I, Katiliya L Mundo, hereby submit this original work as part of the requirements for the degree of Master of Arts in Psychology.

It is entitled:
The Effects of Depression and Anxiety on Memory Functioning in Adults with Psychogenic Nonepileptic Seizures

Student's name: Katiliya L Mundo

This work and its defense approved by:

Committee chair: Steven Howe, PhD
Committee member: Paula Shear, PhD
Committee member: Jerzy Szafarski, MD, PhD
The Effects of Depression and Anxiety on Memory Functioning in Adults with Psychogenic Nonepileptic Seizures

A thesis submitted to the Graduate School
of the University of Cincinnati
in partial fulfillment of the
requirements for the degree of

MASTER OF ARTS

in the Department of Psychology
of the College of Arts and Sciences

2012

by

Katiliya L. Mundo

B.S., University of Georgia, 2006

Committee Chair: Steven R. Howe, Ph.D.
Committee Member: Paula Shear, Ph.D.
Committee Member: Jerzy Szafarlaski, M.D., Ph.D
Abstract

Background: No research to date has examined the impact of depression and anxiety on memory in those with psychogenic non-epileptic seizures (PNES). Individuals with PNES have more psychopathology, lower quality of life, and higher depression and anxiety when compared to patients with epilepsy (Szaflarski & Szaflarski, 2004). Furthermore, when compared to patients with epilepsy, these individuals rate their memory abilities as more impaired (Fargo et al., 2004). Preliminary findings suggest that individuals with PNES report more stressors and rate these stressors as more severe than do patients with epilepsy (Fargo et al., 2004). Since stress has been associated with increased levels of depression and anxiety (Kizilbash, Rodney & Curtiss, 2002) and depression and anxiety can result in memory impairment, it is possible that these two mood states may account for some of the reported memory impairment in this population. The current study will examine the relationship between memory functioning, depression, and anxiety in those with PNES. It was hypothesized that individuals with PNES who exhibit higher levels of depression and anxiety will have more memory impairment than those who exhibit lower levels of depression and anxiety.

Method: Patients in this study had a confirmed diagnosis of PNES. These patients also met the following criteria: a) age 18 or older; b) absence of epilepsy or other neurologic or psychiatric disorders other than depression or anxiety; c) a valid MMPI-2; d) not missing more than two of the memory measures described below, and d) a WAIS-R or WAIS-III Full Scale IQ score of 70 or above. A total of fifty-seven participants met the study criteria. All patients completed the MMPI-2. Scale 2 and scale 7 were used to measure self-reported levels of depression and anxiety, respectively. In addition, verbal memory was assessed using Logical Memory I and II, Verbal Paired Associates I and II, and Word Lists I and II from the WMS-III. Non-verbal
memory was assessed with the Benton Visual Retention Test and the Warrington’s Recognition of Memory Test for Faces. Scales 2 and 7 were treated as continuous variables for evaluating levels of depression and anxiety. Item-analysis was performed to find composites of the memory measures. Multiple regression analyses were then used to examine the relationship between these memory measures and both depression and anxiety.

**Results and Discussion:** The findings of this study did not support the hypothesis. Specifically, there was no significant relationship between these mood and anxiety symptoms and memory impairment. The primary limitation of the current study was that it utilized two scales of the MMPI-2, a widely used self-report measure. The use of scales 2 and 7 of the MMPI-2 to assess depressive and anxiety symptoms may not have accurately captured these mood states. Future studies should explore objective methods of measuring depressive and anxiety symptoms in this population (e.g., cortisol levels).
List of Tables

1. Psychogenic Nonepileptic Seizure Characteristics.................................................................16
2. MMPI-2 Sample Data and Comparisons to the Normative Mean..............................................17
3. Wechsler Memory Scale- Third Edition Sample Data and Comparisons to the Normative
   Mean........................................................................................................................................18
4. Sample and General Population Means and Standard Deviations for the WRMT by Age.................................................................................................................................19
5. Sample Means and Standard Deviations for the BVRT..............................................................20
6. Correlations for the Memory Measures ....................................................................................21
7. Multiple Regression Results......................................................................................................22
Introduction

Up to one half of those seeking diagnosis of their seizure disorders in epilepsy monitoring units are diagnosed with psychogenic nonepileptic seizures (PNES; Hovorka, Nezadal, Herman, Nemcova, & Bajacek, 2007). These are episodes of modified sensations, movements, or experiences that are in certain ways similar to epilepsy but are the result of psychological processes rather than epileptiform activity in the brain (O’Sullivan et al., 2007). Studies suggest that individuals with PNES rate their memory abilities as more impaired when compared to patients with epilepsy (Fargo et al., 2004). Since depression and anxiety can be associated with memory impairment (e.g., Kizilbash, Vanderploeg, & Curtiss, 2002), it is possible that these mood and anxiety disorders may account for some of the reported memory impairment in the PNES population.

Depression and anxiety are among the most prevalent psychiatric disorders in the general population (Bjelland 2004). Among mental disorders, depression has been rated the fourth highest for years lived with disability and sum of years lost due to premature mortality, or disability-adjusted life years (DALY), and it is expected to become the second most important cause of DALY by the year 2020 (Bjelland 2004). Anxiety disorders are estimated to account for 31% of the total costs for treatment of mental illness (Bjelland 2004).

Research shows that both depression and anxiety can have negative effects on memory (Kizilbash, Vanderploeg, & Curtiss, 2002; Airaksinen, Larsson, Lundberg, & Forsell, 2004). Specifically, depression and anxiety alone can result in decreases in the ability to immediately recall new information, as well as the amount of acquisition (Kizilbash, Rodney, Vanderploeg, & Curtiss, 2002). In addition to these deficits, people with high levels of both depression and
anxiety can experience impairments in the retention of new information (Kizilbash, Rodney, Vanderploeg, & Curtiss, 2002).

Recently, a growing interest in depression and anxiety has emerged in epilepsy research (Johnson, Jones, Seidenberg, & Hermann, 2004; Szafarski & Szafarski, 2004; Testa, Schefft, Szafarski, Yeh, & Privitera, 2007). Epilepsy is a common neurological disorder with a prevalence rate of 0.5 - 0.8 percent (Fisher et al., 2000). In addition, epilepsy is inadequately controlled in about 30% of patients (Fisher et al., 2000). Furthermore, even among those patients whose seizures remain adequately controlled, the fear of having another seizure remains a constant worry (Fisher et al., 2000). In conjunction with this fear, epilepsy can impair the ability to work, to drive, and maintain social relationships (Fisher et al., 2000). It can also negatively affect a person’s self-esteem and self-image (Fisher et al., 2000).

Epilepsy can result in impairment in cognitive functioning (Jokeit & Schacher, 2003; Aldenkamp, Baker, Meador, 2003; Black et al., 2010; Kent et al., 2006). An enormous body of research has shown that many individuals with epilepsy have impaired memory, and many patients report this impairment to be more debilitating than their actual seizures (Aldenkamp, Baker, Meador, 2003). In those with temporal lobe epilepsy (TLE), memory has been shown to be the most affected cognitive domain (Hermann, Seidenberg, Schoenfeld, & Davies, 1997).

Depression and anxiety are the most commonly reported psychiatric disorders among individuals diagnosed with epilepsy, and each has a prevalence rate in individuals with epilepsy that is significantly higher than is found in the general population (Reuber, Anderson, & Helmstaedter, 2004). Depression and anxiety have been linked to impairments in language on the Boston Naming Test, Controlled Oral Word Association Task, Animal Naming, and Token Test in a sample of patients with epilepsy (Ramirez, 2010). The same study also found that perceived
depression and anxiety moderated language performance. On tasks that typically rely on the integrity of the temporal lobe (e.g., Boston Naming Test, category fluency), anxiety was associated with poorer performance in those with temporal lobe epilepsy (TLE) when compared to those with frontal lobe epilepsy (FLE; Ramirez, 2010). Depression was associated with poorer language performance on tasks that were intrinsic to the underlying epileptogenic lesion (Ramirez, 2010). For example, performance on the Boston Naming Test was negatively affected by depression in those with left TLE compared to those with right TLE, and depression negatively affected performance on the Word Fluency test in those with FLE compared to those with right TLE (Ramirez, 2010).

A more recent study conducted with medically intractable TLE patients showed that higher levels of depression and anxiety (as assessed by MMPI scales 2 and 7, respectively) were associated with poorer verbal memory but not with non-verbal memory (Baker, unpublished master’s thesis). Thus, in addition to the known memory problems in this patient population, their emotional status may confer risk for cognitive dysfunction.

No research to date has examined the impact of depression and anxiety on memory in individuals with PNES. Individuals with PNES have more psychopathology, lower quality of life, and more depression and anxiety when compared to patients with epilepsy (Bautista, Gonzales-Salazar, & Ochoa, 2008; Szafarski & Szafarski, 2004; Testa, Schefft, Szafarski, Yeh, & Privitera, 2007). Preliminary findings suggest that individuals with PNES report more stressors and rate these stressors as more severe than do patients with epilepsy (Tojek, Lumley, Barkley, Mahr, & Thomas, 2000). Furthermore, when compared to patients with epilepsy, these individuals rate their memory abilities as more impaired (Fargo et al., 2004).
Baker (unpublished master’s thesis) examined the effects of depression and anxiety (as assessed by MMPI scales 2 and 7) on memory functioning in patients with medically intractable TLE and found that depression and anxiety negatively affected verbal memory. His methodology is relevant to the current study because he used the same archival data base as is used in this study and because his measures were identical to those used here. He used Logical Memory I and II, Verbal Paired Associates I and II, and Word Lists I and II from the Wechsler Memory Scale-III as verbal memory indices. For non-verbal memory indices, he included the Warrington Recognition Memory Test for Faces and the Benton Visual Retention Test. Prior to performing his main analyses, Baker conducted a factor analysis to determine whether the memory measures loaded onto two latent variables, specifically verbal and non-verbal memory. His final factor analyses revealed two factors: FACTOR VERBAL (composed of all the verbal memory indices) and RMT FACES (composed of one non-verbal memory measure, the Warrington Recognition Memory Test for Faces). The Benton Visual Retention Test was excluded from the analyses because it did not load highly on any factor (Baker, master’s thesis). He concluded that this measure is not a pure measure of nonverbal memory abilities because it places much demand on other cognitive processes, such as organization, constructional praxis, and sequencing (Baker, master’s thesis).

The current study will examine the relationship between memory functioning, depressive symptoms, and anxiety symptoms in those with PNES. Depressive and anxiety symptoms were measured by the Minnesota Multiphasic Personality Inventory – 2. It was hypothesized that individuals with PNES who exhibit higher levels of depressive and anxiety symptoms would have more memory impairment than those who exhibit lower levels of depressive and anxiety symptoms.
Method

Participants

This is a retrospective study of data collected from individuals who had undergone pre-surgical evaluation of medically intractable seizures on the Epilepsy Monitoring Unit at University Hospital in Cincinnati, Ohio. The current study is an analysis of archival data from clinical neuropsychological evaluations and medical records. All aspects of the study were approved by the University of Cincinnati Institutional Review Board.

Patients in this study had a confirmed diagnosis of PNES based on the results of prolonged video/EEG monitoring at University Hospital showing an absence of epileptiform activity in the brain during typical seizure episodes. These patients also met the following criteria: a) age 18 or older; b) absence of comorbid neurological disorders or psychiatric disorders, other than depression, anxiety, or PNES (to ensure that the results were not confounded by other ailments); c) a valid Minnesota Multiphasic Personality Inventory – 2 (MMPI-2); d) no more than two memory measures missing, and d) a Wechsler Adult Intelligence Scale – Revised (WAIS-R) or Wechsler Adult Intelligence Scale-III (WAIS-III) Full Scale IQ score of 70 or above (to exclude individuals who were more likely to have difficulty completing the neuropsychological measures). A total of fifty-seven participants met the study criteria.

Measures

All patients completed the MMPI-2, a widely used self-report measure employed for assessing personality and psychopathology (Rademaker, Kleber, Meijer, & Vermetten, 2009). All reported results are T scores. Profiles with the following scores were considered invalid and were not included in the study: L ≥ 80, K ≥ 65, and F ≥ 80 (Graham, 2006). From the MMPI-2,
scale 2 was used to measure level of depressive symptoms and scale 7 was used to measure level of anxiety symptoms.

Six subtests of the WMS-III (Logical Memory I and II, Verbal Paired Associates I and II, and Word Lists I and II; Tulsky, Zhu, & Ledbetter, 1997) were included in this study to examine verbal memory. Logical Memory assesses an individual’s ability to remember information presented within a story context. In Verbal Paired Associates, eight semantically unrelated words (e.g., Star-Ladder) are verbally administered four times, and the examinee is required to recall these word pairs each time. Lastly, in Word Lists the examiner presents a list of twelve unrelated words four times, and the examinee is required to recall as many words he or she can remember from that list. From this memory measure, four scores are obtained: 1) total recall (total number of words recalled immediately after the four trials); 2) interference (degree to which distracters interfere with recollection of target stimuli); 3) delayed recall (amount of information recalled after a delay); and 4) recognition (number of target stimuli recognized from a list).

Non-verbal memory was assessed with the Benton Visual Retention Test (BVRT; Benton, 1974) and the Warrington Recognition Memory Test (WRMT; Warrington, 1984). On the BVRT, ten geometric designs are presented individually for ten seconds (some of which include two figures). After each stimulus presentation, the examinee is required to reconstruct the design from memory on a blank sheet of paper. Two scores describe the overall performance on this measure; total designs correctly constructed and number of errors. On the WRMT, 50 black and white pictures of faces are presented to the examinee for approximately three seconds each. The examinee is then asked to recall which face he or she had previously seen in a forced choice recognition task that includes one target and one foil in each pair that is presented.
**Procedure**

The MMPI-2 and memory test data were obtained from the comprehensive neuropsychological examination that is routinely administered during each patient’s admission to the Epilepsy Monitoring Unit as part of the epilepsy evaluation. T scores equal to or above 65 on Scale 2 (Depression) or Scale 7 (Psychasthenia) are representative of clinically significant levels of depressive and anxiety symptoms, while lower scores (T < 65) on these scales are not.

**Data Analysis**

Scales 2 (Depression) and 7 (Psychasthenia) of the MMPI-2 were treated as continuous variables for evaluating levels of depressive and anxiety symptoms. Item-analysis was performed to find composites of the memory measures that had high internal consistency. Multiple regression analyses were then used to examine the relationship between these memory composites and both depressive and anxiety symptoms.

**Results**

Descriptive statistics for the final PNES sample are shown in Table 1. The means and standard deviations for all the scales from the MMPI-2 are shown in Table 2. The Full Scale IQ for the PNES sample is significantly lower than the normative mean for the general population, $t(56) = -6.32, p < .002, d = -0.90$. Additionally, with the exception of scale 5, all of the MMPI-2 scale means in the sample are significantly higher than in the general population (Table 2).

The means and standard deviations on the memory measures are shown in Tables 3 - 5. On the Wechsler’s Memory Scale- Third Edition subtests, only scores on the Verbal Paired Associates- Immediate Recall were significantly lower than the general population (Table 3). On the Warrington Recognition Memory Test, the PNES sample’s scores for those ages 18-39 and 40-54 were significantly lower than the general population (Table 4). Those ages 55-70 were not
significantly different than the general population. The sample means and standard deviations for the Benton Visual Retention Test are shown in Table 5.

Item-analysis was performed to find composites for the memory measures that had high internal consistency. The correlations among the memory measures are shown in Table 6. Based on the correlation matrix, LMI, LMD, VPAI, VPAD, WLT, WLD, WLI, and WLR almost all consistently had moderate to strong correlations with each other. BVRTNE and BVRTNC also correlated with some of the Wechsler memory measures (i.e., LMI, VPAD). In contrast, the WRMT did not correlate significantly with any of the memory measures. Cronbach’s alpha was first calculated for the eight WMS subscales. They had good internal consistency ($\alpha = 0.87$); thus they were combined to form one memory composite, VMEM (Verbal Memory). Next, Cronbach’s alpha was evaluated to determine whether BVRTNC, BVRTNE, and WRMT could be combined to form a composite. The internal consistency was low ($\alpha = 0.59$). After removing WRMT, the internal consistency greatly increased ($\alpha = 0.89$). Based on these results, BVRTNC and BVRTNE were combined to form one memory composite, whereas WRMT was analyzed independently.

The predictors (MMPI-2 scales 2 and 7) and criterion variables (VMEM, BVRT, WRMT) were not correlated with each other. One way in which this might have occurred would be restriction of range in this sample on the MMPI-2 measures. However, evaluation of scatterplots for the predictor and criterion variables suggested no reason to believe that if the relationships had been extrapolated across a wider range of scores that there would have been a markedly higher correlation.

Multiple regressions were used to investigate whether depressive symptoms, anxiety symptoms, and the additive effects of both are associated with memory performance. Tests of the
null hypothesis that $R^2 = 0$ were non-significant, VMEM, $F(2, 52) = 0.11, p = 0.90; R^2 = 0.00$, BVRT, $F(2, 52) = 0.73, p=0.49; R^2 = 0.03$ and WRMT, $F(2,52)=0.36, p=0.70, R^2 = 0.01$, respectively. In none of the models were the $b$ weights for either predictor significantly different from zero (Table 7). An interaction term was incorporated into the model to determine if the multiplicative effects of depressive and anxiety symptoms had a significant influence on these three memory measures. To reduce the impact of multicollinearity, the interaction was centered before the analyses were performed. Results show that the centered interaction between these two moods did not significantly predict memory functioning. The overall model $F$ and the univariate terms for the centered interaction were not significant, therefore only the results from the analyses without the interaction were reported.

In Baker’s study (unpublished master’s thesis), he used the combined average of scale 2 (Depression) and scale 7 (Psychasthenia) for each individual. To eliminate the possibility of differential findings due to methodological differences between Baker’s (master’s thesis) study and this study, the analyses were conducted again using Baker’s (master’s thesis) methods. Results show that the combined average of scales 2 (Depression) and 7 (Psychasthenia) were not significant predictors of memory functioning.

It is known that this population typically presents with the highest MMPI-2 elevations on scales 1 and 3 (Binder & Salinsky, 2007). Consistent with this finding, the highest elevations for this sample were scale 1 and 3 (Table 2). Since this population typically exhibits the highest elevations in these scales, it may be possible that the reported memory impairment is associated with the levels of these scales and not scales 2 and 7. To test this hypothesis, three multiple regressions were conducted with scales 1 and 3 as the predictor variables. No relationship was found between the memory measures and these scales. Thus, the possibility that the
psychopathology found in the highest elevated scales (scale 1 and 3) may be contributing to the reported memory impairment was not supported.

Discussion

It was hypothesized that those with PNES who exhibit higher levels of depressive and anxious symptoms would have more memory impairment than those who exhibit lower levels of these symptoms. The findings of this study did not support the hypothesis. Specifically, there was no significant relationship between these depression and anxiety scale elevations on the MMPI-2 and memory impairment. Given that depression and anxiety have been shown to negatively impact memory (Kizilbash, Rodney, Vanderploeg, & Curtiss, 2002), I had expected to see decreased memory performance in those with PNES, particularly those individuals endorsing high levels of depression and anxiety symptoms on the MMPI-2, but such was not the case.

An important contributor to the negative findings was likely the relative lack of measured memory dysfunction in the PNES group. Research has shown that patients with PNES report roughly equivalent amounts of memory impairment to those with epilepsy despite normal objective memory performance (Fargo et al., 2004; Drane et al., 2006). Thus, the present finding that this sample was not clinically impaired on the neuropsychological measures is consistent with the published literature.

Another limitation is that the MMPI-2 scales 2 and 7 are not specific to mood and anxiety symptoms in this population. Research has demonstrated the presence of a “somatic effect” when utilizing the MMPI-2 to assess depressive symptoms in those with epilepsy (Karzmark, Zeifert, and Barry 2001). This “somatic effect” refers to the potential bias in somatic content in the items that comprise the depression scale. For instance, Karzmark, Zeifert, and Barry (2001) compared the ability of scale 2 of the MMPI-2 and the Beck Depression Inventory in accurately assessing...
depressive symptoms in those with epilepsy. They found that the Beck Depression Inventory was more effective than scale 2 at assessing depressive symptoms in this population. It was suggested that scale 2 may not have accurately measured the amount of this mood in patients with epilepsy because they may have endorsed items in the depression scale that reflect their somatic symptoms (resulting from their disorder) rather than symptoms of depression. Even though those with PNES do not have epilepsy they still report experiencing somatic symptoms, thus it is possible that scale 2 may not have accurately measured the amount of this mood reported in this sample. Review of the literature did not discover research investigating the validity of scale 7 to accurately measure anxiety symptoms in this population. However, it may be possible that some of the items loading onto scale 7 may have reflected symptoms of the disorder than actual symptoms of anxiety. The utilization of other measures to assess these mood and anxiety symptoms may show a relationship between memory, depression and anxiety in this population.

The primary limitation of the current study was that it utilized two scales of the MMPI-2, a widely used self-report measure (Rademaker, Kleber, Meijer, & Vermetten, 2009). As mentioned earlier, the use of scales 2 and 7 of the MMPI-2 to assess depressive and anxiety symptoms may not have accurately captured these mood states. The items that load onto scale 2 have somatic content that may be elevated as a direct result of the disorder (PNES) rather than symptoms of depression (Karzmark, Zeifert, and Barry 2001). Additionally, this method of determining an individual’s level of depressive and anxiety symptoms is very subjective. Many individuals with conversion disorders, such as PNES, may be unaware of the emotional conflict they may be experiencing (Devinsky, Mesad, & Alper, 2001). Future studies should explore objective methods of measuring depressive and anxiety symptoms in this population (e.g., cortisol levels).
Overall, this study failed to find a significant relationship between levels of depressive symptoms, anxiety symptoms and memory functioning in those with PNES as originally hypothesized. It is striking that these patients had highly elevated MMPI profiles yet their memory was in general within normal limits. However, the measures employed to assess depressive and anxiety symptoms may not have accurately captured these mood states, nor was a structured interview included to assess whether patients met diagnostic criteria for specific mood or anxiety disorders. Future studies should re-examine this question using different methods for measuring and examining the impact of depression and anxiety on memory functioning in this population (i.e., measuring cortisol levels; obtaining an objective measure of duration and controlling for its effects).

References


Table 1
*PNES Sample Characteristics (n=57).*

<table>
<thead>
<tr>
<th></th>
<th>M</th>
<th>SD</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age (years)</td>
<td>39</td>
<td>11</td>
</tr>
<tr>
<td>Full Scale IQ*</td>
<td>91</td>
<td>10</td>
</tr>
<tr>
<td>Education</td>
<td>12.79</td>
<td>2.09</td>
</tr>
<tr>
<td>Sex</td>
<td>77% Females</td>
<td></td>
</tr>
<tr>
<td>Race</td>
<td>93% White</td>
<td></td>
</tr>
</tbody>
</table>

* $t(56) = -6.32, p < 0.001$
Table 2

**MMPI-2 Sample Data and Comparisons to the Normative mean (n=57).**

<table>
<thead>
<tr>
<th>Scales</th>
<th>M</th>
<th>SD</th>
<th>t</th>
<th>p</th>
<th>d</th>
</tr>
</thead>
<tbody>
<tr>
<td>Scale 1 (Hs)</td>
<td>74</td>
<td>12</td>
<td>15.57</td>
<td>.00</td>
<td>2.00</td>
</tr>
<tr>
<td>Scale 2 (D)</td>
<td>70</td>
<td>13</td>
<td>11.64</td>
<td>.00</td>
<td>1.54</td>
</tr>
<tr>
<td>Scale 3 (Hy)</td>
<td>74</td>
<td>14</td>
<td>12.93</td>
<td>.00</td>
<td>1.71</td>
</tr>
<tr>
<td>Scale 4 (Pd)</td>
<td>56</td>
<td>11</td>
<td>4.01</td>
<td>.00</td>
<td>0.55</td>
</tr>
<tr>
<td>Scale 5 (MF)</td>
<td>50</td>
<td>9</td>
<td>0.04</td>
<td>.96</td>
<td>0.00</td>
</tr>
<tr>
<td>Scale 6 (Pa)</td>
<td>56</td>
<td>12</td>
<td>4.13</td>
<td>.00</td>
<td>0.50</td>
</tr>
<tr>
<td>Scale 7 (Pt)</td>
<td>63</td>
<td>13</td>
<td>7.85</td>
<td>.00</td>
<td>1.00</td>
</tr>
<tr>
<td>Scale 8 (Sc)</td>
<td>66</td>
<td>12</td>
<td>10.74</td>
<td>.00</td>
<td>1.33</td>
</tr>
<tr>
<td>Scale 9 (Ma)</td>
<td>57</td>
<td>12</td>
<td>4.63</td>
<td>.00</td>
<td>0.58</td>
</tr>
<tr>
<td>Scale 0 (Si)</td>
<td>54</td>
<td>11</td>
<td>2.84</td>
<td>.00</td>
<td>0.36</td>
</tr>
</tbody>
</table>

*Note: MMPI-2= Minnesota Multiphasic Multiple Personality Inventory- Second Edition; Hs = Hypochondriasis; D =Depression; Hy =Hysteria; Pd = Psychopathic Deviant; MF =Masculinity/Femininity; Pa = Paranoia; Pt = Psychasthenia; Sc = Schizophrenia; Ma =Hypomania; Si = Social Introversion; t = single sample t-score in relation to the general population; p = probability value for the single sample t-score.*
Table 3
Wechsler Memory Scale – Third Edition Sample Data and Comparisons to the Normative Mean (n=57).

<table>
<thead>
<tr>
<th>Subtests</th>
<th>M</th>
<th>SD</th>
<th>t</th>
<th>p</th>
<th>d</th>
</tr>
</thead>
<tbody>
<tr>
<td>LMI</td>
<td>9.53</td>
<td>2.84</td>
<td>-1.26</td>
<td>0.21</td>
<td>-0.17</td>
</tr>
<tr>
<td>LMD</td>
<td>9.98</td>
<td>2.86</td>
<td>-0.05</td>
<td>0.96</td>
<td>-0.01</td>
</tr>
<tr>
<td>VPAI</td>
<td>8.96</td>
<td>3.15</td>
<td>-2.48</td>
<td>0.02</td>
<td>-0.33</td>
</tr>
<tr>
<td>VPAD</td>
<td>9.26</td>
<td>3.59</td>
<td>-1.55</td>
<td>0.13</td>
<td>-0.21</td>
</tr>
<tr>
<td>WLT</td>
<td>9.42</td>
<td>3.12</td>
<td>-1.40</td>
<td>0.17</td>
<td>-0.19</td>
</tr>
<tr>
<td>WLD</td>
<td>9.85</td>
<td>3.13</td>
<td>-0.34</td>
<td>0.73</td>
<td>-0.05</td>
</tr>
<tr>
<td>WLI</td>
<td>9.32</td>
<td>2.95</td>
<td>-1.72</td>
<td>0.09</td>
<td>-0.22</td>
</tr>
<tr>
<td>WLR</td>
<td>9.78</td>
<td>3.24</td>
<td>-0.50</td>
<td>0.62</td>
<td>-0.07</td>
</tr>
</tbody>
</table>

Note: LMI = Logical Memory- Immediate Recall; LMD = Logical Memory Delayed Recall; VPAI = Verbal Paired Associates- Immediate Recall; VPAD = Verbal Paired Associates- Delayed Recall; WLT = Word Lists – Immediate Total Recall; WLD = Word Lists- Delayed Recall; WLI = Word List Interference; WLR = Word Lists Recognition; The general population mean for each VMEM subtests is 10. The general population standard deviation for each subtest is 3.
Table 4

Sample and General Population Means and Standard Deviations for WRMT by age (n=56).

<table>
<thead>
<tr>
<th></th>
<th>Ages 18-39 (n=27)</th>
<th>Ages 40-54 (n=23)</th>
<th>Ages 55-70 (n=6)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>M</td>
<td>SD</td>
<td>M</td>
</tr>
<tr>
<td>WRMT</td>
<td>40.63&lt;sup&gt;a&lt;/sup&gt;</td>
<td>4.01</td>
<td>39.35&lt;sup&gt;b&lt;/sup&gt;</td>
</tr>
<tr>
<td>General Population</td>
<td>43.60</td>
<td>3.30</td>
<td>44.30</td>
</tr>
</tbody>
</table>

Note: WRMT = Warrington's Recognition of Memory For Faces.
<sup>a</sup> t(26) = -3.85, p = 0.00, d = -0.75; <sup>b</sup> t(22) = -5.71, p = 0.00, d = -1.19; <sup>c</sup> t(5) = -0.55, p = 0.61, d = -0.22.
Table 5
*Sample Means and Standard Deviations for the BVRT* (n=57).

<table>
<thead>
<tr>
<th>BVRT Subtests</th>
<th>M</th>
<th>SD</th>
</tr>
</thead>
<tbody>
<tr>
<td>BVRTNC</td>
<td>8.88</td>
<td>3.29</td>
</tr>
<tr>
<td>BVRTNE</td>
<td>9.38</td>
<td>3.46</td>
</tr>
</tbody>
</table>

*Note: BVRTNC = Benton Visual Retention Test Number of Correct; BVRTNE = Benton Visual Retention Test Number of Errors.*
Table 6

Correlations of Memory Measures

<table>
<thead>
<tr>
<th></th>
<th>LM</th>
<th>VPA</th>
<th>VPA</th>
<th>WL</th>
<th>WL</th>
<th>WL</th>
<th>WL</th>
<th>BVRTN</th>
<th>BVRTN</th>
<th>WRM</th>
</tr>
</thead>
<tbody>
<tr>
<td>D</td>
<td>0.85</td>
<td>0.34</td>
<td>0.33</td>
<td>0.43</td>
<td>0.33</td>
<td>0.30</td>
<td>0.36</td>
<td>0.27</td>
<td>0.30</td>
<td>0.28</td>
</tr>
<tr>
<td>I</td>
<td>0.42</td>
<td>0.46</td>
<td>0.33</td>
<td>0.45</td>
<td>0.30</td>
<td>0.47</td>
<td>0.39</td>
<td>0.36</td>
<td>0.28</td>
<td></td>
</tr>
<tr>
<td>D</td>
<td>0.81</td>
<td>0.34</td>
<td>0.53</td>
<td>0.40</td>
<td>0.49</td>
<td>0.12</td>
<td>0.16</td>
<td>0.25</td>
<td></td>
<td></td>
</tr>
<tr>
<td>I</td>
<td>0.43</td>
<td>0.59</td>
<td>0.30</td>
<td>0.51</td>
<td>0.38</td>
<td>0.45</td>
<td>0.27</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>T</td>
<td>0.70</td>
<td>0.10</td>
<td>0.32</td>
<td>0.37</td>
<td>0.38</td>
<td>0.06</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>D</td>
<td>0.30</td>
<td>0.50</td>
<td>0.47</td>
<td>0.44</td>
<td>0.16</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>I</td>
<td>0.36</td>
<td>0.00</td>
<td>0.11</td>
<td>0.02</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>R</td>
<td>0.36</td>
<td>0.31</td>
<td>0.03</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>C</td>
<td>0.79</td>
<td>0.03</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>E</td>
<td>0.06</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Note: LMI = Logical Memory- Immediate Recall; LMD = Logical Memory Delayed Recall; VPAI = Verbal Paired Associates- Immediate Recall; VPAD = Verbal Paired Associates- Delayed Recall; WLT = Word Lists – Immediate Total Recall; WLD = Word Lists- Delayed Recall; WLI = Word List Interference; WLR = Word Lists Recognition; BVRTNC = Benton Visual Retention Test Number Correct; BVRTNE = Benton Visual Retention Test Number of Errors; WRMT = Warrington's Recognition of Memory for Faces.
Table 7
*Multiple Regression Results.*

<table>
<thead>
<tr>
<th>Source</th>
<th>VMEM</th>
<th></th>
<th></th>
<th>BVRT</th>
<th></th>
<th></th>
<th>WRMT</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>B</td>
<td>t</td>
<td>p</td>
<td>b</td>
<td>t</td>
<td>P</td>
<td>b</td>
<td>t</td>
<td>p</td>
</tr>
<tr>
<td>MMPID</td>
<td>0.00</td>
<td>-0.04</td>
<td>0.97</td>
<td>0.00</td>
<td>0.08</td>
<td>0.94</td>
<td>0.05</td>
<td>0.95</td>
<td>0.35</td>
</tr>
<tr>
<td>MMPIPT</td>
<td>0.01</td>
<td>0.36</td>
<td>0.72</td>
<td>0.04</td>
<td>0.82</td>
<td>0.41</td>
<td>-0.04</td>
<td>-0.71</td>
<td>0.48</td>
</tr>
</tbody>
</table>

*Note:* MMPID = Minnesota Multiphasic Multiple Personality Inventory- Depression; MMPIPT = Minnesota Multiphasic Multiple Personality Inventory- Psychasthenia; VMEM = Composite Variable Verbal Memory; BVRT = Composite Variable Benton Visual Retention Test; WRMT = Warrington Recognition of Memory for Faces.