**Introduction**

Embedded indices of effort within neuropsychological tests ensure appropriate effort throughout batteries and are not as easily detected by individuals feigning cognitive disorders (Greve & Bianchini, 2004; Hook, Marquine & Hoelzle, 2009). To date, two embedded indices of effort have been developed for the Repeatable Battery for the Assessment of Neuropsychological Status (RBANS; Randolph, 1998); the Effort Index (Silverberg, Wertheimer, & Fichtenberg, 2007) and the Effort Scale (Novitski, Steele, Karantzoulis & Randolph, 2012).

The Effort Index (EI) was developed and subsequently validated in a sample of individuals with mild Traumatic Brain Injury by Silverberg and colleagues (2007). Other researchers have examined the use of the EI in various samples. Hook and colleagues (2009) used the EI in a medically ill older adult sample and found support for the EI, with the caveat that the EI is not appropriate for those with severe cognitive impairment. Barker and colleagues (2010) applied the EI in a large older adult sample and found support for the index, but not without a stand-alone measure; the researchers reported a sensitivity of 64% and a specificity of 85%.

The Effort Scale (ES) was developed by Novitski et al. (2012) to discriminate between poor effort and amnestic disorders. These researchers caution that high false positive rates may be found if the ES is used in a population without genuine cognitive impairment; this is due to a ceiling effect that is inherent in the List Recognition subtest. The current study examines specificity of the EI and ES among elderly individuals.

**Participants and Methods**

Archived cases from an inpatient unit that specializes in older adult psychiatric concerns (i.e., dementia, bipolar, and schizophrenia) were used in this study. Fifty-two archived cases that included a discharge diagnosis from a geriatric psychiatrist of Alzheimer’s Disease (AD; N = 10), Vascular Dementia (VaD; N = 16), Mixed-type Dementia (MTD; N = 7), Dementia Not Otherwise Specified (D-NOS; N = 9), or No Cognitive Impairment (NCI; N = 10) and had available RBANS protocols were used. The mean age of the sample was 74.5 (SD = 6.4) with an average of 12.06 (SD = 3.27) years of education. All fifty-two participants had co-morbid medical diagnoses and identified as Caucasian. The average hospitalization was 7.85 days (SD = 3.91) while medication levels were determined and patients were stabilized to be discharged to lower levels of care.

**Results**

EI and ES scores were calculated for each participant using the methods derived from the Silverberg et al. (2007) and Novitski et al. (2012) studies. A cut-off of > 3 was used for the EI (Silverberg et al., 2007) and < 12 was used for the ES (Novitski et al., 2012).

- Specificity of the ES for the total sample was 63.5%, 100% in the AD group, 75% in the VaD group, 57.1% in the MTD group, 55.6% in the D-NOS group, and 20% in the NCI group.
- EI specificity was 76.9% in the total sample, 70% in the AD group, 87.5% in the VaD group, 42.9% in the MTD group, 66.7% in the D-NOS group, and 100% in the NCI group. See Table 1.

**Table 1. Specificity of the EI and ES by Diagnostic Category**

<table>
<thead>
<tr>
<th></th>
<th>Alzheimer’s Disease</th>
<th>Vascular Dementia</th>
<th>Mixed Type Dementia</th>
<th>Dementia NOS</th>
<th>NCI</th>
<th>TOTAL</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Effort Index</strong></td>
<td>70%</td>
<td>87.5%</td>
<td>42.9%</td>
<td>66.7%</td>
<td>100%</td>
<td>76.9%</td>
</tr>
<tr>
<td><strong>Effort Scale</strong></td>
<td>100%</td>
<td>75%</td>
<td>57.1%</td>
<td>55.6%</td>
<td>20%</td>
<td>63.5%</td>
</tr>
</tbody>
</table>

*Note: NCI = No Cognitive Impairment*
Pearson product moment correlation coefficient indicated a moderate, negative correlation between the EI and RBANS Total Scale score, $r = -0.53$, $n = 52$, $p < 0.001$.

There was also a moderate, negative correlation between the ES and RBANS Total Scale score, $r = -0.62$, $n = 52$, $p < 0.001$, and between the ES and years of education, $r = -0.38$, $n = 52$, $p < 0.05$.

There was a small to moderate positive correlation between the years of education and RBANS total score, $r = 0.34$, $n = 52$, $p = 0.14$, See Table 2.

### Table 2. Relationship of the RBANS EI and ES between Demographics and RBANS Total Scaled Score

<table>
<thead>
<tr>
<th></th>
<th>EI</th>
<th>ES</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age</td>
<td>0.27, $p = 0.06$</td>
<td>0.07, $p = 0.61$</td>
</tr>
<tr>
<td>Education</td>
<td>-0.29, $p = 0.074$</td>
<td>-0.38, $p &lt; 0.05$</td>
</tr>
<tr>
<td>RBANS Total Scale</td>
<td>-0.53, $p &gt; 0.001$</td>
<td>-0.62, $p &gt; 0.001$</td>
</tr>
</tbody>
</table>

*Note:* The Repeatable Battery for the Assessment of Neuropsychological Status (RBANS) is from Randolph (1998).

### Discussion

- The ES had 100% accuracy in an Alzheimer’s sample compared with 70% accuracy of the EI. In a Vascular Dementia group, the ES had only 75% accuracy compared with the 87.5% of the EI. Over half of the Mixed-type dementia group was correctly classified by the ES compared with 42.9% of the EI. 66.7% of the Dementia NOS group was correctly classified by the EI as compared with 55.6% by the ES. The greatest disparity however, was found between the EI (100%) and the ES (20%) in the NCI group.

- Research findings are consistent with Novitski and colleagues (2012) which indicate that the ES may produce a high false positive rate in a population with no cognitive impairment or implication of poor effort.

- The results of the current study support previous findings that the EI has variable utility in groups with amnestic disorders (Hook et al., 2009). The ES showed greatest specificity in groups with more severe amnestic disorders, but limited specificity in groups with no cognitive impairment, similar to Novitski et al., (2012).

- EI and ES scores were negatively correlated with RBANS Total Scaled score, indicating that more impaired cognition is associated with greater misclassification of suspect effort.

- ES scores were also negatively correlated with years of education suggesting that less educated individuals were more likely to be misclassified as having suspect effort. These results suggest that education levels and cognitive functioning may affect EI and ES results and should be taken into consideration when using these measures for the detection of effort in samples with cognitive impairment.

### References


