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Graphs of WAIS®-III/WMS®-III Clinical Data Highlight Interesting Trends

Keith A. Hawkins, Psy.D.

To assess the clinical sensitivity of the *Wechsler Adult Intelligence Scale®—Third Edition/Wechsler Memory Scale®—Third Edition* (WAIS®-III/WMS®-III), The Psychological Corporation sponsored the assessment of samples of patients with diagnoses associated with disordered cognition and memory, and reported the resulting data in the Technical Manual for these tests (The Psychological Corporation, 1997). The presentation of these complex data in the form of graphs makes several interesting trends more clearly discernible (Hawkins, 1998). The WAIS-III Processing Speed Index (PSI) emerges as commonly depressed, suggesting that the PSI will prove to be particularly sensitive to brain dysfunction of a nature frequently seen in neuropsychological settings (reflecting the diversity of the samples: traumatic brain injury, schizophrenia, alcohol abuse, and Parkinson's, Huntington's, Alzheimer's, and Korsakoff's disease). Factors that may complicate interpretation, such as a possible effect of psychological depression upon the PSI, and base rates for difference scores between the WAIS-III Indexes showing the greatest differential in these samples—the Verbal Comprehension Index (VCI) and Processing Speed Index (PSI)—must be taken into account, and warrant further investigation.

While these clinical data suggest that the WMS-III Visual Index may also be highly sensitive to brain compromise *per se*, the data presented for lateralized hippocampectomy samples show encouraging modality (auditory vs. visual) effects. An additional interesting



possibility suggested by the graphed data is that the Immediate Memory Index may be generally as sensitive to memory deficiency as the WMS-III General Memory Index (measuring delayed recall and recognition), at least at the level of group data, a prospect with obvious implications in terms of testing time economy. In support of this possibility, data from the Technical Manual show that the WMS-III Immediate and General Indexes correlate in similar ways with other recall measures, regardless of whether these other measures are immediate or delayed.

Running counter to this argument are data supporting separate WMS-III immediate and

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Conventions

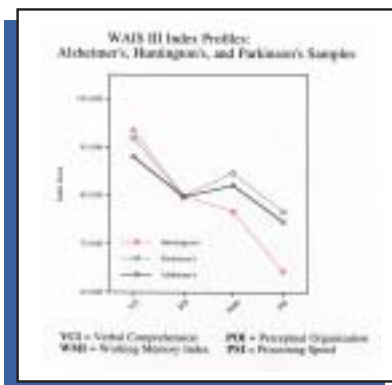
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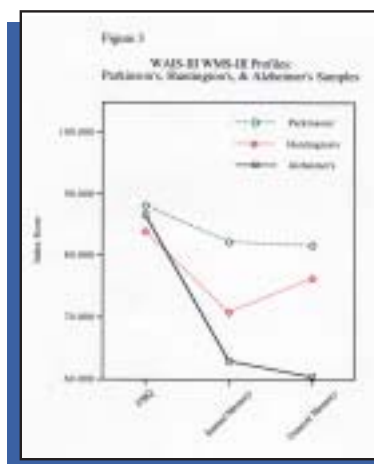


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delayed memory factors (The Psychological Corporation, 1997).

All of the trends discussed in the paper by Hawkins (1998) must be considered tentative, and especially so for the memory data, given the complexity of memory processes and the radical nature of this latest revision of the WMS. The trends suggested by the graphs are nevertheless striking, and should serve to provoke further research. The generation of multiple factors and co-norming of the Wechsler Scales generates an exciting potential for profile analysis across conditions, and many fruitful investigations along these lines can be anticipated.

generation of multiple factors and co-norming of the Wechsler Scales generates an exciting potential for profile analysis across conditions, and many fruitful investigations along these lines can be anticipated.



Dr. Keith Hawkins is an Associate Professor in Psychology in the Department of Psychiatry at Yale University. Reprints of Hawkins (1998) incorporating graphed presentations of the clinical samples data are available from him (Room 530, CMHC, 34 Park Street, New Haven, CT 06519). Email: Keith.Hawkins@Yale.edu

References

Hawkins, Keith A. (1998) Indicators of brain dysfunction derived from graphic representations of the WAIS-III/WMS-III Technical Manual clinical samples data: A preliminary approach to clinical utility. *The Clinical Neuropsychologist*, 12 (4) 535-551.

The Psychological Corporation. (1997). WAIS-III/WMS-III Technical Manual. San Antonio, TX: The Psychological Corporation.

WAIS®-III/WMS®-III Administration Order... A Concern?

Jianjun Zhu, Ph.D. and David S. Tulsky, Ph.D.

The co-norming of the *Wechsler Adult Intelligence Scale®—Third Edition* (WAIS®-III) and *Wechsler Memory Scale®—Third Edition* (WMS®-III) allows clinicians to compare performance directly between different domains of cognitive functioning. For example, co-norming allows prediction of memory scores based on an individual's IQ scores, to identify possible areas of concern.

Norming two instruments in the same administration provides a powerful tool for clinicians. However, it may also introduce some problems. First, exposure to subtests in one instrument might influence performance on the second instrument, due to practice effects, procedural learning, and so on. Second, co-norming during the same administration lengthens testing time substantially, possibly allowing fatigue to play a role.

During WAIS-III/WMS-III standardization, the two instruments were administered in counter-balanced order, with an average total testing time of approximately five hours. However, no norms were reported by test-order. It is possible that fatigue, practice effects, or their interaction, might have influenced test performance and the resulting normative data.

WAIS-III/WMS-III

To investigate whether co-norming the two instruments in this way might have influenced the results, Zhu & Tulsky (in press) examined test performance in the WAIS-III/WMS-III standardization sample. Performance for those administered WAIS-III first was compared to performance for those given WMS-III first.

Mean scores were calculated for each subtest, factor index, and IQ score by administration order. These mean scores were tested using both repeated-measures MANOVA and Tukey's HSD method. When significant differences were identified, the effect size of the difference was estimated.

In WAIS-III, significant differences (due to administration order) were found in only two instances. Digit Span and Coding subtest scores were lower when WAIS-III was administered last. The estimated effect size however was extremely small, suggesting that this finding may result from the sensitivity of the statistical procedures applied. When WMS-III was administered last, differences were found only for Faces II and Logical Memory II subtests. Both means were lower. However, the estimated effect size was again very small, suggesting the finding may be an artifact.

Whatever order effects that exist for WAIS-III/WMS-III administration are small and difficult to detect. More detail regarding this investigation can be found in the reference at the end of this article.

Letter-Number Sequencing

Letter-Number Sequencing (LNS) is unique in that it appears in both WAIS-III and WMS-III published editions, and therefore it deserves special attention. The LNS data published in both instruments are based on the 1250 cases on which WMS-III was standardized. LNS was the last subtest administered during WMS-III standardization.

Because of the counter-balanced administration of WAIS-III/WMS-III during co-norming, LNS was administered (on average) after approximately 2.3 hours of testing or nearly five hours of testing. If order effects occurred in the WAIS-III/WMS-III standardization, LNS would be likely to exhibit such effects.

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To test whether LNS performance was affected by administration order, Tulskey & Zhu (in press) compared three groups of cases. The first group consisted of 124 individuals who were administered LNS as part of the published WAIS-III battery. These cases were given WAIS-III first, as part of either a *Wechsler Abbreviated Scale of Intelligence™* (WASI™; Wechsler, 1998) or BETA-III (Kellogg & Morton, 1999) standardization validity study.



The second group consisted of 124 cases from the WAIS-III/WMS-III standardization sample. These individuals were given WMS-III first and matched to group I based on age, education, ethnicity, and sex. A third group of 124 cases was also selected from the WAIS-III/WMS-III standardization sample. Group 3 was administered WAIS-III first and matched to Group I on the same demographic variables listed above.

A repeated measures MANOVA revealed no significant differences between the three groups. LNS scores were not influenced by the order of administration during WAIS-III/WMS-III standardization, as part of the WMS-III battery. Nor did LNS scores differ when administered normally within the WAIS-III.

It must be noted that LNS was administered only *once* to each examinee during WAIS-III/WMS-III standardization. If both WAIS-III and WMS-III are given to an examinee within a short interval, the LNS score should be transferred from one protocol to the other. Until more research is done, LNS should not be administered twice at intervals of less than two weeks. The short-term practice effects are not yet clear. At retest intervals of 2 to 12 weeks, LNS scores showed slight increases in a WAIS-III validity study (see Tables 3.6–3.9 in the WAIS-III/WMS-III Technical Manual; The Psychological Corporation, 1997). Clinicians should use caution in interpreting the second LNS score if they choose to administer it in both WAIS-III and WMS-III batteries.

Conclusion

These two investigations suggest that scores on the majority of the WAIS-III and WMS-III are not influenced by the effect of fatigue or test order in a normal population. Nevertheless, these studies have not been conducted within clinical samples and it will be important to see if the results hold up when testing is performed with individuals who may become fatigued more easily. Additionally, the results do not guarantee that all individuals are immune to length or order effects. Certainly some individuals will be sensitive to these influences, and the clinician should always remain alert to this possibility.

References

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Zhu, J. & Tulskey, D. S. (In press). Co-norming the WAIS-III and WMS-III: Is there a test-order effect on IQ and memory scores? *The Clinical Neuropsychologist*.

Dr. Zhu is a senior project director at The Psychological Corporation. **Dr. Tulskey** former senior project director at The Psychological Corporation, is co-director at Kessler Medical Rehabilitation Research and Education Corporation.

Summary of Using WASI™ in Conjunction with WAIS-III®: Are There Procedural Learning/Practice Effects?

Jianjun Zhu, Ph.D. and Elsa Garcia, B.A.

The *Wechsler Abbreviated Scale of Intelligence™* (WASI™; Wechsler, 1999) is a brief intelligence scale useful for estimating, screening and re-evaluating intellectual functioning. WASI has different, but parallel items to the *Wechsler Adult Intelligence Scale®—Third Edition* (WAIS®-III; Wechsler, 1997). Both of these measures can be administered concurrently. A drawback, though, is that WAIS-III subtests and IQ and index scores may be impacted by first administering WASI. This type of administration may result in higher WAIS-III scores. The design of the WASI should reduce practice effects when the WASI and WAIS-III are used in conjunction. However, procedural learning effects are still a concern. A method to assure minimal procedural learning is the substitution of the four WASI subtest scores for parallel WAIS-III subtests. This, too, has drawbacks since measurement errors may result due to estimations.



A study conducted by Zhu, Tulskey, and Leyva (1999) evaluated potential procedural learning effects and measurement error associated with these two ways that clinicians can combine the WASI and the WAIS-III. This study included three samples of non-clinical adolescents and adults aged 16–89 who participated in the 1996 WASI validity study.

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Summary of Using WASI, continued from page 3

Samples 1 and 2 were used to evaluate the procedural learning effect associated with concurrent administration of the WASI and WAIS-III. Sample 1 (N=248), were administered the WASI and WAIS-III in a counterbalanced order with a testing interval of 2 to 12 weeks. Sample 2 (N=50 matched pairs by demographics) was drawn from Sample 1. These pairs alternated test administration so that one individual took the WASI first, while the other took the WAIS-III first. It was hypothesized that if a procedural learning effect exists, 1) inflated scores would result on the WAIS-III, especially for Performance subtests and the PIQ, and 2) the WAIS-III scores should be higher for individuals who took WASI first.

The design of the WASI should reduce practice effects when the WASI and WAIS-III are used in conjunction.

Results for Sample 1 and 2 revealed only small discrepancies (within +1 point for subtests, and within +2 – 2.5 points for IQ and index scores) between the adjusted means scores of the two testing orders. Only Block Design revealed minimal (1 point difference), but significant discrepancies (with very small effect size Sample 1, $w2=.026$; Sample 2, $w2=.066$) for both Samples.

Sample 3 (N=124) was used to evaluate the degree of measurement error involved in the substitution method. The difference between an obtained and an estimated WAIS-III score, and the relationship between the ability level and score discrepancy were evaluated. Participants in Sample 3 were classified into three ability levels according to FSIQ of the WAIS-III, and were administered the WASI first. The estimated WAIS-III IQ and index scores were derived by converting the four WASI subtest T scores (M=50 and SD=10), that are parallel to the WAIS-III subtests, into scaled scores (M=10 and SD=3) and combining them with the remaining WAIS-III subtest scaled scores.

Results for Sample 3, overall, revealed that: 1) the differences between the observed and estimated IQ are only 2 points with the obtained scores slightly lower. 2) The discrepancy for PIQ are larger than for VIQ and IQ. 3) Among the 124 cases, 90 to 98 percent of the discrepancies between the observed and estimated scores are within the range of 5 to 7 points. 4) Correlation coefficients between the estimated and obtained scores were very high (ranging from .91 – .98) for the overall sample, and lower (ranging from .82 – .96, except POI with .75 to .76) for correlations between ability levels.

In general, Zhu, Tulsy and Leyva (1999) support concurrent administrations of the WASI and WAIS-III. Overall, clinicians can be assured that either method of administration will provide accurate and efficient assessments. Because the procedural learning effect reported in the study was very small overall, and concentrated on the WAIS-III Block Design and PIQ scores, administering both tests in full would be the best practice. Full administration of both the WASI and the WAIS-III would provide the greatest amount of accuracy for assessment purposes. Only those subtests associated with performance would need to be considered more carefully. Nevertheless, a clinician could complete a thorough assessment of individuals, with only a minimal impact from practice effect with the full administration of both tests.

However, it would be highly appropriate to use the substitution method when time is a concern. Substituting WASI subtest scores for WAIS-III scores that are not administered would reduce testing time and provide adequate estimates of subtest scores and overall IQ. High correlations between estimated and obtained scores reported in this study assure very accurate estimates. Further, it is proposed that using this method is acceptable clinical practice because a substantial increase in measurement error did not result from a very short interval (2 to 12 weeks) between WASI and WAIS-III testing. As noted in Zhu, Tulsy, and Leyva (1999), “the consistency between the estimated and obtained scores was significantly higher than the one between test and retest scores reported in the

Overall, clinicians can be assured that either method of administration will provide accurate and efficient assessments.

WAIS-III/WMS-III technical manual (The Psychological Corporation, 1997).”

A caveat to using the substitution method is that WAIS-III IQ and index scores tend to be underestimated when using this method. Also, the substitution method appears to be more effective with IQ scores as opposed to index scores. Additionally, this method is more favorable for use with those of average ability rather than above or below average ability. Clinicians, therefore, should be cautious in obtaining estimates for individuals with extremely high or low abilities.

The results of Zhu, Tulsy, and Leyva (1999) suggest that using the WASI and WAIS-III in conjunction is an effective method for clinicians to conveniently evaluate, assess, and re-evaluate individuals. Thus, the decision to administer in full, both the WASI and the WAIS-III, or to use the substitution method is highly dependent upon the needs of the clinician.

References

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Dr. Zhu is a project director for The Psychological Corporation.
Ms. Elsa Garcia is a research assistant for The Psychological Corporation.



WAIS®—III Reliability Data for Clinical Groups

Jianjun Zhu, Ph.D., Larry Weiss, Ph.D., and Jennifer Leigh Brown, B.A.

In accordance with the new *Standards for Educational and Psychological Testing* (American Psychological Association, 1999), test publishers need to provide data related to conditional reliability and standard error of measurement.

In the past, reliability estimates for IQ tests such as the *Wechsler Adult Intelligence Scale®—Third Edition* (WAIS®—III; Wechsler, 1997), *Stanford Binet Intelligence Scale: Fourth Edition* (SB—IV, Thorndike, Hager, & Sattler, 1986), and the *Kaufman Adolescent & Adult Intelligence Test* (KAIT, Kaufman & Kaufman, 1993) are almost always reported for non-clinical populations.

Following the new standards, Zhu and Tulsy (1999) reported research that evaluated the conditional reliability of the WAIS—III using data from 403 adults who were recruited as part of the WAIS—III clinical validity studies. Inclusion and exclusion criteria for these subjects can be found in Appendix E of the *WAIS—III—WMS—III Technical Manual* (The Psychological Corporation, 1997). These adults were diagnosed with mild Alzheimer's disease (N=35), Huntington's disease and Parkinson's disease (N=25), Traumatic Brain Injury (N=22), Temporal Lobe Epilepsy (N=27), Schizophrenia (N=38), Alcohol-Related Disorders (N=42), Mental Retardation (N=108), ADHD/ADD (N=30), Learning Disabilities (N=46), and Hearing Impairment (N=30). More detailed information about the clinical samples is presented in the *WAIS—III—WMS—III Technical Manual*.



The split-half internal consistency reliability coefficients were calculated by specific diagnosis and combined clinical groups by age. All reliability coefficients of the samples were corrected for the variability of the standardization sample.

Most of the split-half reliability coefficients for the clinical groups were either higher or comparable to those reported for the WAIS—III standardization sample. In general, the internal consistency coefficients for the Verbal subtests tended to be higher than the coefficients for the Performance subtests. The corrected coefficients were quite high (ranging from .81 – .91) for samples with Neurological Disorders (Alzheimer's disease, Huntington's disease and Parkinson's disease, and Traumatic Brain Injury). The only exception was that for the Object Assembly subtest, the coefficient is .72 for the sample

with Alzheimer's disease. The samples with Temporal Lobe Epilepsy, Schizophrenia, and Alcohol-Related Disorders also had high coefficients (ranging from .82 – .96), with the exception that on

Arithmetic and Object Assembly, the coefficient of the sample with Temporal Lobe Epilepsy are .75 and .78, respectively. The reliability coefficient on Similarities for the sample with Schizophrenia was .74 and .68 for Picture Arrangement among the sample with Alcohol-Related Disorders. Within the samples with Developmental Disorders (Mental Retardation, ADHD/ADD, Learning Disabilities, and Hearing Impairment), individuals with Mental Retardation and Hearing Impairment demonstrated high reliability coefficients (ranging from .80 to .98). For the ADHD/ADD and Learning Disabilities groups, the coefficients ranged from .82 – .96, except on Picture Completion, Picture Arrangement, and Object Assembly, where the internal consistencies were lower for samples with ADHD/ADD (ranging from .59 to .76) and Learning Disabilities (ranging from .51 to .68). The sample with Learning Disabilities also showed lower internal consistency on the Similarities subtest (.68).

The coefficients for the groups that are more homogeneous, such as those with Mental Retardation, tend to be higher because individuals in these groups consistently pass or fail most of the items. On the other hand, the groups that are less homogeneous, due to the nature of their problems, such as the ADHD/ADD and learning disabilities samples, tend to have relatively lower split-half coefficients on certain subtests.

In the clinical groups, the corrected reliability coefficients were generally higher than the uncorrected coefficients because most of the standard deviations from these groups were smaller than the standard deviations from the normative sample (which are 3 points).

As expected, Object Assembly had the lowest coefficients for most groups, probably due to the smaller number of items on this subtest. The coefficients were quite high for samples with Alzheimer's disease, Traumatic Brain Injury, Temporal Lobe Epilepsy, Schizophrenia, Alcohol-Related Disorders, Mental Retardation, and Hearing Impairment; however, the internal consistencies were relatively lower for samples with ADHD/ADD and Learning Disabilities. For these two groups, the split-half coefficients for Picture Completion and Picture Arrangement were lower than those reported in the WAIS—III manual for the standardization sample.

Because the internal consistency coefficients vary across different clinical groups, an overall coefficient for all clinical groups may not be meaningful. In certain situations, it may even be misleading.

In summary, the current study demonstrated that the WAIS—III has very good internal consistency reliability when used to evaluate specific cognitive functions in certain clinical groups. This suggests

Zhu and Tulsy (1999) reported research that evaluated the conditional reliability of the WAIS—III using data from 403 adults who were recruited as part of the WAIS—III clinical validity studies.

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WAIS-III Reliability Data continued from page 5

that the reliability and standard error of measurement reported in the WAIS-III for the Standardization sample can be used for these clinical groups. It is important to note however, that the reliability coefficients appear to vary for different clinical populations. A major limitation of this study is the small sample sizes for the specific clinical groups. Additional research is needed to evaluate the WAIS-III reliabilities for clinical groups that were not included in the current study. If possible, larger samples should be used so that the coefficients can be calculated by age for each clinical group.

Dr. Zhu is a senior project director for The Psychological Corporation. **Dr. Weiss** is director of the Psychological and Human Resource Products Group at The Psychological Corporation. **Ms. Brown** is a research assistant for The Psychological Corporation.

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Editor: Kathy Overstreet

Contributors: Jennifer Leigh Brown, BA; Elsa Garcia, BA; Keith A. Hawkins, PsyD; David S. Tulsy, PhD; Larry Weiss, PhD; Jianjun Zhu, PhD.

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