_c). For the original three studies (excluding the new Teacher Certification Routes study), the values are identical with those shown in Table 2 in the attrition white paper. The following text summarizes the empirical values observed after including the Teacher Certification Routes results, noting where summary statistics differed from the information in the original analysis.

TABLE A.1. RESPONSE RATES, RESPONDENT–NONRESPONDENT DIFFERENCES IN BASELINE TEST SCORES, AND IMPLIED CORRELATIONS BETWEEN TEST SCORES AND THE PROPENSITY TO RESPOND FROM FOUR RANDOMIZED TRIALS

Evaluation	Treatment Group			Control Group		
	P_t	Δ_t	Implied α_t	P_c	Δ_c	Implied α_c
21st Century	0.81	0.02	0.01	0.83	0.10	0.06
Education Technology						
1st Grade	0.91	0.46	0.23	0.90	0.35	0.18
4th Grade	0.87	0.40	0.21	0.90	0.51	0.26
6th Grade	0.88	0.54	0.28	0.90	0.44	0.23
9th Grade	0.80	0.18	0.10	0.76	0.28	0.16
Reading Comprehension	0.89	0.31	0.16	0.88	0.32	0.17
Teacher Certification Routes						
Vocabulary	0.90	0.20	0.10	0.91	-0.14	-0.07
Math	0.90	0.16	0.08	0.91	-0.04	-0.02

(continued)

[2] This study allowed for an estimation of model parameters for two outcomes (Vocabulary and Mathematics). Therefore, we calculated parameter values separately for each outcome.

Across these studies, the higher value in each pair of α's ranges from 0.06 to 0.28, with a mean of 0.17 (the mean was 0.19 before adding the new estimates). In addition, the difference between the higher and lower value of α ranges from 0.01 to 0.17, with a mean of 0.07 (the mean was 0.05 before adding the new estimates).
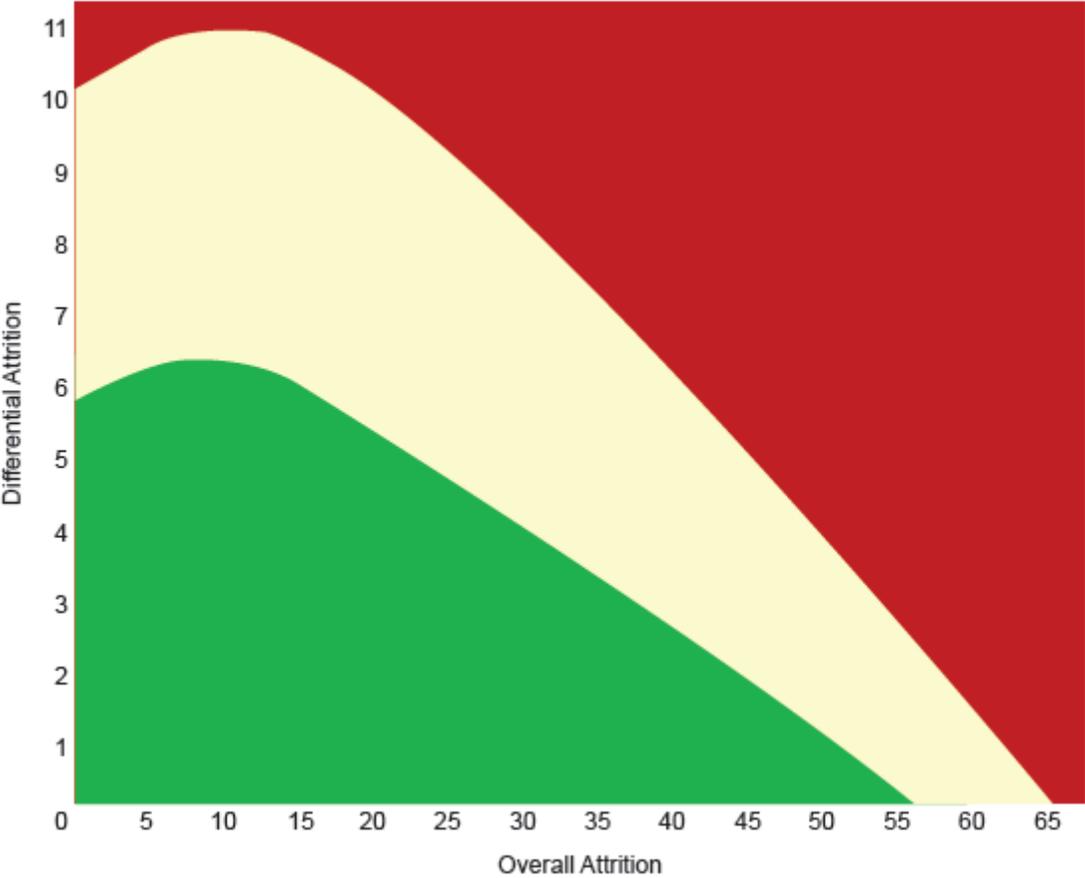
Of the various sets of assumptions for α_t and α_c presented in Table 1 of the attrition white paper, the assumptions in the first column of Table 1 ($\alpha_t = 0.27$ and $\alpha_c = 0.22$) still appear consistent with the empirical estimates of α.

C. SENSITIVITY OF THE RESULTS TO ALTERNATE VALUES OF KEY PARAMETERS

In this section, we examine the sensitivity of expected bias at the attrition boundaries shown in Figure 1 of the attrition white paper to variation in values for α_t and α_c. The purpose of this analysis is to assess the implications of errors in selecting values for these parameters. If small differences in these parameter values lead to substantial differences in expected bias at the boundary, then potentially costly efforts to develop better parameter estimates may be warranted. However, if these differences are not substantial, then the costs of adopting new boundaries may exceed the benefit.

In this analysis, we hold the attrition boundaries fixed at the locations shown in Figure A.1 below (that is, the existing attrition standard) and then calculate the average bias across all points along a boundary, given alternative values for α_t and α_c. Table A.2 shows the expected bias at the liberal attrition boundary (the boundary between the red and yellow regions in Figure A.1) and Table A.3 shows the expected bias at the conservative boundary (the boundary between the yellow and green regions in Figure A.1).

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FIGURE A.1. TRADEOFFS BETWEEN OVERALL AND DIFFERENTIAL ATTRITION

We note two findings from Tables A.2 and A.3. First, the *difference* between α_t and α_c is much more important than the *level* of α_t and α_c. This can be seen in both tables as bias increases faster moving vertically down the table than it does moving horizontally across the table. Second, within the range of the previously described empirical estimates of these correlations (indicated by the shaded cells in both tables), bias never exceeds 0.08 standard deviations at the conservative boundary and never exceeds 0.11 standard deviations at the liberal boundary. Outside of the empirical range, bias can be noticeably higher.

TABLE A.2. SENSITIVITY OF EXPECTED BIAS AT THE <u>LIBERAL</u> ATTRITION

BOUNDARY WITH RESPECT TO ATTRITION MODEL PARAMETER VALUES

Difference in Correlation Between Treatment and Control Groups	Overall Correlation Between Outcomes and Attrition				
	0.1	0.2	0.3	0.4	0.5
0.05	0.04	0.05	0.05	0.06	0.07
0.10	0.06	0.07	0.08	0.09	0.10
0.15	0.09	0.10	0.11	0.12	0.13
0.20	0.12	0.13	0.13	0.14	0.15
0.25	0.14	0.15	0.16	0.17	0.18

Note: Shaded cells correspond to the range of correlations estimated using data from past studies.

TABLE A.3. SENSITIVITY OF EXPECTED BIAS AT THE <u>CONSERVATIVE</u> ATTRITION BOUNDARY WITH RESPECT TO ATTRITION MODEL PARAMETER VALUES

Difference in Correlation Between Treatment and Control Groups	Overall Correlation Between Outcomes and Attrition				
	0.1	0.2	0.3	0.4	0.5
0.05	0.03	0.03	0.04	0.04	0.05
0.10	0.05	0.06	0.06	0.07	0.07
0.15	0.07	0.08	0.08	0.09	0.10
0.20	0.10	0.10	0.11	0.11	0.12
0.25	0.12	0.12	0.13	0.14	0.14

Note: Shaded cells correspond to the range of correlations estimated using data from past studies.

Because the attrition standard is expected to guard against bias in excess of 0.05 standard deviations, it is important that the current attrition standard maintain this tolerance in most studies. Given that in six of the eight empirical estimates, the difference in the correlation between the treatment and control groups was 0.06 or less (shown in Table A.1), it appears that the first row of Tables A.2 and A.3 may be the most appropriate lens on which to focus the appropriateness of the current standard. And given that in all of the shaded cells in those rows, the expected bias is less than or equal to 0.05 standard deviations, the current attrition standards appear to be appropriate and robust. As a result, the WWC recommends that the existing attrition standards continue to be used under version 3.0 of the Procedures and Standards Handbook.