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Factors contributing to impaired self-awareness of cognitive functioning in an HIV positive and at-risk population

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Abstract

Purpose—To examine the association between self-awareness of cognitive impairment and age, selected mood disorders, and type and severity of cognitive impairment in a sample of individuals with HIV/AIDS and at risk for HIV.

Method—75 subjects, 52 HIV+ and 23 at risk for HIV completed a psychosocial interview, the Patient's Assessment of Own Functioning (PAOF) questionnaire, and a battery of neuropsychological tests. Based upon the differences between their clinical impairment and self-reported impairment, subjects were classified as being "Underestimators", "Good Awareness", or "Impaired Awareness" with regard to self-awareness.

Results—Those with more severe cognitive impairment were less aware than those with normal or borderline cognitive impairment. A one-way ANOVA suggested that the Impaired Awareness group differed significantly from the Underestimators on the Rey Figure Immediate and Delayed Recall tasks, and from both the Underestimators and Good Awarenesss groups on the Digit Symbol Substitution Task. There were significant differences among all awareness groups on the test of Simple Reaction Time. Furthermore there is some suggestion that age may contribute to impaired self-awareness. The role of HIV in self-awareness remains unclear, as both, individuals with HIV and at risk, demonstrated impaired self-awareness.

Conclusions—Overall, impaired awareness was associated with poorer test performance, suggesting a relationship between awareness and sustained complex attention and visual spatial processing. This research has implications for understanding factors contributing to poor awareness among individuals with cognitive impairment.

Keywords

self-awareness; HIV; cognitive impairment

Introduction

Self-awareness is "the capacity to perceive the 'self ' in relatively objective terms while maintaining a sense of subjectivity" [1]. Self-awareness of cognitive abilities is frequently impaired in neuropsychiatric syndromes (e.g. depression, bipolar disorder), brain injury (e.g.

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stroke, traumatic brain injury), and dementia (e.g. Alzheimer's disease, Mild Cognitive Impairment; [2]), and as severity of cognitive impairment increases, deficits in self-awareness increase [3–6]. These deficits can be measured by comparing differences between self-reported complaints of cognitive impairment and performance on neuropsychological tests of specific cognitive abilities [7]. Poor self-awareness is associated with poor recovery and rehabilitation outcome; and conversely, better awareness is associated with better rehabilitation outcome [8–11]. Individuals with poor self-awareness may have difficulty setting realistic goals, recognizing when to use compensatory strategies, and interacting appropriately in social situations [2]. In addition, poor self-awareness can affect treatment adherence and motivation in a rehabilitation programme [12]. Thus, identification and measurement of self-awareness deficits may facilitate the creation of more comprehensive and effective rehabilitation plans and improve rehabilitation outcomes.

While self-awareness has been studied in individuals with cognitive impairment attributed to brain injury and dementia, less is known about self-awareness among individuals with cognitive impairment attributed to HIV/AIDS [7]. An estimated 30% of individuals in the asymptomatic stages of HIV have cognitive impairment, as measured by neuropsychological tests [13]. The advent of Highly Active Anti-Retroviral Therapy (HAART) has changed the pattern of cognitive deficits in HIV/AIDS, but the rate of mild cognitive impairment has remained the same [14]. Given these changing patterns in cognitive impairment, researchers and clinicians have started looking at multiple explanations for cognitive impairments in this population, such as consequences of associated "at risk" behaviors or common comorbidities of HIV infection. Understanding cognitive impairments in this population is important to rehabilitation professionals as these impairments negatively affect performance in the areas of cooking, shopping, financial management, medication management, and vocational abilities [15]. Disability in these areas was best predicted by impairments in attention and working memory, learning, executive functioning, and verbal abilities, and was associated with increased dependence on others and increased rates of unemployment [15].

The purpose of this study was to examine self-awareness by measuring the differences between self-reported cognitive impairment and clinically-tested cognitive impairment, and to investigate the association between self-awareness of cognitive impairment and age, selected mood disorders, and type and severity of cognitive impairment in a sample of individuals with HIV disease and at risk for HIV. We chose to examine both individuals with HIV and at risk for HIV because we wanted to explore whether HIV itself or at-risk behaviors were strongly associated with impairments in cognition and self-awareness.

Methods

Study participants

Data were obtained from the Allegheny County Neuropsychological Survey Study (AG21431). For the parent study, individuals who were HIV+ with a diagnosis of AIDS, as well as individuals at risk for contracting HIV, were recruited. Individuals "at risk" were individuals engaging in any behavior that increases the likelihood of contracting HIV, including intravenous drug use and unprotected or high-risk sexual practices. At-risk individuals were included in the present study in order to better understand factors contributing to poor self-awareness that may be common in the HIV/AIDS population but may not be attributable to the disease process itself. All participants were at least 18 years of age and capable of providing informed consent. Individuals were excluded if they were experiencing active psychosis or had a history of stroke, brain tumor, or any injury resulting in a loss of consciousness. For the current analyses, participants were selected from the parent study if they had complete data on the clinical and self-report measures of cognitive

impairment. All procedures were approved by the University of Pittsburgh's Institutional Review Board.

Measurement

To determine impairments in self-awareness, we used data from clinical, neuropsychological and self-reported measures of cognitive impairment. The comparison of self-reported cognitive impairment and objective performance on neuropsychological tests is a method for measuring self-awareness that has been used in other studies [7]. To examine the association between impairment in self-awareness, and selected mood disorders, we used data from a psychosocial interview.

Clinical measures of cognitive impairment were derived from a neuropsychological battery designed to be sensitive to the cognitive impairments associated with aging and HIV/AIDS [16]. The battery addressed six domains (psychomotor speed, visual construction, language, memory, motor function, and executive functions, Table II) and was administered by trained raters. To determine global cognitive impairment ratings, the neuropsychological test scores reflecting individual cognitive domains were transformed into T-scores adjusted for age, education, gender and race [17]. A clinical rating ranging from 1 ("Above Average") to 9 ("Severe Impairment") was assigned to each domain, and subsequently to each participant (Clinical Impairment rating, Table I) [18]. The ratings were completed by two individuals who knew the participant's age, education, race, and estimated premorbid IQ, but who were unaware of any other subject-specific characteristics (e.g. serostatus). In our past use of this procedure, inter-rater reliability was high for the individual domain scores ($r > 0.85$), the number of impaired domains ($r > 0.89$), and the global ratings ($r > 0.90$).

The self-report measure of cognitive impairment was the Patient's Assessment of Own Functioning (PAOF). The PAOF is comprised of 33 questions addressing cognitive impairment in the course of daily activities, with scores ranging from 1 (almost always) to 6 (almost never). The total score ranges from 33 to 198, with 33 indicating the highest degree of perceived impairment and 198 indicating no perceived impairment. The PAOF is a valid and reliable instrument for self-reported cognitive impairment, and has been used in various clinical populations [19–23].

Mood disorders—History and current status of depression and substance abuse/dependence were determined using a semi-structured interview based on the Structured Clinical Interview for DSM-III-R (SCID) [24], which was administered by trained raters supervised by a neuropsychologist. For each disorder, data were coded into one of two categories: "not present" (indicating either no history or currently in full remission) and "present" (indicating current episode or in partial remission).

Data analyses—We used a 3-step process to derive the measure of self-awareness.

First, we assigned a Clinical Impairment Rating to each participant as described above. This rating was based on domain impairment scores, along with results from a neurological medical exam, and derived through adjudication review attended by a neurologist, neuropsychologist (J.B.) and psychiatrist [18]. Participants were then classified into one of three groups based on these ratings: Clinically Normal (Clinical Impairment Rating 1, 2, 3, 4), Clinically Borderline (Clinical Impairment Rating 5, 6), and Clinically Impaired (Clinical Impairment Rating 7, 8, 9– Table I).

Second, we used the total PAOF score to classify participants into one of three self-reported cognitive impairment groups. Categories were created using normalized percentiles determined by Tukey's proportion estimate formula. Participants whose PAOF scores were

in the 50th percentile or higher (PAOF scores 171.50 or higher), were classified as Self-report Normal, as they fell within the average to above average range for normalized percentile ranking. Those classified between the 25th and 50th percentile (PAOF scores between 140.00 and 171.49) were Self-report Borderline, as they fell within the somewhat below average to average range for normalized percentile ranking. Those whose scores fell below the 25th percentile (PAOF scores below 140.00) were classified as Self-report Impaired, as they fell at or below the below average range for normalized percentile ranking (Table II).

Third, self-awareness of cognitive impairment, the dependent variable for these analyses, was derived by comparing the clinical impairment group ratings and the self-report group ratings. Participants whose self-report group indicated a higher degree of impairment than their clinical impairment group were classified as “Underestimators”. While there is some indication that outcomes for those who underestimate their abilities do not differ significantly from those with good awareness [9], there is evidence to suggest that underestimators may perform better on cognitive tests [25–26]. Thus for the current analyses, we separated these individuals from the rest of the sample. Participants whose self-report group matched their clinical impairment group were categorized as “Good Awareness”. Those whose self-report group was Normal and whose clinical impairment group was Borderline and those whose self-report group was Borderline and whose clinical impairment group was Impaired were initially classified as “Borderline Awareness”. However, preliminary analyses indicated that this group did not differ significantly from the Good Awareness group on any factor. The decision was made to combine these two groups into a single Good Awareness group. Finally, those whose self-report group was Normal and whose clinical impairment group was Impaired were classified as “Impaired Awareness”.

Next, we conducted a χ^2-test to examine the distribution of clinical impairment groups by self reported cognitive impairment groups. We conducted χ^2-tests to examine differences in the presence of various mood disorders, drug abuse, and HIV among self-awareness groups. We conducted a one-way ANOVA to examine differences in age, race, gender, years of education, and neuropsychological measures among self-awareness groups (underestimators, good awareness, impaired awareness). Post hoc analyses using Bonferroni corrections were run for factors that were statistically significant in the one-way ANOVA. Finally, we computed effect sizes using Cramer’s V for χ^2-tests and eta-squared for the ANOVA. For Cramer’s V, effect sizes of greater than 0.25 were considered very strong, those between 0.15 and 0.25 were strong, those between 0.11 and 0.15 were moderate, and those below 0.10 were weak to not present. For eta-squared, effect sizes over 0.64 were considered strong, those between 0.25 and 0.64 were considered moderate, and the recommended minimum “practically” significant effect for social science data is an effect size above 0.04 [27].

Results

There were 75 participants in the present study: 52 with HIV infection and 23 without HIV infection. The distribution of those who were clinically impaired differed across self-reported cognitive impairment groups ($\chi^2_4 = 11.17$; $p = 0.03$), indicating those with the most severely impaired cognitive functioning demonstrated the greatest variance in self-reported cognitive impairment (see Table I).

Self-awareness groups did not differ by age, though did demonstrate a small practically significant effect size ($F_{2, 72} = 2.81$, $p = 0.07$, $\eta^2 = 0.07$), with the Impaired Awareness group being younger than Underestimators or those in the Good Awareness group. While the difference was not statistically significant, the effect size was above the minimum

"practically" significant effect for social science data [27]. Self-awareness did not differ with regard to alcohol abuse ($\chi^2_2 = 1.32$, $p = 0.52$, $V = 0.133$) or depression ($\chi^2_2 = 1.09$, $p = 0.58$, $V = 0.12$). As it relates to at-risk behaviors, self-awareness did not differ significantly with regard to drug abuse ($\chi^2_2 = 4.68$, $p = 0.10$), but did demonstrate a moderately strong effect size ($V = 0.25$), indicating those currently using drugs were more likely to have impaired awareness. HIV status ($\chi^2_2 = 2.46$, $p = 0.04$) was significantly different across awareness groups with a strong effect size ($V = 0.30$); those who were at risk for HIV demonstrated a greater variance in self-awareness compared to those who were HIV positive (see Table II).

A summary of the ANOVAs is presented in Table II. Four neuropsychological measures differed significantly among the three self-awareness groups, including the Digit Symbol Substitution Task ($F_{2, 72} = 6.51$, $p = 0.003$, $\eta^2 = 0.153$), the test of Simple Reaction Time ($F_{2, 72} = 11.28$, $p = 0.000$, $\eta^2 = 0.26$), and the Rey-Osterrieth Complex Figure Immediate Recall ($F_{2, 72} = 5.03$, $p = 0.009$, $\eta^2 = 0.123$) and Delayed Recall ($F_{2, 72} = 4.33$, $p = 0.017$, $\eta^2 = 0.107$). There was a trend towards significance for the Digit Span Pointing ($F_{2, 70} = 2.45$, $p = 0.094$, $\eta^2 = 0.065$), and the Grooved Pegboard tasks ($F_{2, 72} = 2.88$, $p = 0.063$, $\eta^2 = 0.074$) tasks. Effect sizes for all tests are presented in Table II. The test of Simple Reaction Time demonstrated a moderate effect size and all other tests that were significant at the $p = 0.10$ level demonstrated effect sizes above the minimum "practically" significant effect size for social science data ($\eta^2 = 0.04$).

Post hoc analyses using Bonferroni correction indicated that the Impaired Awareness group differed significantly from both the Underestimators and Good Awareness group on the Digit Symbol Substitution Task ($p = 0.006$, $p = 0.010$ respectively), with the Impaired Awareness group again demonstrating poorer performance. There were significant differences between all three awareness groups on the test of Simple Reaction Time. Underestimators performed better than the Good Awareness ($p = 0.046$) and Impaired Awareness ($p = 0.000$) groups and the Good Awareness group performed better than the Impaired Awareness group ($p = 0.002$). Finally, Underestimators and those with Impaired Awareness differed significantly on the Rey-Osterrieth Complex Figure Immediate ($p = 0.011$) and Delayed Recall ($p = 0.016$), with Underestimators performing better on these tasks.

Discussion

The present study examined self-awareness by testing differences between self-reported cognitive impairment and clinically tested cognitive impairment in a sample of individuals with HIV/AIDS or at risk for HIV. We then examined associations between self-awareness and several personal factors, mood disorders, and neuropsychological measures. As expected, participants demonstrating more severe cognitive impairment had a greater variability in self-reported cognitive impairment, suggesting that severity of cognitive impairment is associated with self-awareness. As for selected mood disorders, drug abuse may also be associated with differences in self-awareness, with those currently using drugs more likely to demonstrate impaired awareness. While this finding only demonstrated borderline significance in our sample, it is consistent with the literature on the relationship between self-awareness and drug abuse [23].

The role of HIV in this study remains unclear. Findings from this sample suggest a greater variance in self-awareness in the at risk group than in the HIV/AIDS group, though this may be an artifact of sample size. These two groups were compared with regard to drug abuse, to determine if this was a confounding factor; however, the groups did not differ. Further exploration may clarify whether impaired self-awareness is a disease-specific problem in the

HIV positive population, or if, much like cognitive impairment post-HAART, it is due to other co-occurring factors such as those seen in the at-risk population (e.g. drug abuse). Our findings led us to question whether risky behaviors associated with HIV are likely to be more strongly associated with cognitive impairment and impaired self-awareness than the HIV disease process itself. Further examination is warranted to clarify these relationships.

Examining associations between self-awareness and neuropsychological test performance, performance on the Digit Symbol Substitution, the Rey-Osterrieth Complex Figure Immediate and Delayed Recall tasks, and the test of Simple Reaction Time were associated with differences in self-awareness. In each of these tasks, poorer performance was associated with impaired self-awareness. These measures characterize psychomotor speed, memory, and attention. Collectively, they measure sustained complex attention and visual spatial processing. The lack of significant differences in all other neuropsychological measures, suggests that these two common domains of cognitive function may be associated with self-awareness of cognitive impairment.

Similar findings have been reported in previous studies. For example, impairment in sustained attention has previously been associated with impaired self-awareness among individuals with traumatic brain injury [28] and among “healthy” older adults [29]. However, given that visual attention tasks, and not similar verbal tasks, were associated with impaired self-awareness, this may indicate greater involvement of the right hemisphere in self-awareness. Studies of individuals with traumatic brain injury reported that impaired self-awareness was more strongly associated with right, as compared to left, hemispheric injuries [30–31]. Additionally, impaired awareness has been found to be associated with right temporal dysfunction for individuals with Alzheimer’s disease [32]. It is important to note the visual-spatial memory tasks and not visual-spatial construction tasks were found to be associated with self-awareness. While the explanation for this is not clear from this study, it suggests that awareness maybe associated with a deeper level of visual-spatial processing than is required for simple reconstruction. Further exploration into the neuropsychological correlates of self-awareness may clarify the extent to which impaired awareness is due to impairments in sustained attention or right hemispheric processing.

These findings provide the first insights into the rehabilitation implications for individuals with and at risk for HIV/AIDS, suggesting that individuals with or at risk for HIV/AIDS have a critical need that could be addressed by rehabilitation professionals with expertise in assessing and treating impairments in self-awareness. The role of HIV in self-awareness remains somewhat unclear, though the suggestion in the present study that those at risk for HIV demonstrate a higher variability in self-awareness may have important implications for early detection and intervention for HIV/AIDS. Furthermore, the inclusion of individuals with cognitive impairment who are at risk for HIV/AIDS provides a more generalizable model for examining self-awareness in any population demonstrating cognitive impairment. In the HIV/AIDS population, we are able to separate out confounding factors (e.g. at-risk behaviors) from the disease process, something we are unable to do in populations such as traumatic brain injury where we cannot assess the pre-diagnosis state.

Presently, the settings in which individuals with HIV/AIDS obtain services often revolve around medical care. These professionals often rely on self-report of cognitive impairment to trigger services; it is often difficult to obtain any objective standard against which to compare self-reports, as many individuals in this population do not have caregivers or family members who can provide a report on everyday cognitive functioning. If individuals with HIV/AIDS are experiencing cognitive impairment not directly tied to another disease marker (e.g. viral load, CD4-cell count), it may go unnoticed by medical professionals if not self-reported. Neuropsychological services are often not provided to individuals with HIV/

AIDS. Therefore, it is likely there are cognitively impaired individuals who remain undiagnosed, while these impairments continue to impact self-report of health status and medication compliance. The presence of self-awareness deficits in this population, the limited attention given to these deficits, and the potential significant impact of these deficits, all suggest that there is a need for rehabilitation assessment and intervention services for individuals with HIV/AIDS.

Understanding factors associated with poor self-awareness may be useful for designing focused cognitive rehabilitation interventions. If the personal factors and mood disorders that contribute to deficits in self-awareness, such as age and drug abuse, are verified, then these factors can be incorporated in rehabilitation plans. Further, adjusting for known cognitive deficits may be helpful in assisting clients to set realistic goals and develop appropriate compensatory strategies. Goal-setting becomes particularly important when related to longterm planning for progressive diseases or conditions, such as HIV/AIDS.

Limitations

This study was a secondary analysis of existing data in an HIV/AIDS and at-risk population. Given that, there were methodological limitations that can be addressed in subsequent research.

Self-awareness, in general, continues to be difficult to define and measure. Across the research, inconsistencies in the measurement and/or definition of self-awareness may account for the discrepancies in research findings. Self-awareness theories have proposed that there are different types of self-awareness and different neurological processes for self-awareness. The present study defined self-awareness as the difference between self-report and objective performance as measured by neuropsychological tests. Different definitions of self-awareness may yield a different pattern of results. Furthermore, this method of measuring self-awareness relies on varying degrees of classification that are each subject to error or bias. Additionally, neuropsychological tests may be measuring a different construct than that which is being self-reported, and therefore may not provide the most ecologically valid data [33]. Validated methods for defining and measuring self-awareness are necessary to ensure that findings are valid and not an artifact of measurement.

Future directions

Despite these limitations, the present study is significant as it is among the first to explore factors contributing to self-awareness in and HIV/AIDS population. Future research attempting to further illuminate our understating of self-awareness should attend to the relationship between what is being asked in a self-report and what is being measured via the objective measure of functioning. Multiple objective measures such as formal assessment, staff report, or caregiver report may be combined to provide a more global objective assessment of functioning to be compared to self reports of functioning as a definition of self-awareness.

Expanding the number of contributing personal factors that are being investigated may provide a clearer picture of self-awareness. Including imaging data would also add to the robustness of this research and provide an additional clinical measure for cognitive impairment. Additionally, comparing factors influencing self-awareness among different populations, such as traumatic brain injury, attention deficit disorder, or different etiologies of dementia may enhance our understanding of self-awareness deficits.

While understanding factors contributing to impaired self-awareness is important, the critical question in rehabilitation is what impact impaired self-awareness has self-care, health maintenance, performance of activities, and participation in the community.

Specifically with regard to HIV/AIDS, medication management, health maintenance, safety, and good judgment are all critical issues that may be significantly affected by impaired self-awareness.

Conclusion

Being able to evaluate self-awareness and understand its etiology may provide a basis of judgment for rehabilitation professionals when assessing and treating individuals with potential self-awareness deficits. The ability to measure and understand impairments in self-awareness may help to circumvent the barriers to functioning and allow for the creation of appropriate and effective rehabilitation interventions.

Implications for Rehabilitation

- Impaired self-awareness is associated with poor rehabilitation outcomes in populations with cognitive impairment.
- Individuals with and at risk for HIV/AIDS demonstrate cognitive impairments often associated with impaired self-awareness.
- Individuals with or at risk for HIV/AIDS have a critical need that could be addressed by rehabilitation professionals with expertise in assessing and treating impairments in self-awareness.

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Table I

Self-report of cognitive impairment by clinical impairment.

		Self-report of cognitive impairment			
		Normal	**Borderline**	**Impaired**	**Total**
Clinical impairment	Normal	9	2	1	12
	Borderline	16	5	3	24
	Impaired	13	11	15	39
	Total	38	18	19	75

Light grey = Underestimators, Medium dark grey = Good Awareness, Dark grey = Impaired Awareness.

Table II

Effects of self-awareness of cognitive impairment on age, HIV status, mood disorders and neuropsychological test performance.

	Underestimators ***n*** **= 6**	**Good awareness** ***n*** **= 56**	**Impaired awareness** ***n*** **= 13**		**Effect sizes**
Age	45.12 (10.34)	48.79 (10.12)	41.73 (8.87)	$F_{2,72} = 2.812^{\dagger}$	$\eta^2 = 0.072$
HIV infected, %	33.3	76.8	53.8	$\chi^2_2 = 6.586^{*}$	0.296
Drug abuse, present, %	0	10.7	30.8	$\chi^2_2 = 4.676^{\dagger}$	0.25
Alcohol abuse, present, %	0	14.3	7.7	$\chi^2_2 = 1.324$	0.133
Depression, present, %	33.3	14.3	15.4	$\chi^2_2 = 1.086$	0.12
Psychomotor speed					
Trail making test, part A [34]	55.17 (21.03)	53.13 (13.70)	48.00 (10.97)	$F_{2,72} = 0.843$	$\eta^2 = 0.023$
Digit symbol substitution task[35]	56.83 (12.29)	50.45 (10.04)	41.38 (6.41)	$F_{2,72} = 6.509^{*}$ U>GA>IA	$\eta^2 = 0.153$
Simple reaction time [36]	61.23 (10.98)	48.70 (11.56)	35.54 (12.23)	$F_{2,65} = 11.28^{*}$ U, GA > IA	$\eta^2 = 0.258$
Trail making test, part B [34]	59.83 (15.25)	54.61 (12.84)	53.50 (12.42)	$F_{2,72} = 1.117$	$\eta^2 = 0.030$
Visual construction					
WAIS-R block design [35]	56.17 (10.25)	48.13 (12.02)	47.00 (8.11)	$F_{2,68} = 1.519$	$\eta^2 = 0.043$
ROCF, copy [37]	52.33 (6.31)	47.40 (12.66)	43.75 (10.74)	$F_{2,72} = 1.048$	$\eta^2 = 0.029$
Language					
Boston naming test [38]	45.20 (9.52)	52.48 (14.47)	45.92 (11.32)	$F_{2,67} = 1.631$	$\eta^2 = 0.046$
Verbal fluency, FAS [39]	57.83 (13.47)	51.45 (11.23)	55.17 (13.39)	$F_{2,71} = 1.150$	$\eta^2 = 0.031$
Verbal fluency, animals [39]	59.33 (12.66)	53.13 (9.57)	53.50 (12.42)	$F_{2,71} = 0.987$	$\eta^2 = 0.027$
Memory					
CVLT, total [40]	47.33 (14.00)	48.31 (11.47)	44.08 (13.00)	$F_{2,64} = 0.601$	$\eta^2 = 0.018$
CVLT, delayed recall [40]	51.67 (8.96)	50.35 (12.78)	47.83 (13.15)	$F_{2,64} = 0.249$	$\eta^2 = 0.008$
ROCF, immediate recall [37]	58.83 (5.42)	49.70 (12.27)	40.77 (13.54)	$F_{2,72} = 5.034^{*}$ U>IA	$\eta^2 = 0.123$
ROCF, delayed recall [37]	57.83 (8.52)	48.79 (11.42)	41.85 (11.59)	$F_{2,72} = 4.329^{*}$ U>IA	$\eta^2 = 0.107$
Digit span, verbal	49.67% (31.17)	57.31% (29.97)	39.31% (33.24)	$F_{2,70} = 1.869$	$\eta^2 = 0.050$

	Underestimators ***n*** **= 6**	**Good awareness** ***n*** **= 56**	**Impaired awareness** ***n*** **= 13**		**Effect sizes**
Digit span, pointing	56.67% (17.85)	50.39% (34.21)	30.00% (24.02)	$F_{2,70} = 2.448^{\dagger}$	$\eta^2 = 0.065$
Motor function					
Grooved pegboard	48.17 (8.035)	43.61 (9.99)	37.38 (11.46)	$F_{2,72} = 2.875^{\dagger}$	$\eta^2 = 0.074$
Executive function					
Trail making test, part B [34]	59.83 (15.25)	54.61 (12.84)	53.50 (12.42)	$F_{2,72} = 1.117$	$\eta^2 = 0.030$
Booklet category test [41]	56.33 (18.57)	50.69 (12.10)	48.11 (17.82)	$F_{2,54} = 0.655$	$\eta^2 = 0.024$

Note. WAIS-R = Wechsler Adult Intelligence Scale–Revised, CVLT = California Verbal Learning Test, ROCF = Rey-Osterrieth Complex Figure. All test scores are t scores (mean, SD) except digit span (mean, SD %)

$^{*}p < .05$;

$^{\dagger}p \leq 0.10$.

Effect sizes for η^2 are Cramer's V statistics. U = Underestimators; GA = Good Awareness; IA = Impaired Awareness.

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