

Six Alternative Methods of Use of Employee Selection Test Data

By Joel P. Wiesen, Ph.D. & Aaron A. Brown*
Applied Personnel Research
Newton, MA

APA Convention
August 14, 2008

* Enrolled at New York University as of Fall, 2008

Summary

We demonstrate 4 novel approaches to using test data in an attempt to achieve lower adverse impact (AI) while maintaining validity in hiring employees.

Method

We used a multivariate Monte Carlo simulation to evaluate these approaches (novel approaches listed first):

- ! Greatest Strength Method
- ! Drop the Lowest Score Method
- ! Composite Without the Written Test
- ! Two Greatest Strengths
- ! Equally Weighted Composite
- ! M/C Cognitive Ability Test (control)
- ! Random Selection (control)

Tests Simulated

- ! M/C Cognitive Ability Test
- ! Structured Oral Interview
- ! Physical Performance Test
- ! Personality Test
(Conscientiousness)

Independent Variables

- ! Selection Ratio
- ! Proportion of Minorities
- ! Sample Size (number of applicants)

Dependent Variables

- ! Adverse Impact EEO (AI EEO)
- ! Adverse Impact Gender (AI Gender)
- ! Validity

Results

- ! The AI and validity varied greatly across the several methods of using test grades in all applicant group sizes.
- ! The Written Cognitive Ability test had an AI EEO and AI Gender of .13 and .97, respectively, with an applicant group size of 1,000,000 and a .01 selection ratio.
- ! The Composite had AI of .32 and .21 for EEO and Gender.
- ! The Greatest Strength Method had AI of .55 and .62
- ! The Drop the Lowest Score Method had AI of .31 and .41.

Discussion

- ! The four innovative approaches all have validity greater than or equal to the Cognitive Ability Test.
- ! The Greatest Strength Method has the least simultaneous AI EEO and AI Gender.
- ! The Composite has the highest validity (.70), followed by the Drop the Lowest Score Method (.67).
- ! With very small selection ratios and very low proportions of minority applicants the results for any one applicant group may be expected to vary considerably from the mean.

| Table 1. Specified Intercorrelations for Firefighter Selection Test and Criterion Data* | | | | | | |
|--|------|-----|-------------------|--------|-----------|-----------------|
| | Oral | PPT | Conscientiousness | Gender | EEO Group | Job Performance |
| M/C Cognitive | .31 | 0 | .03 | 0 | 0 | .51 |
| Oral | | 0 | 0 | 0 | 0 | .48 |
| PPT | | | 0 | 0 | 0 | .35 |
| Conscientiousness | | | | 0 | 0 | .22 |
| Gender | | | | | 0 | 0 |
| EEO Group | | | | | | 0 |

* Values were taken from Potosky, Bobko, and Roth (2005), Table 1, p. 308.

| Table 2. Constants Used to Create Specified Mean Group Differences, in z-Scores | | | | | |
|--|---------------|----------------------|-------|-------------------|-----------------|
| | M/C Cognitive | Structured Interview | PPT | Conscientiousness | Job Performance |
| Women | 0 | 0 | -1.25 | 0 | 0 |
| Minorities | -.72* | -.31* | 0 | .07** | -0.27 *** |

* Potosky, Bobko, Roth, 2005, Table 1, p. 308)

** Foldes, In Press, Table 2, p. 50

*** Roth, Huffcutt, and Bobko, 2003, Table 2, p. 699; and McKay and McDaniel, 2006, Table 2, p. 544

| Table 3. Adverse Impact Appointments by Seven Methods of Using Test Grades* | | | | | | | | | | | | | | |
|--|---------------|--------|-----------|--------|---------------------------------|--------|-------------------|--------|------------------------|--------|-------------------|--------|------------------|--------|
| S.R. | M/C Cognitive | | Composite | | Composite Without M/C Cognitive | | Greatest Strength | | Two Greatest Strengths | | Drop Lowest Score | | Random Selection | |
| | EEO | Gender | EEO | Gender | EE O | Gender | EEO | Gender | EE O | Gender | EEO | Gender | EEO | Gender |
| 0.01 | 0.13 | 0.97 | 0.32 | 0.21 | 0.70 | 0.13 | 0.55 | 0.62 | 0.33 | 0.54 | 0.31 | 0.41 | 1.09 | 1.01 |
| 0.2 | 0.35 | 1.00 | 0.55 | 0.45 | 0.83 | 0.35 | 0.66 | 0.64 | 0.59 | 0.59 | 0.56 | 0.54 | 1.00 | 1.00 |
| All Passers | 0.88 | 1.00 | 0.92 | 0.90 | 0.98 | 0.88 | 0.86 | 0.83 | 0.86 | 0.83 | 0.86 | 0.83 | 1.00 | 1.00 |

Note: S.R. = selection ratio

* With 1,000,000 applicants and proportion of minorities = .5

| Table 4. Validity in Appointments for Seven Methods of Using Test Grades* | | | | | | |
|--|-----------|---------------------------------|-------------------|------------------------|-------------------|------------------|
| M/C Cognitive | Composite | Composite Without M/C Cognitive | Greatest Strength | Two Greatest Strengths | Drop Lowest Score | Random Selection |
| 0.52 | 0.70 | 0.57 | 0.50 | 0.61 | 0.67 | 0.00 |

* With 1,000,000 applicants and proportion of minorities = .5

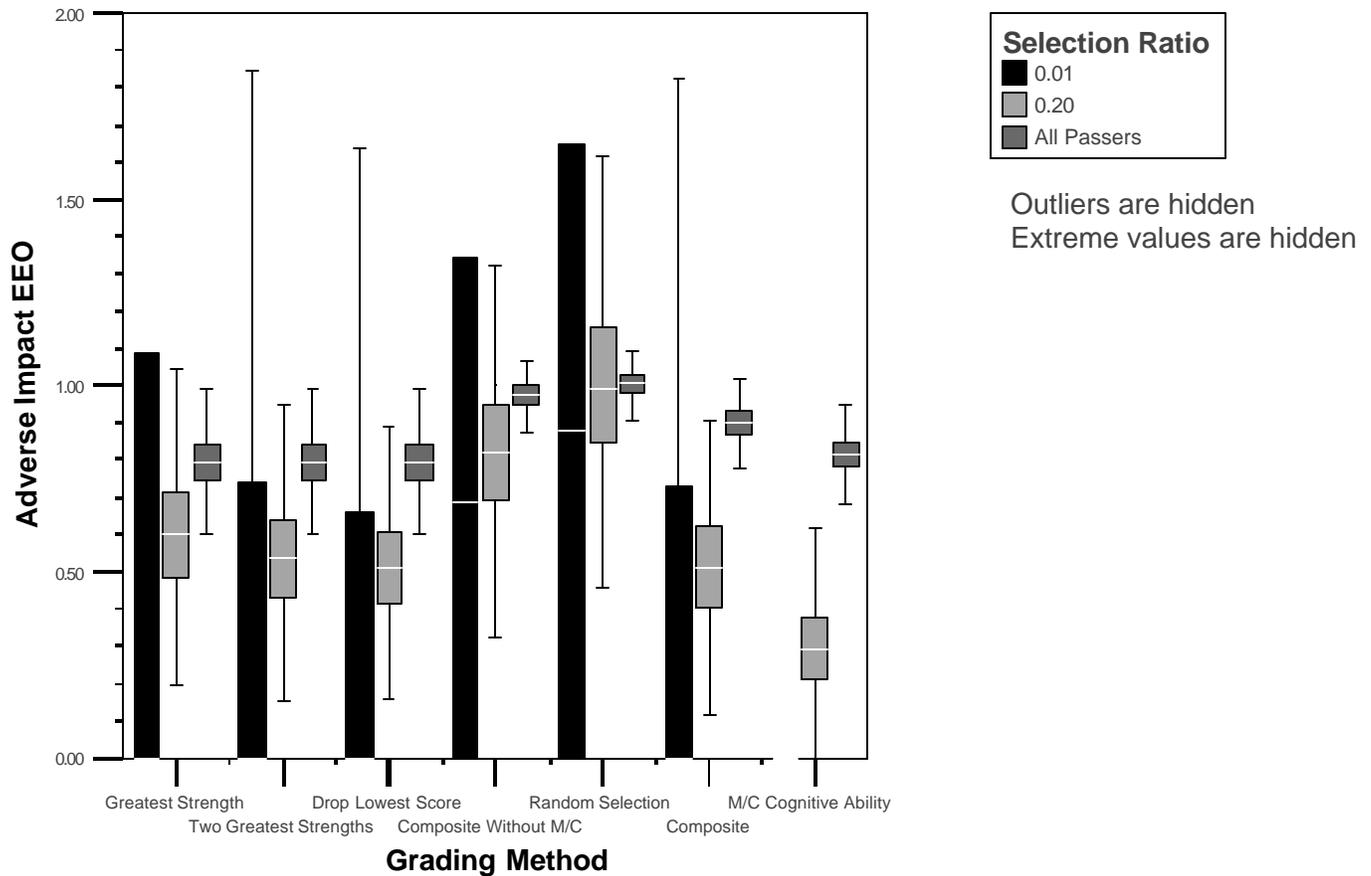
TABLE 5. Validity and Adverse Impact by EEO, Gender, Selection Ratio, Proportion of Minorities, and Grading Method

Number of Applicants = 1,000

| Grading Method | | M/C Cognitive Ability | | | Composite | | | Composite Without M/C | | | Greatest Strength | | | Two Greatest Strengths | | | Drop Lowest Score | | | Random Selection | | | |
|-----------------|--------------------------|-----------------------|--------------------|-----------------------|-----------|--------------------|-----------------------|-----------------------|--------------------|-----------------------|-------------------|--------------------|-----------------------|------------------------|--------------------|-----------------------|-------------------|--------------------|-----------------------|------------------|--------------------|-----------------------|------|
| Selection Ratio | Proportion of Minorities | Validity | Adverse Impact EEO | Adverse Impact Gender | Validity | Adverse Impact EEO | Adverse Impact Gender | Validity | Adverse Impact EEO | Adverse Impact Gender | Validity | Adverse Impact EEO | Adverse Impact Gender | Validity | Adverse Impact EEO | Adverse Impact Gender | Validity | Adverse Impact EEO | Adverse Impact Gender | Validity | Adverse Impact EEO | Adverse Impact Gender | |
| 0.01 | 0.1 Mean | 0.51 | 0.14 | 1.28 | 0.70 | 0.37 | 0.23 | 0.57 | 0.85 | 0.15 | 0.52 | 0.63 | 0.79 | 0.62 | 0.39 | 0.73 | 0.67 | 0.35 | 0.53 | 0.00 | 1.16 | 1.22 | |
| | N | 750 | 750 | 747 | 750 | 750 | 750 | 750 | 750 | 750 | 750 | 750 | 747 | 750 | 750 | 749 | 750 | 750 | 750 | 750 | 750 | 750 | 749 |
| | Std. Dev. | 0.02 | 0.42 | 1.06 | 0.02 | 0.70 | 0.22 | 0.02 | 1.08 | 0.15 | 0.02 | 0.99 | 0.63 | 0.02 | 0.77 | 0.65 | 0.02 | 0.67 | 0.48 | 0.03 | 1.47 | 0.91 | |
| | 0.5 Mean | 0.52 | 0.16 | 1.33 | 0.70 | 0.37 | 0.26 | 0.57 | 0.88 | 0.15 | 0.50 | 0.66 | 0.77 | 0.61 | 0.38 | 0.67 | 0.67 | 0.36 | 0.50 | 0.00 | 1.43 | 1.26 | |
| | N | 750 | 750 | 743 | 750 | 750 | 750 | 750 | 749 | 750 | 750 | 749 | 746 | 750 | 750 | 750 | 750 | 750 | 750 | 748 | 750 | 746 | 747 |
| | Std. Dev. | 0.02 | 0.21 | 1.23 | 0.02 | 0.33 | 0.33 | 0.02 | 0.74 | 0.18 | 0.02 | 0.54 | 0.71 | 0.02 | 0.35 | 0.71 | 0.02 | 0.31 | 0.62 | 0.03 | 1.24 | 1.06 | |
| | Mean | 0.52 | 0.15 | 1.30 | 0.70 | 0.37 | 0.24 | 0.57 | 0.87 | 0.15 | 0.51 | 0.64 | 0.78 | 0.61 | 0.38 | 0.70 | 0.67 | 0.36 | 0.51 | 0.00 | 1.30 | 1.24 | |
| | N | 1500 | 1500 | 1490 | 1500 | 1500 | 1500 | 1500 | 1499 | 1500 | 1500 | 1499 | 1493 | 1500 | 1500 | 1499 | 1500 | 1500 | 1500 | 1498 | 1500 | 1496 | 1496 |
| | Std. Dev. | 0.02 | 0.33 | 1.15 | 0.02 | 0.55 | 0.28 | 0.02 | 0.93 | 0.16 | 0.03 | 0.80 | 0.67 | 0.02 | 0.60 | 0.68 | 0.02 | 0.52 | 0.55 | 0.03 | 1.36 | 0.99 | |
| 0.2 | 0.1 Mean | 0.51 | 0.30 | 1.01 | 0.70 | 0.52 | 0.44 | 0.57 | 0.83 | 0.36 | 0.52 | 0.60 | 0.67 | 0.62 | 0.54 | 0.62 | 0.67 | 0.52 | 0.56 | 0.00 | 1.01 | 1.01 | |
| | N | 750 | 750 | 750 | 750 | 750 | 750 | 750 | 750 | 750 | 750 | 750 | 750 | 750 | 750 | 750 | 750 | 750 | 750 | 750 | 750 | 750 | |
| | Std. Dev. | 0.02 | 0.12 | 0.13 | 0.02 | 0.16 | 0.07 | 0.02 | 0.20 | 0.06 | 0.02 | 0.18 | 0.10 | 0.02 | 0.17 | 0.09 | 0.02 | 0.15 | 0.08 | 0.03 | 0.23 | 0.15 | |
| | 0.5 Mean | 0.52 | 0.36 | 1.00 | 0.70 | 0.55 | 0.45 | 0.57 | 0.84 | 0.36 | 0.50 | 0.66 | 0.65 | 0.61 | 0.60 | 0.59 | 0.67 | 0.57 | 0.54 | 0.00 | 1.01 | 1.01 | |
| | N | 750 | 750 | 750 | 750 | 750 | 750 | 750 | 750 | 750 | 750 | 750 | 750 | 750 | 750 | 750 | 750 | 750 | 750 | 750 | 750 | 750 | |
| | Std. Dev. | 0.02 | 0.05 | 0.14 | 0.02 | 0.08 | 0.07 | 0.02 | 0.11 | 0.06 | 0.02 | 0.10 | 0.10 | 0.02 | 0.08 | 0.09 | 0.02 | 0.08 | 0.08 | 0.03 | 0.12 | 0.14 | |
| | Mean | 0.52 | 0.33 | 1.01 | 0.70 | 0.53 | 0.45 | 0.57 | 0.83 | 0.36 | 0.51 | 0.63 | 0.66 | 0.61 | 0.57 | 0.60 | 0.67 | 0.54 | 0.55 | 0.00 | 1.01 | 1.01 | |
| | N | 1500 | 1500 | 1500 | 1500 | 1500 | 1500 | 1500 | 1500 | 1500 | 1500 | 1500 | 1500 | 1500 | 1500 | 1500 | 1500 | 1500 | 1500 | 1500 | 1500 | 1500 | |
| | Std. Dev. | 0.02 | 0.09 | 0.13 | 0.02 | 0.12 | 0.07 | 0.02 | 0.16 | 0.06 | 0.03 | 0.15 | 0.10 | 0.02 | 0.13 | 0.09 | 0.02 | 0.12 | 0.08 | 0.03 | 0.18 | 0.15 | |
| All Passers | 0.1 Mean | 0.51 | 0.82 | 1.00 | 0.70 | 0.90 | 0.90 | 0.57 | 0.97 | 0.88 | 0.52 | 0.79 | 0.83 | 0.62 | 0.79 | 0.83 | 0.67 | 0.79 | 0.83 | 0.00 | 1.00 | 1.00 | |
| | N | 750 | 750 | 750 | 750 | 750 | 750 | 750 | 750 | 750 | 750 | 750 | 750 | 750 | 750 | 750 | 750 | 750 | 750 | 750 | 750 | 750 | |
| | Std. Dev. | 0.02 | 0.05 | 0.07 | 0.02 | 0.04 | 0.06 | 0.02 | 0.04 | 0.06 | 0.02 | 0.07 | 0.07 | 0.02 | 0.07 | 0.07 | 0.02 | 0.07 | 0.07 | 0.03 | 0.04 | 0.07 | |
| | 0.5 Mean | 0.52 | 0.88 | 1.00 | 0.70 | 0.92 | 0.90 | 0.57 | 0.98 | 0.88 | 0.50 | 0.86 | 0.83 | 0.61 | 0.86 | 0.83 | 0.67 | 0.86 | 0.83 | 0.00 | 1.00 | 1.00 | |
| | N | 750 | 750 | 750 | 750 | 750 | 750 | 750 | 750 | 750 | 750 | 750 | 750 | 750 | 750 | 750 | 750 | 750 | 750 | 750 | 750 | 750 | |
| | Std. Dev. | 0.02 | 0.02 | 0.07 | 0.02 | 0.02 | 0.06 | 0.02 | 0.02 | 0.06 | 0.02 | 0.04 | 0.07 | 0.02 | 0.04 | 0.07 | 0.02 | 0.04 | 0.07 | 0.03 | 0.02 | 0.07 | |
| | Mean | 0.52 | 0.85 | 1.00 | 0.70 | 0.91 | 0.90 | 0.57 | 0.97 | 0.88 | 0.51 | 0.82 | 0.83 | 0.61 | 0.82 | 0.83 | 0.67 | 0.82 | 0.83 | 0.00 | 1.00 | 1.00 | |
| | N | 1500 | 1500 | 1500 | 1500 | 1500 | 1500 | 1500 | 1500 | 1500 | 1500 | 1500 | 1500 | 1500 | 1500 | 1500 | 1500 | 1500 | 1500 | 1500 | 1500 | 1500 | |
| | Std. Dev. | 0.02 | 0.05 | 0.07 | 0.02 | 0.04 | 0.06 | 0.02 | 0.03 | 0.06 | 0.03 | 0.07 | 0.07 | 0.02 | 0.07 | 0.07 | 0.02 | 0.07 | 0.07 | 0.03 | 0.03 | 0.07 | |
| Total | 0.1 Mean | 0.51 | 0.42 | 1.10 | 0.70 | 0.60 | 0.53 | 0.57 | 0.88 | 0.46 | 0.52 | 0.67 | 0.76 | 0.62 | 0.57 | 0.72 | 0.67 | 0.55 | 0.64 | 0.00 | 1.06 | 1.08 | |
| | N | 2250 | 2250 | 2247 | 2250 | 2250 | 2250 | 2250 | 2250 | 2250 | 2250 | 2247 | 2250 | 2250 | 2249 | 2250 | 2250 | 2250 | 2250 | 2250 | 2250 | 2249 | |
| | Std. Dev. | 0.02 | 0.38 | 0.63 | 0.02 | 0.47 | 0.31 | 0.02 | 0.64 | 0.32 | 0.02 | 0.59 | 0.38 | 0.02 | 0.49 | 0.39 | 0.02 | 0.44 | 0.31 | 0.03 | 0.86 | 0.54 | |
| | 0.5 Mean | 0.52 | 0.46 | 1.11 | 0.70 | 0.61 | 0.54 | 0.57 | 0.90 | 0.46 | 0.50 | 0.73 | 0.75 | 0.61 | 0.61 | 0.70 | 0.67 | 0.59 | 0.62 | 0.00 | 1.14 | 1.09 | |
| | N | 2250 | 2250 | 2243 | 2250 | 2250 | 2250 | 2250 | 2249 | 2250 | 2250 | 2249 | 2246 | 2250 | 2250 | 2250 | 2250 | 2250 | 2248 | 2250 | 2246 | 2247 | |
| | Std. Dev. | 0.02 | 0.33 | 0.73 | 0.02 | 0.30 | 0.33 | 0.02 | 0.44 | 0.33 | 0.02 | 0.33 | 0.42 | 0.02 | 0.29 | 0.43 | 0.02 | 0.28 | 0.39 | 0.03 | 0.74 | 0.63 | |
| | Mean | 0.52 | 0.44 | 1.10 | 0.70 | 0.60 | 0.53 | 0.57 | 0.89 | 0.46 | 0.51 | 0.70 | 0.76 | 0.61 | 0.59 | 0.71 | 0.67 | 0.57 | 0.63 | 0.00 | 1.10 | 1.08 | |
| | N | 4500 | 4500 | 4490 | 4500 | 4500 | 4500 | 4500 | 4499 | 4500 | 4500 | 4499 | 4493 | 4500 | 4500 | 4499 | 4500 | 4500 | 4498 | 4500 | 4496 | 4496 | |
| | Std. Dev. | 0.02 | 0.36 | 0.68 | 0.02 | 0.40 | 0.32 | 0.02 | 0.55 | 0.33 | 0.03 | 0.48 | 0.40 | 0.02 | 0.40 | 0.41 | 0.02 | 0.37 | 0.35 | 0.03 | 0.80 | 0.59 | |

Figure 1. Adverse Impact EEO by Grading Method

Proportion of Minorities = .1, Applicant Group Size = 1000, Number of Replications = 750



Highlights (Adverse Impact EEO, Proportion of Minorities = .1, Applicant Group Size = 1000)

Least impact for Random and Composite Without Written

Most impact for Written

Very high variance in adverse impact occurs with a selection ratio of .01, especially when the applicant group size or proportion of minorities are also smaller values.

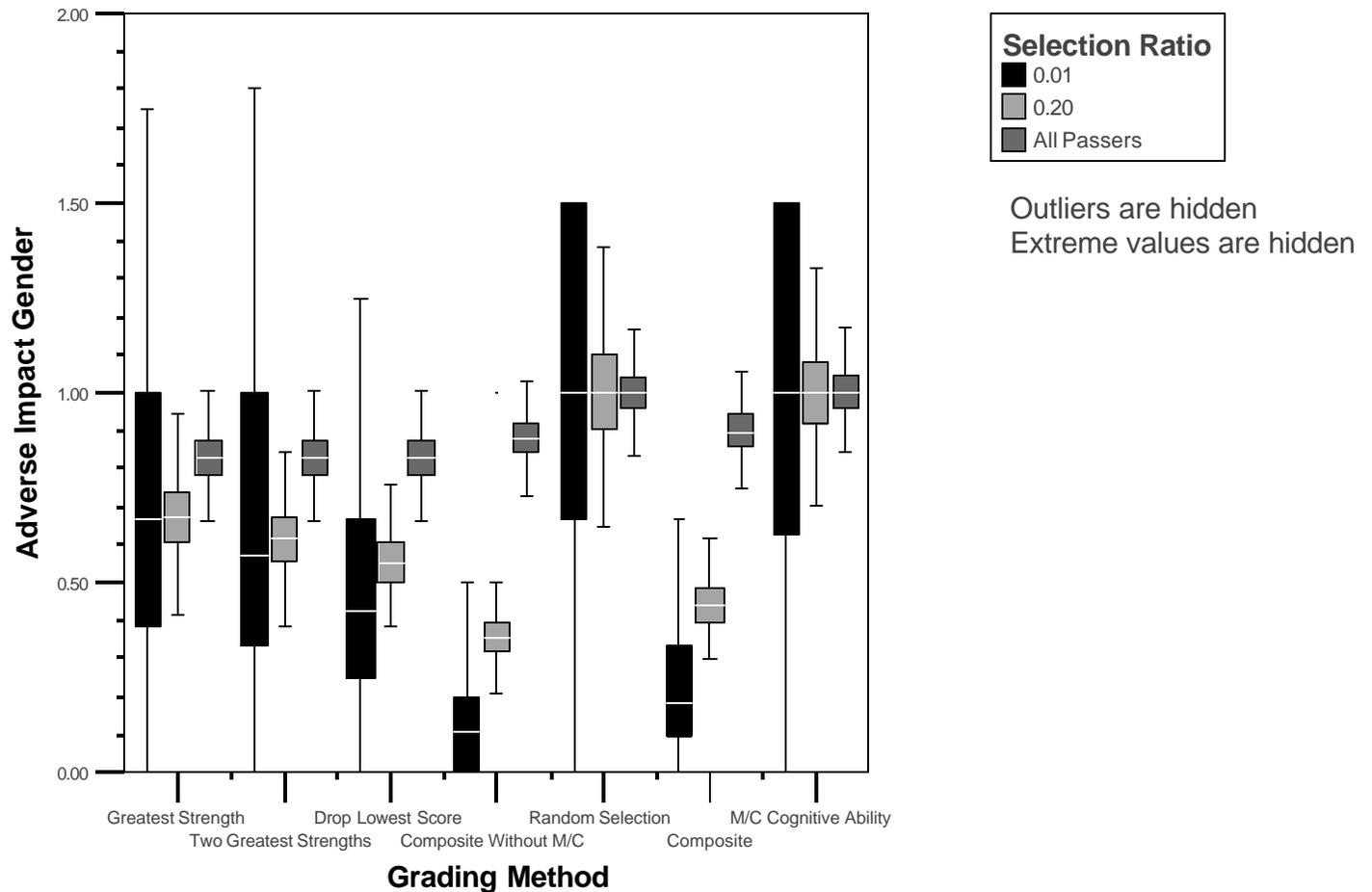
In some cases, no minority applicant is hired, resulting in an adverse impact of 0.

The Written test's median and quartile values for adverse impact with a .01 selection ratio are all 0, so there is no visible box and whiskers— only the blank line on the x-axis representing the median.

Note: Figures 1-8 plot median values for adverse impact.

Figure 2. Adverse Impact Gender by Grading Method

Proportion of Minorities = .1, Applicant Group Size = 1000, Number of Replications = 750



Highlights (Adverse Impact Gender, Proportion of Minorities = .1, Applicant Group Size = 1000)

Least impact for Random and Written

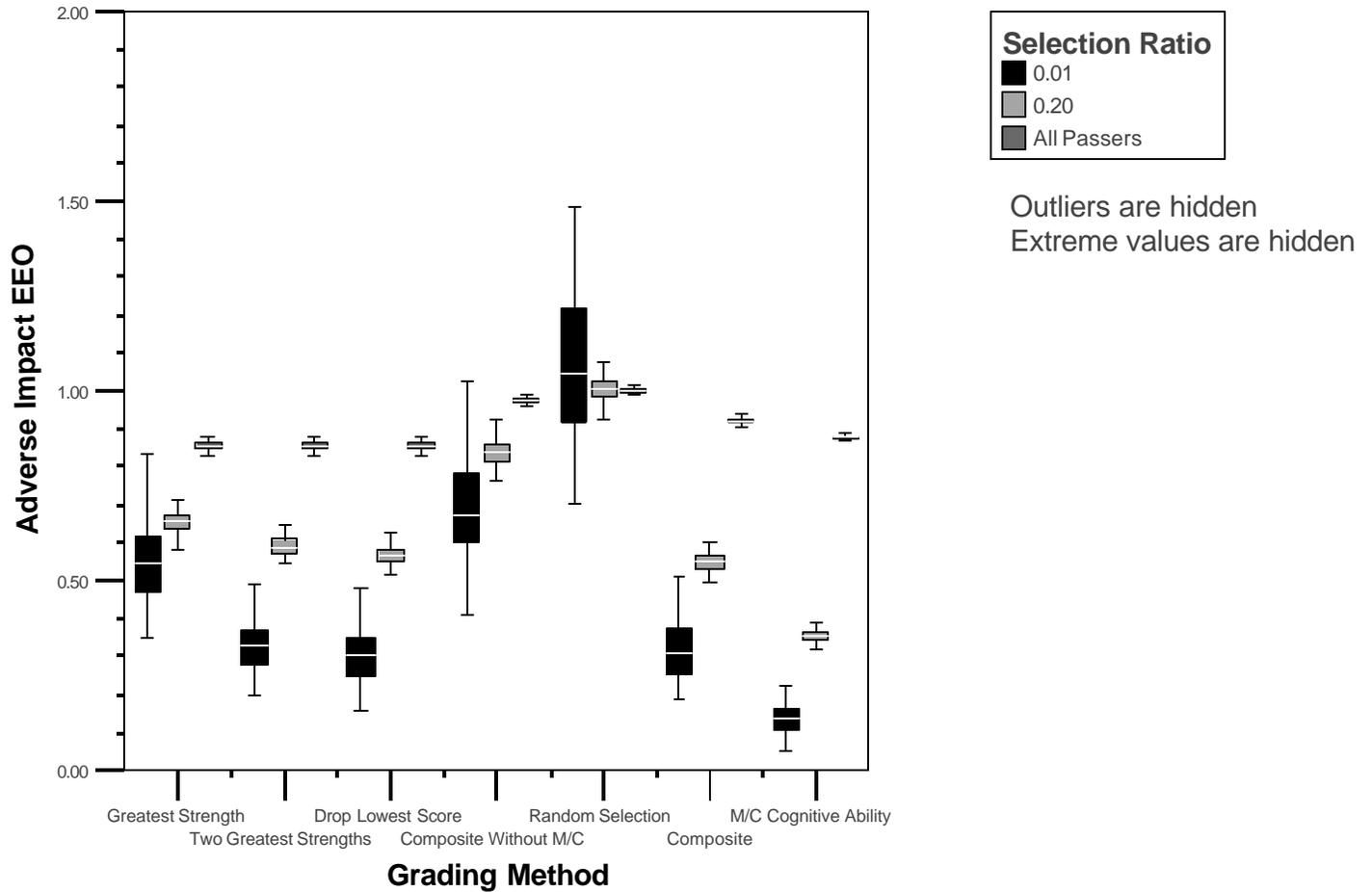
Most impact for Composite and Composite Without Written

Greatest Strength impact = .7-.85

There is high variance in adverse impact for a smaller applicant group size (1000) with a selection ratio of .01.

Figure 7. Adverse Impact EEO by Grading Method

Proportion of Minorities = .5, Applicant Group Size = 10000, Number of Replications = 75



Highlights (Adverse Impact EEO, Proportion of Minorities = .5, Applicant Group Size = 10000)

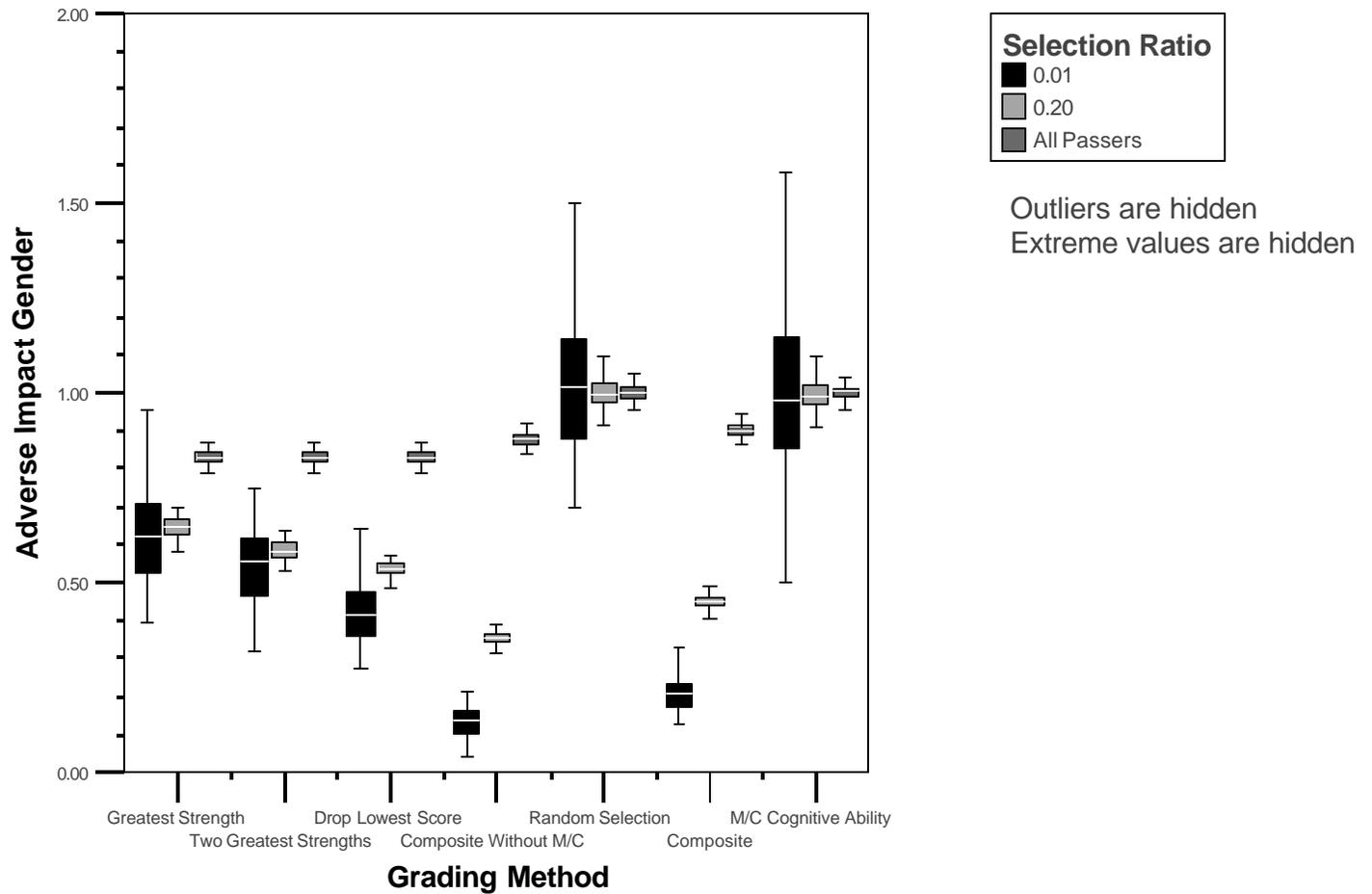
Least impact for Random and Composite Without Written
 Most impact for Written

Greatest Strength impact = .5-.85

Comparatively little variance in adverse impact is seen with larger values for proportion of minorities and applicant group size.

Figure 8. Adverse Impact Gender by Grading Method

Proportion of Minorities = .5, Applicant Group Size = 10000, Number of Replications = 75



Highlights (Adverse Impact Gender, Proportion of Minorities = .5, Applicant Group Size = 10000)

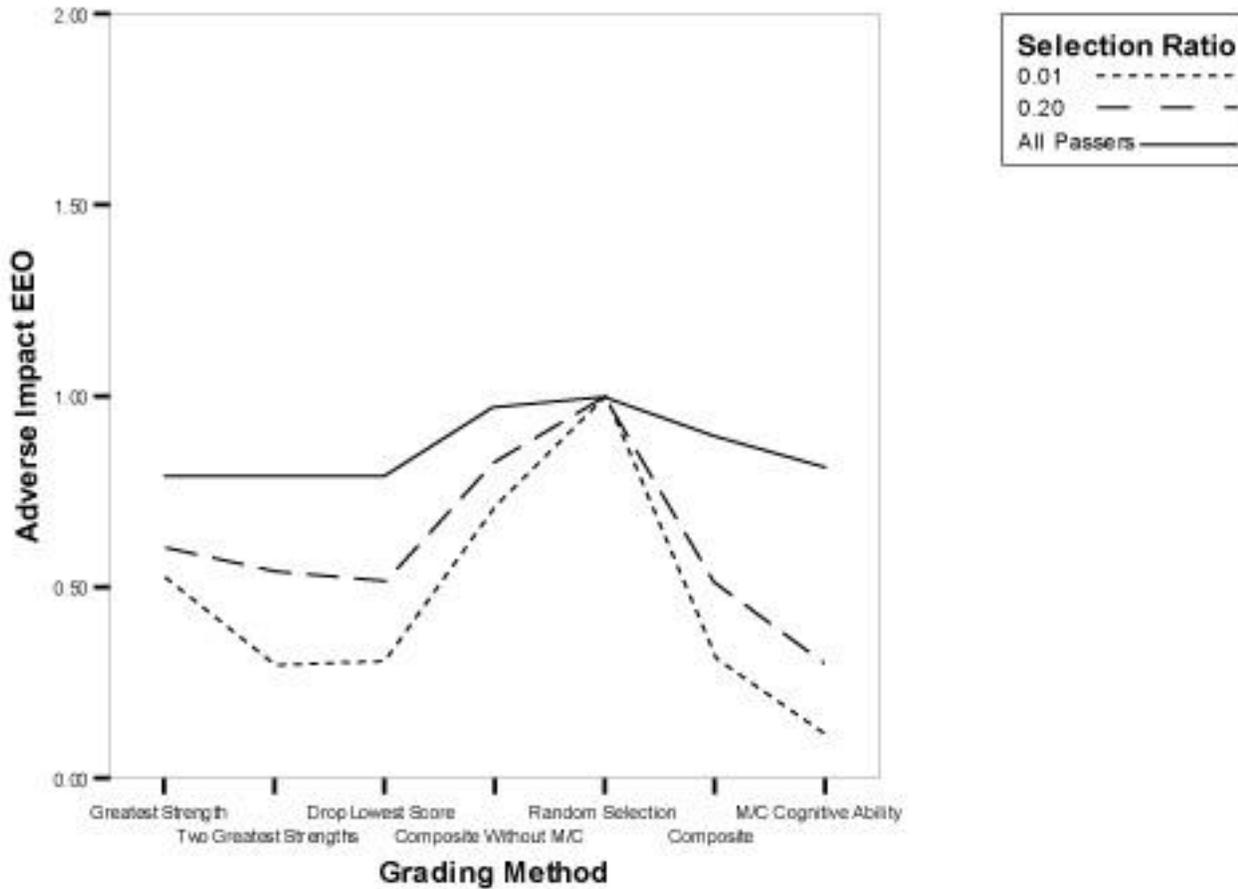
Least impact for Random and Written

Most impact for Composite and Composite Without Written

Greatest Strength impact = .6-.8

Figure 11. Adverse Impact EEO by Grading Method

Proportion of Minorities = .1, Applicant Group Size = 1,000,000



Highlights (Adverse Impact EEO, Proportion of Minorities = .1, Applicant Group Size = 1,000,000)

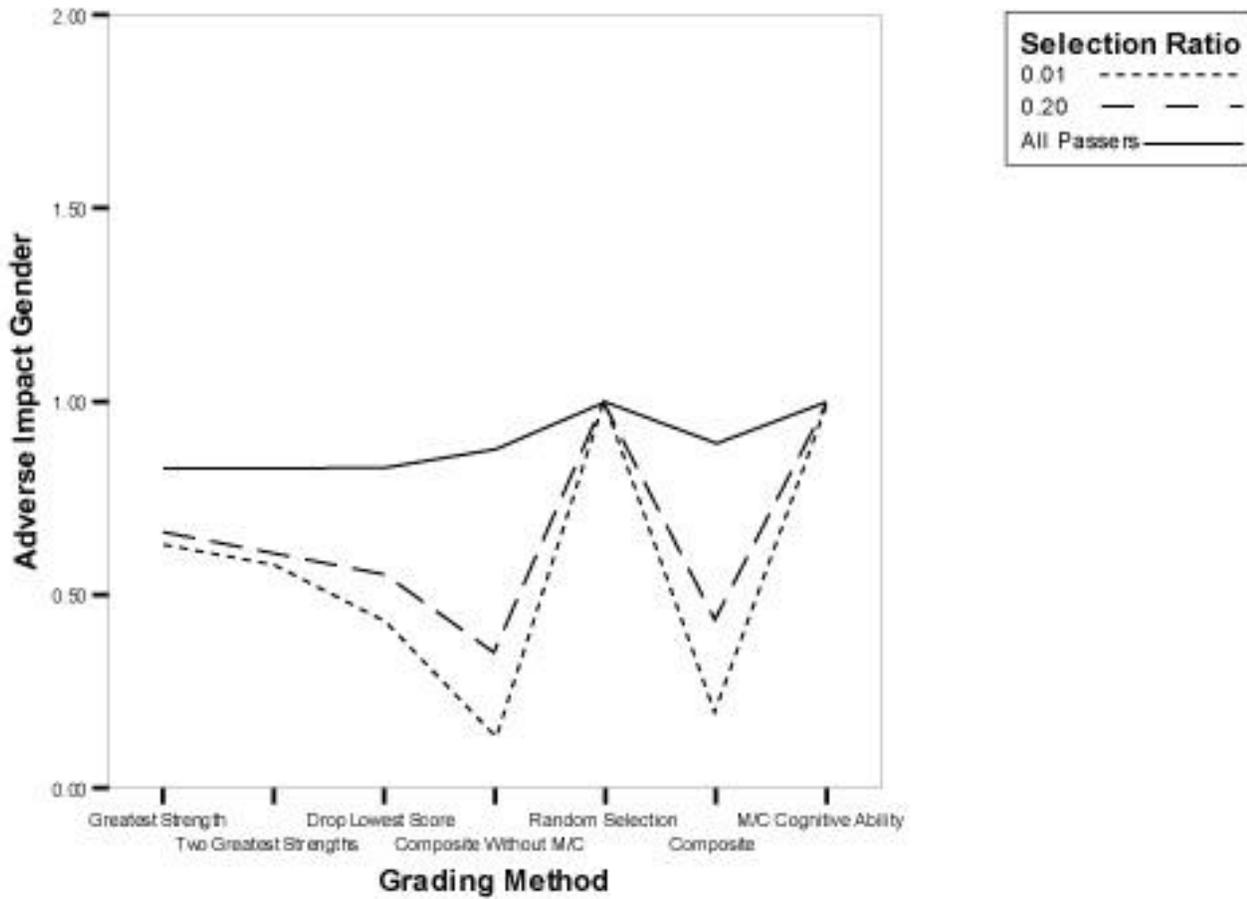
Least impact for Random and Composite Without Written

Most impact for Written

Greatest Strength impact = .5-.8

Figure 12. Adverse Impact Gender by Grading Method

Proportion of Minorities = .1, Applicant Group Size = 1,000,000



Highlights (Adverse Impact Gender, Proportion of Minorities = .1, Applicant Group Size = 1,000,000)

Least impact for Random and Written

Most impact for Composite and Composite Without Written

Greatest Strength impact = .6-.8

The poster exhibits above and a more complete version of the study are available at:

<http://apr-boston.com/mc>

Direct questions and comments to:

Joel Wiesen, Ph.D.

Applied Personnel Research

27 Judith Road

Newton, MA 02459

(617) 244-8859

jwiesen@appliedpersonnelresearch.com