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The WAIS-III and Major Depression: Absence of VIQ/PIQ Differences

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Poor Performance IQ (PIQ) relative to Verbal IQ (VIQ) is a standard finding in depressed patients administered the Wechsler Adult Intelligence Scale-Revised (WAIS-R). This study examined performance of depressed subjects on the instrument's latest revision, the WAIS-III, which provides a more detailed subdomain profile of intellectual functioning. WAIS-III IQ, index and subscale scores were compared between 121 unmedicated subjects in major depressive episode and 41 healthy volunteers, using demographically adjusted T-score conversions. Depressed subjects had significantly lower PIQ scores, but neither the absolute VIQ/PIQ difference nor prevalence of VIQ/PIQ discrepancies >1 SD differed between groups. Index score differences were exclusively in Processing Speed, and subtest differences only on timed tasks. WAIS-III scores did not differ between subjects with major depressive and bipolar disorders, nor between subjects with and without melancholia or history of suicidal behavior. Results suggest general intellectual performance in depression is best characterized by deficits in processing speed, rather than global nonverbal abilities, and that this deficit is consistent across depression subtypes.

Introduction

Measurement of intellectual functioning is an integral component of neuropsychological assessment, and various editions of the Wechsler Adult Intelligence Scale (WAIS) (Wechsler, 1955, 1981, 1997) have been used for this purpose in neuropsychological batteries. Major depressive disorder (MDD) has been a focus of assessment both as a disorder of interest and as a confound in the assessment of other psychiatric and neurological conditions. Delineation of the performance profile of depressed patients on the WAIS has been useful to characterize the degree of intellectual impairment in this psychiatric illness, as well as to distinguish it from other neuropsychological disorders. With the publication of the WAIS-Third Edition (WAIS-III), the most current version of the WAIS, it is important to determine how the new format of this test might alter our perspective on depression-related intellectual deficits.

The most common finding with the WAIS-Revised (WAIS-R) in depression is the discrepancy between verbal and nonverbal abilities, with lower Performance IQ (PIQ) relative to Verbal IQ (VIQ) (Groth-Marnat, 1997; Kluger & Goldberg, 1990; Pernicano, 1986; Sackeim et al., 1992; Zillmer, Ball, Fowler, Newman & Stutts, 1991). A fifteen point (1 SD) difference (Anastasi, 1988; Wechsler, 1981) has been reported more frequently in depressed patients than nonpatient comparison samples (Pernicano, 1986; Sackeim et al., 1992). However, VIQ/PIQ discrepancies are common in a variety of psychiatric disorders (Kaufman, 1990; Zillmer et al., 1991; Pernicano, 1986), as well in healthy individuals (Iverson, Woodward & Green, 2001; Matarazzo & Herman, 1984). Depressed patients may demonstrate differences of this magnitude at the same frequency as in the general population (Hackerman, Buccino, Gallucci & Schmidt, 1996; Iverson, Turner & Green, 1999), and larger discrepancies tend to be more prevalent in all subjects with higher Full Scale IQs (FSIQ) (Iverson et al., 2001; Kaufman, 1990).

Lower PIQ scores in depression have been attributed to psychomotor retardation, a general slowing of mental processes recognized as a symptom of major depression (American Psychiatric Association, 2000). Timed tests within the PIQ domain are more sensitive to the effects of slowing than verbal subtests that are chiefly untimed (Pernicano, 1986). Sackeim et al. (1992), though, suggest that the poor nonverbal abilities seen in depressed patients are a stable deficit and not due to psychomotor retardation. In their study, patients demonstrated lower PIQs relative to control subjects when assessed both in and out of episode. Also, these patients had significantly larger VIQ/PIQ differences relative to controls whether the PIQ subtests were administered under timed or untimed conditions. Sackeim et al.'s (1992) interpretation of the VIQ/PIQ difference is consistent with reports of visuospatial and visuomotor tracking deficits in depression when subjects are assessed with more focused neuropsychological tests (Calev, Pollina, Fennig & Banerjee, 1999; Cassens, Wolfe & Zola, 1990; Veiel, 1997).

While scores obtained via the WAIS-R and WAIS-III are highly correlated (Tulsky, Zhu & Ledbetter, 1997), the WAIS-III contains several key changes in format. In addition to Verbal and Performance IQs, the WAIS-III also provides four indices that measure more discrete factors of cognitive functioning. These indices allow more crystallized Verbal Comprehension and Perceptual Organization abilities to be distinguished from skills seen as mediators of cognitive functioning and pertinent to learning ability (Working Memory and Processing Speed). To further distill the elements of intellectual performance, the WAIS-III has added an untimed component into the formulation of PIQ and the Perceptual Organization index, in the form of the new Matrix Reasoning subtest. This subtest does not depend on quick performance or manual manipulation, and is the best Performance scale correlate of FSIQ (Tulsky et al., 1997). In WAIS-III PIQ subtests overall, fewer bonus points are awarded for rapid task completion (Tulsky et al., 1997). In addition, normative data has been compiled concerning the frequency of IQ and index differences within ranges of FSIQ, providing for better awareness of the variability of these differences across FSIQ, as well as better characterization of the significance of these differences (Tulsky et al., 1997).

To date, no studies have reported on the performance profile of major depression or depressive subtypes on the WAIS-III. Changes in the composition and calculation of the WAIS-III IQs and indices may alter our perspective of the effects of major depression on intellectual functioning. In particular, questions about the relative importance of deficits in Processing Speed, versus those in visuospatial and general non-verbal abilities, can be addressed.

In the current study, the WAIS-III 'index subset' of tests (excluding Picture Arrangement, Comprehension, and Object Assembly subtests) was administered to 41 healthy volunteers

and 121 subjects during a depressive episode, following washout of psychotropic medications. The sample included subjects with unipolar major depression or bipolar disorder during the depressed phase. Sample sizes were sufficient to permit comparison between these affective disorder subtypes. The sample also included comparable numbers of subjects with and without a history of a suicide attempt, so that differences in performance related to attempt status could be examined. Comparisons were also made between subjects with and without melancholic depression, a subtype that has more overt clinical signs of psychomotor slowing. To enhance the sensitivity of these comparisons, adjustments for the effects of gender, education and ethnicity on IQ scores were made through the use of recently available T score conversions of WAIS-III IQs, indices and subscales. These T scores provide the type of normative adjustments available for most other neuro-psychological tests.

Method

Subjects

The study sample was comprised of 121 subjects and 41 nonpatient healthy volunteers participating in protocols within the Conte Center for the Study of Suicidal Behavior at Columbia University Medical Center. All patients met DSM-IV criteria for current major depressive episode, with a minimum 17-item Hamilton Depression Rating Scale (HDRS; Hamilton, 1960) score of 16 at time of study entry. Healthy volunteers were free of any current or past Axis I or Axis II Cluster B disorders. Clinical histories, as well as physical and laboratory exams were used to rule out neurological disease and acute medical conditions. Urine toxicology screens were conducted to screen for current illicit substance use. Demographic and clinical data for subjects and controls are presented in Table 1.

Within the depressed group, 67% (N = 81) met criteria for a major depressive disorder, and 33% (N = 40) were in the depressed phase of a bipolar disorder. Criteria for melancholic depression were met by 32% (N = 39) of subjects. Twenty nine percent of subjects (N = 35) had comorbid Borderline Personality Disorder, and 50% (N = 61) had made a previous suicide attempt. All participants gave written informed consent for the protocol which was approved by the local institutional review board. Depressed subjects were offered six weeks of inpatient or six months of outpatient no-cost psychiatric treatment for their participation, and healthy volunteers were compensated $100 for completion of the neuropsychological assessment battery.

Measures

Consensus Axis I and II diagnoses were made using the Structured Clinical Interview for DSM-IV patient edition (SCID I and II) (First et al., 1996; Spitzer, Williams, Gibbon & First, 1990). Psychiatric conditions were ruled out for control subjects with the nonpatient version of the SCID (First, Spitzer, Gibbon & Williams, 1997). Current depression was assessed with the HDRS and Beck Depression Inventory (BDI) (Beck, Ward, Mendelson, Mock & Erbaugh, 1961), and hopelessness with the Beck Hopelessness Inventory (BHI) (Beck, Weissman, Lester & Trexler, 1974). Suicide history was collected with the Columbia Suicide History Form (Oquendo, Halberstam & Mann, 2003). Suicidal ideation was measured currently as well as for the two-week period prior to admission with the Scale for Suicidal Ideation (SSI) (Beck, Kovacs & Weissman, 1979).

Table 1

Demographic characteristics and psychiatric features of non-patient controls and depressed patients

	Non-patients N = 41		Depressed patients N = 121		
	Mean	SD	Mean	SD	p-value
Age	33.80	(11.9)	38.40	(12.0)	.03
Education	16.49	(2.5)	15.86	(2.4)	.15
# Major depressive episodes(*log*)	–	–	0.85	(0.9)	
			Median = 4		
# Prior hospitalizations(*log*)	–	–	1.70	(0.9)	
			Median = 1		
Length of current episode (wks)(*log*)	–	–	3.10	(1.3)	
			Median = 23		
GAF (w/suicide assessment)	88.00	(6.8)	46.40	(10.8)	**<.01**
GAF (w/o suicide assessment)	88.00	(6.8)	47.00	(10.4)	**<.01**
Hamilton DRS (24 item)	0.97	(1.2)	25.60	(7.4)	**<.01**
Beck Depression Inventory	1.90	(2.9)	29.20	(11.0)	**<.01**
Suicidal ideation (prior)	0.00	(0.0)	11.20	(9.5)	**<.01**
Suicidal ideation (current)	0.00	(0.0)	6.40	(7.4)	**<.01**
Beck Hopelessness Inventory	1.50	(1.9)	12.70	(6.0)	**<.01**
	%	N	%	N	p-value
Gender (%Female)	51.20%	*21*	58.70%	*71*	.41
Race (%Caucasian)	41.50%	*17*	73.60%	*89*	**<.01**
Language (%English)	81.10%	*30*	84.70%	*94*	.61
Hx substance use	0.00%	*0*	38.30%	*44*	**<.01**
Hx substance dependence	0.00%	*0*	21.70%	*25*	.10

The WAIS-III was administered as part of a comprehensive neuropsychological battery. Subtests necessary to generate prorated VIQ, PIQ and FSIQ scores were given, omitting Picture Arrangement, Comprehension and Object Assembly. Symbol Search and Letter Number Sequencing were administered in order to obtain all standard WAIS-III index scores. Three subjects did not complete all the WAIS-III subtests, so their available scores were included only in subtest analyses.

Procedures

Depressed subjects were recruited to participate in the protocols within the Conte Center by referral from local clinicians and through advertisement. Healthy volunteers were recruited by advertisement. These protocols involved biological measures that required all subjects to be medication free; however, no subjects were removed from currently effective treatments to participate in these studies. After signing informed consent, depressed subjects were washed out from psychotropic medications. Subjects were free of medication for a minimum of two weeks, four weeks for subjects receiving oral neuroleptics and six weeks for those receiving fluoxetine. Clinical ratings were conducted at the end of

washout, followed by administration of a comprehensive neuropsychological battery that included the WAIS-III. The WAIS-III was completed in one session over the course of a day, though assessment was extended to two days for two subjects. The same examiner administered all WAIS-III subtests for each subject. All tests were administered by examiners blind to clinical ratings.

Statistical Analyses

The depressed subject and healthy control groups were first compared on demographic and clinical variables using t tests and chi-square analyses. Log transformations were used for clinical history variables of number of hospitalizations, number of prior depressive episodes, and length of current episode, which were highly skewed.

Scaled scores were computed for all WAIS-III subtest, IQ and index scores. All analyses were conducted using demographically adjusted T scores, obtained from algorithms developed by Robert Heaton and colleagues at the University of California, San Diego. These score conversions are currently incorporated into the updated version of the scoring software (WAIS-III/WMS-III Scoring Assistant) available from the tests' publisher (Psychological Corporation). Student's t-tests were used to compare IQ, index and subtest scores between patient and control groups. In addition, we compared these measures between unipolar and bipolar patients, suicide attempters and nonattempters, and melancholic and non-melancholic depressed patients, to determine if these subgroups were affecting depressed subject/healthy control group differences. Pearson correlations were calculated among clinical variables and WAIS-III scores demonstrating significant group differences, to evaluate their association with cognitive task performance. Statistical significance was set to .01 to adjust for inflation of error due to multiple comparisons. A Bonferroni correction is excessively stringent for a study with measures as intercorrelated as WAIS-III subtests, because individual subtest comparisons are not independent.

Results

Characteristics of the Sample

As shown in Table 1, the depressed subject group was slightly older than healthy volunteers (mean = 38.4, SD = 12 versus mean = 33.8, SD = 11.9), and included relatively more Caucasian individuals (73.6% versus 41.5%). The groups had similar percentages of Hispanic subjects, but there were proportionately more African American (24.4% versus 8.2%) and Asian/Other Ethnicity (19.6% versus 3.3%) subjects in the control group. The groups were comparable in educational attainment, and percentages of females and native English speakers.

Patient versus Non-patient WAIS-III Performance

Mean WAIS-III IQ, index and subtest scores for depressed subjects and healthy comparison subjects are reported in Table 2, as well as the mean T scores for these measures. T score profiles for these groups are also shown in Figures 1 and 2.

The depressed subject group had significantly lower T scores for Performance IQ (t = 2.7, df = 159, p = .01), and tended to have lower Full Scale IQ scores (t = 2.3, df = 159, p = .02). Among the index scores, depressed subjects had significantly poorer performance in the Processing Speed (t = 3.7, df = 160, p < .01) domain only. Perceptual Organization (t = 1.7, df = 158, p = .09), Verbal Comprehension (t = 1.5, df = 160, p = .15)

Table 2
Non-patient and depressed patient WAIS-III scaled scores and T-scores

| | Standard scores | | | | T-scores | | | | |
| | Non-patients | | Depressed patients | | Non-patients | | Depressed patients | | |
	Mean	SD	Mean	SD	Mean	SD	Mean	SD	p-value
IQ Scores									
Full Scale IQ	118.4	(17.9)	112.9	(15.2)	59.0	(12.3)	54.0	(12.1)	.02
Verbal IQ	118.3	(18.0)	114.3	(14.2)	59.3	(11.8)	55.7	(11.1)	.08
Performance IQ	115.1	(18.4)	108.4	(17.0)	57.5	(12.8)	51.1	(13.2)	**.01**
Indices									
Verbal Comprehension	120.5	(17.3)	117.1	(14.0)	60.6	(11.1)	57.6	(11.6)	.15
Perceptual Organization	113.4	(17.1)	109.5	(16.5)	56.4	(11.2)	52.6	(12.6)	.09
Working Memory	109.8	(17.3)	106.8	(14.8)	53.7	(11.6)	51.2	(9.6)	.17
Processing Speed	110.0	(13.8)	101.9	(15.5)	54.2	(9.9)	46.6	(12.0)	**<.01**
Subtests									
Picture Completion	12.4	(3.3)	11.8	(3.2)	56.2	(11.7)	53.3	(11.5)	.17
Vocabulary	13.8	(3.7)	13.6	(3.0)	59.6	(13.0)	58.2	(12.3)	.53
Digit Symbol	12.0	(3.1)	10.1	(3.1)	53.9	(10.9)	45.7	(11.9)	**<.01**
Similarities	13.2	(3.1)	12.6	(2.9)	57.9	(9.6)	55.0	(11.4)	.14
Block Design	11.5	(3.2)	10.5	(3.0)	52.3	(10.9)	48.0	(11.0)	.03
Arithmetic	11.7	(3.1)	10.8	(2.8)	52.0	(10.1)	48.8	(10.0)	.08
Matrix Reasoning	12.5	(2.7)	12.3	(2.9)	54.9	(8.5)	53.8	(11.3)	.58
Digit Span	11.5	(3.4)	11.3	(3.1)	52.4	(12.1)	51.3	(10.0)	.57
Information	13.6	(2.7)	12.8	(2.4)	58.5	(8.6)	55.8	(9.8)	.12
Symbol Search	11.7	(2.5)	10.6	(2.9)	52.7	(8.9)	47.8	(11.1)	**.01**
Letter Number	11.6	(3.0)	11.5	(2.9)	53.3	(9.8)	52.0	(9.2)	.46

and Working Memory (t = 1.4, df = 159, *p* = .17) scores did not differ significantly between the groups. VIQ/PIQ difference scores ranged from −31 to +34 points. However, there was no significant difference between depressed subjects and controls in VIQ/PIQ discrepancy (patient mean = 4.6, SD = 10.9; control mean = 1.8, SD = 13.1; t = −1.3, df = 159, *p* = .19). The frequency of subjects with a standard deviation difference between VIQ and PIQ also did not differ between groups (30.8% of depressed subjects versus 24.4% of controls, χ^2 = .61, *p* = .43).

Among the subtests, group differences were found exclusively in tasks that involve speed demands. Digit Symbol (t = 3.9, df = 160, *p* < .01) and Symbol Search (t = 2.6, df = 158, *p* = .01) differed significantly between depressed subjects and controls; Block Design (t = 2.2, df = 158, *p* = .03) tended to differ between groups. Depressed subjects had poorer performance on the remaining timed subtest, Arithmetic, (t = 1.8, df = 160, *p* = .08), but this difference was not significant. Performance differences were not found on any of the
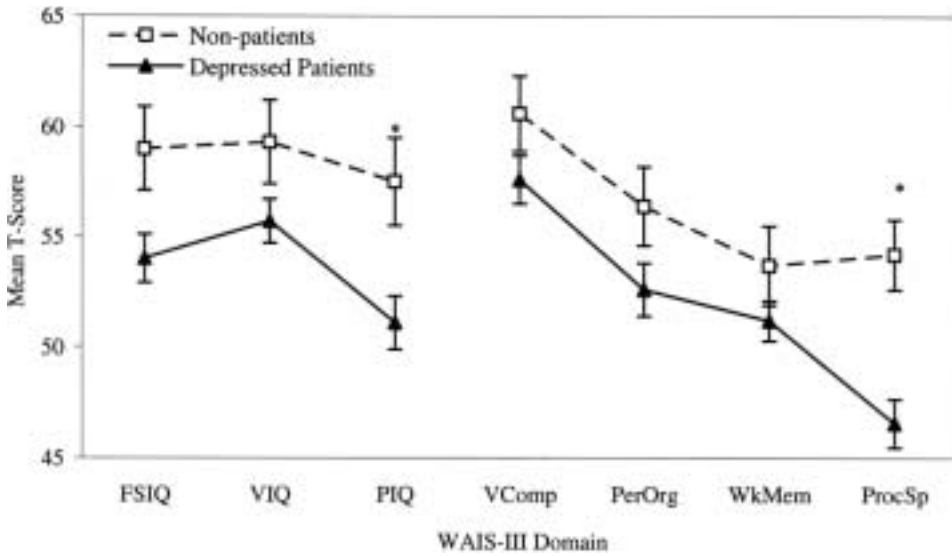
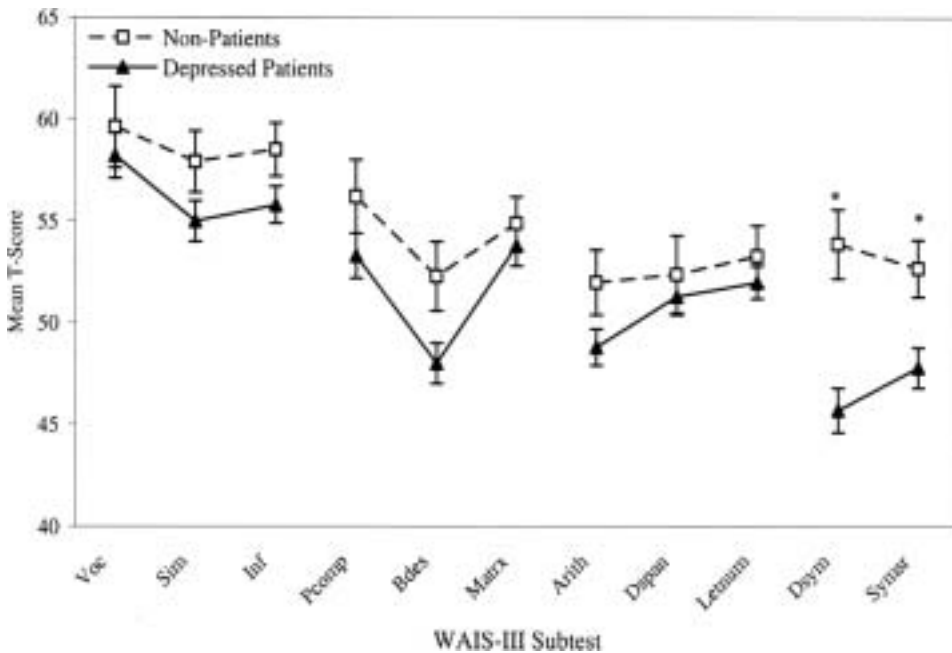**Figure 1.** Non-Patient and Depressed Patient WAIS-III IQ and Index T-Scores.

Figure 2. Non-Patient and Depressed Patient WAIS-III Subtest T-Scores.

untimed subtests: Vocabulary (t = 0.6, df = 160, p = .53), Information (t = 1.6, df = 160, p = .17), Similarities (t = 1.5, df = 160, p = .14), Picture Completion (t = 1.4, df = 159, p = .17), Matrix Reasoning (t = 0.6, df = 159, p = .58), Digit Span (t = 0.6, df = 160, p = .57), or Letter Number Sequencing (t = 0.7, df = 157, p = .46).

Major Depressive Disorder versus Bipolar Depression WAIS-III Performance

MDD and bipolar depression groups were comparable in age (t = 1.3, df = 119, p = .21), education (t = −.9, df = 119, p = .40) and both objective (t = .1, df = 119, p = .94) and subjective (t = .6, df = 118, p = .55) ratings of depression severity. Bipolar subjects had more episodes of depression (t = −3.3, df = 108, p < .01). MDD subjects had higher mean scores on all WAIS-III IQs, indices and subtests, but no differences were statistically significant.

Suicide Attempters versus Nonattempters

Suicide attempter and nonattempter subjects were similar in attained education (t = −1.0, df = 119, p = .31), and HDRS (t = 1.5, df = 119, p = .13) and BDI (t = 1.5, df = 118, p = .14) depression ratings. Suicide attempters had more prior hospitalizations (t = 5.9, df = 116, p < .01), and lower GAF scores (t = −2.6, df = 113, p = .01 with suicide assessment, although t = −2.2, df = 112, p = .03 without inclusion of suicide assessment). Attempters also had significantly more suicidal ideation prior to study entry (t = 4.8, df = 110, p < .01). Mean WAIS-III IQ, index and subtest scores, however, were comparable between attempters and nonattempters.

Melancholic versus Non-melancholic Depression

Clinically, melancholic subjects had higher HDRS scores (t = −3.0, df = 117, p = .003), more prior hospitalizations (t = −2.9, df = 115, p = .004), and lower GAF scores (t = 3.2. df = 111, p < .01 with suicide assessment, and t = 3.0, df = 110, p < .01 without). There were no significant differences on WAIS-III scores between melancholic and non-melancholic subjects.

Correlations Among WAIS-III Scores and Clinical Variables in Patients

Within the depression group, correlations were calculated between WAIS-III indices and subtests on which these subjects performed more poorly than the healthy comparison group, and key clinical variables. A modest but statistically significant negative correlation was found between Processing Speed and HDRS scores (r = −.23, p = .01). Processing Speed was positively correlated with GAF scores including (r = .28, p <.01) and excluding (r = .25, p = .01) suicide assessment.

Significant associations were also found with the subtests comprising Processing Speed. Symbol Search was significantly correlated with GAF scores with (r = .30, p < .01) and without (r = .26, p = .01) suicide assessment; its negative association with HDRS scores was not significant (r = −.15, p = .09). Digit Symbol was negatively correlated with HDRS scores (r = −.27, p < .01), and tended to be positively correlated with GAF scores (r = .23, p = .02 and r = .20, p = .03, respectively).

In a final supplementary analysis, no subtest or index differences attributable to history of substance use or dependence were found.

Discussion

Absence of VIQ/PIQ Discrepancy on the WAIS-III

Depressed subjects performed more poorly on the WAIS-III than healthy comparison subjects, but the significantly larger VIQ/PIQ difference reported in depressed subjects on the

WAIS-R was not found on the WAIS-III. With the division of PIQ into Perceptual Organization and Processing Speed components, deficits in depressed subjects appear restricted to Processing Speed. Sackeim et al. (1992) had earlier suggested that processing speed alone could not account for lower Performance IQ in depression because depressed subjects in their study performed more poorly on Block Design, whether or not the test was timed. The WAIS-III, however, modulates the effect of Block Design on Performance IQ by including an untimed test of visual-spatial functioning (Matrix Reasoning). Depressed subjects in the current study performed comparably to non-patients on Matrix Reasoning, and significant deficits were restricted to the subtests comprising the Processing Speed index. Though the depressed subjects tended to perform more poorly on Block Design, this nonverbal reasoning task contains a time constraint as a component of its administration.

It is possible that sample differences between the two studies account for these discrepant findings. The depressed subjects in the Sackeim et al. (1992) sample were older at time of assessment, had a markedly later age of onset relative to the current sample, were rated as more severely depressed, and may have had more treatment resistant depression (all were candidates for ECT). Stable PIQ deficits unrelated to symptom severity may be particular to that population's subtype of depression, but not characteristic of depression overall (Calev et al., 1999).

Several other factors may have contributed to the lack of depression-related VIQ/PIQ differences in the current study. Both depressed and control samples had high FSIQ scores and levels of education, which are associated with increased Verbal and Performance IQ variability (Kaufman, 1990). This trend is reflected in the WAIS-III normative data. With increasing ability level, variability among the IQ and index scores becomes more prevalent, and large VIQ/PIQ differences more common (Tulsky et al., 1997). In the current study, control subjects' index score profiles were by no means flat, and 24% had VIQ/PIQ differences of ten T-score points or greater.

Other changes in format between the WAIS-R and WAIS-III may also have affected the VIQ/PIQ difference. Relative to the WAIS-R, the WAIS-III does not utilize Object Assembly, a test with visuospatial and time demands, as a component of PIQ. The WAIS-III's reduction of PIQ bonus points for speedy performance impacts the discrepancy between the IQs for the same reason. It is possible that the depression profile found here on the WAIS-III would change if the complete test was used. However, previous studies do not suggest that Comprehension and Picture Arrangement subtests drive VIQ/PIQ differences (Sackeim et al., 1992).

Recent imaging studies suggest that dysregulation of the limbic system and subsequent suppression of frontal lobe function (Mayberg, 1997), particularly in the right hemisphere (Liotti & Mayberg, 2001), underlie the cognitive and affective impairments characteristic of depression. These theories have led to the study of discrete cognitive deficits in depression in tasks that are correlates of these anatomical areas, such as set shifting and selective attention (Austin et al., 1999) as well as visuospatial processing (Liotti & Mayberg, 2001). Such deficits might predict lower PIQ scores in depressed samples, and poorer performance on WAIS-III subtests that involve visuospatial abilities. However, the WAIS is not the ideal instrument to test such hypotheses. The composite subtests of this scale were assembled for their association to general intellectual ability, and may be less than ideal for highly sensitive measurement of specific neuropsychological functions. Nonetheless, the exclusive WAIS-III deficit in Processing Speed found here is noteworthy, because it suggests that cognitive problems in depression may be fundamentally related to a global loss of processing resources. The impairments seen with more focused neuropsychological

tests may reflect this more general deficit. For example, in geriatric depression, decreased processing resources appear to mediate performance on a variety of cognitive tasks, including tests of memory and visuospatial function (Nebes et al., 2000). Other studies similarly suggest that the reduction of processing efficiency in depression has a crucial influence on cognitive performance (Degl'Innocenti, Agren & Backman, 1998; Zakzanis, Leach & Kaplan, 1998). Thus, some visuospatial deficits found in depression may be a function of slowed visual tracking and processing speed.

WAIS-III Performance Profiles in Depression and its Subtypes

With the more refined characterization of intellectual ability provided by the WAIS-III and use of demographically corrected scores, we found that intellectual deficits in this relatively large and well-characterized sample of depressed subjects were clearly attributable to slower processing speed. Depressed subjects' Processing Speed index score was markedly lower relative to all of their other indices, and was the only index score to fall below the 50th percentile in this well-educated sample. All subtests that differed significantly between depressed subjects and non-patients contained a timing requirement. In addition, Processing Speed and its component subtests were the only indices and subtests consistently associated with objective and subjective measures of depression symptom severity. Moreover, slower processing speed cannot be ascribed to medication effects because these subjects were all assessed after psychotropic medication washout.

Psychomotor retardation is a key feature of depressive illness (Nelson & Chaney, 1981) and related to depression severity (Dantchev & Widlocher, 1998). It has also been associated specifically with the melancholic subtype of depression (Andreasen, Grove & Maurer, 1980; Dantchev & Widlocher, 1998; Parker et al., 1993), though it may not differentiate melancholia when clinical ratings of observable psychomotor changes (Benazzi, 2002) or performance measures (Austin et al., 1999; Cornell, Suarez & Berent, 1984; Dantchev & Widlocher, 1998; Sackeim et al., 1992) are used. Where differences in neuropsychological test performance have been detected between melancholic and non-melancholic patients, the differences may be accounted for by depression severity (Austin et al., 1999). The findings of the current study support this contention. The melancholic depression subtype subjects were found to have somewhat higher depression ratings, though this difference was not as large as some other studies of melancholic and non-melancholic subjects, and was not associated with intellectual impairment. The lack of difference between melancholic and non-melancholic subjects in Processing Speed further suggests that reduced cognitive processing resources is characteristic of depression in general.

No differences were found between MDD and bipolar subjects in the depressed phase of their illness. Several prior studies comparing MDD and bipolar depression also found no IQ differences between the groups (Abrams, Redfield & Taylor, 1981; Donnelly, Murphy, Goodwin & Waldman, 1982; Goldberg et al., 1993; Robertson & Taylor, 1985), though there is some indication that differences may exist during non-symptomatic periods (Paradiso, Lamberty, Garvey & Robinson, 1997). Lower PIQ (Borkowska & Rybakowski, 2001) and performance subtest scores (Donnelly et al., 1982) have been reported in some comparisons of MDD versus bipolar depression, but these studies have had smaller sample sizes.

No differences in WAIS-III performance were found between depressed subjects with and without a history of suicidal behavior. Some studies report poorer general intellectual functioning in attempters compared to nonpatient controls (Bartfai, Winborg, Nordstrom &

Asbery, 1990; Keilp et al., 2001), but those studies comparing attempters to psychiatrically-ill nonattempters have failed to find differences on the WAIS-R (Keilp et al., 2001) or IQ estimate scores (Ellis, Berg & Franzen, 1992). Since the WAIS-III is a test of global intellectual functioning, it may not be sensitive to more subtle variations in cognitive ability within subgroups of mood disordered subjects. Neuropsychological tests that measure more narrowly defined aspects of cognitive functioning may be necessary to detect them.

Conclusions

In sum, depression-related intellectual deficits on the WAIS-III are concentrated in Processing Speed, and consistent across depression subtypes. Further work is needed to determine whether Processing Speed scores improve with alleviation of depressive symptoms, or if this is a stable deficit in these patients.

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