

Personal factors contributing to deficits in self-awareness of cognitive impairment

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75 subjects, 52 HIV+ and 23 HIV- but considering themselves to be at risk for HIV, completed a psychosocial interview based on the Structured Clinical Interview for DSM-IV (SCID), the Patient's Assessment of Own Functioning (PAOF) questionnaire, and a battery of neuropsychological tests. Subjects were then categorized into one of three clinical impairment groups and one of three self-reported impairment groups. Based upon the differences between their clinical impairment group and self-reported impairment group, subjects were classified as being aware, having limited awareness, or having poor awareness. Factors correlated with deficits in awareness included age and performance on the Digit Symbol test and a test of simple reaction time. In addition, those with more severe cognitive impairment were less aware than those who were normal or borderline. A one-way ANOVA suggested that the poor awareness group differed significantly from both the aware and limited awareness groups on the Digit Symbol test and the Rey Figure Immediate and Delayed Recall. The aware and limited awareness groups were not significantly different for any factor. Overall, poor awareness was associated with poorer test performance. In those with HIV/AIDS, age was inversely related to self-awareness, with those who were older and impaired demonstrating better awareness than those who were younger and impaired. This research has implications for understanding poor awareness in HIV/AIDS and for creating appropriate and effective rehabilitation plans.

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PREFACE

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1.0 INTRODUCTION

1.1 SELF-AWARENESS/ANOSOGNOSIA

Self-awareness, self-monitoring, or self-perception: no matter what term is used, the concept refers to the ability to regard oneself and one's abilities objectively. Self-awareness is "the capacity to perceive the 'self' in relatively objective terms while maintaining a sense of subjectivity" (Prigatano, 1991). Deficits in self-awareness of cognitive impairment, often called anosognosia, occur in individuals with cognitive impairments including but not limited to neuropsychiatric syndromes (e.g. depression, bipolar disorder), brain injury (e.g. stroke, traumatic brain injury), and dementia (e.g. Alzheimer's Disease, mild cognitive impairment; McGlynn & Shacter, 1989). Poor self-awareness is associated with poor recovery and rehabilitation outcome, and conversely, better awareness is associated with better rehabilitation outcome (Clare, Wilson, Carter, Roth, & Hodges, 2006; Hoofien, Gilboa, Vakil, & Barak, 2004; Ownsworth, Fleming, & Strong, 2006; Prigatano, 2005). Individuals with poor awareness may have difficulty setting realistic goals, recognizing when to use compensatory strategies, and interacting appropriately in social situations (McGlynn & Shacter, 1989). In addition, poor awareness can affect treatment compliance and motivation in a rehabilitation program (Prigatano, 1999). Understanding the nature of disturbances of self-awareness is critical for better creating a plan for rehabilitation. Therefore, being able to define and measure deficits in

self-awareness would facilitate the creation of more comprehensive and effective rehabilitation plans and would improve rehabilitation outcomes.

1.2 MODELS OF SELF-AWARENESS

Self-awareness seems to be defined predominantly by its absence; therefore, several models have been proposed to explain deficits in self-awareness. These models describe the personal factors that contribute to poor self-awareness. Ecklund-Johnson and Torres (2005) reviewed the literature on awareness deficits in Alzheimer's disease and outlined three general models: a) unawareness is proportional to the severity of impairment in learning new information, b) unawareness is a psychological defense (denial) associated with limbic structure damage, and c) unawareness (anosognosia) is caused by damage to specific brain systems and involves multiple brain regions. The latter model is the most widely studied of the three and has been broken down into several specific theories. One theory is that unawareness is the result of disconnections between brain areas, and that the nature of awareness is dependent on the brain areas affected (Ecklund-Johnson & Torres, 2005). For example, deficits in self-awareness may be caused by impairments in the functioning of the frontal lobes, which are responsible for drive, behavioral sequencing, and executive control; impairment in these functions would affect an individual's ability to process the objective reality and respond appropriately.

Another important model suggests that poor self-awareness is a result of damage to various areas of the heteromodal association cortex (Prigatano, 1999). In order for poor self-awareness to be lasting, damage has to occur to bilaterally homologous regions (Prigatano, 1999). This model is able to address the differing types of deficits in self-awareness across

populations that display more global impairments (dementia, traumatic brain injury, and others), as these populations differ in regards to the location and extent of damage.

These models provide a broad theoretical basis for understanding self-awareness, but do not establish specific definitions of or a methodology for measuring it. Halligan (2006) describes a framework for understanding and studying self-awareness that incorporates personal factors discussed in each of these models and in current awareness literature. These factors are categorized as follows: neurogenic factors, psychosocial factors, psychogenic factors, and fabrication or exaggeration (Halligan, 2006). Fabrication and exaggeration are a possible explanation for apparent deficits in self-awareness and should be addressed in clinical situations on a case by case basis. For the purposes of this study, however, the focus will be on neurogenic, psychosocial, and psychogenic factors.

1.2.1 Neurogenic factors

Neurogenic factors refer to neurological damage and impairment in specific cognitive domains (Halligan, 2006), particularly those associated with the frontal lobes (McGlynn & Schacter, 1989; Prigatano, 1991; Reed, Jagust, & Coulter, 1993; Starkstein, Migliorelli, Teson, Petracca, Chemerinsky, Manes, et al., 1995.; Stuss, 1991; Stuss, Gallup, & Alexander, 2001). The frontal lobes are the center for executive functions, drive, and sequencing (Stuss, 1991), but also for self-monitoring or metacognitive processes. In an exhaustive review of the literature, Ecklund-Johnson and Torres (2005) found that there was a general consensus regarding the impact of the frontal lobe on awareness, particularly in the right hemisphere.

Other research indicates specific neurogenic contributors to deficits in self-awareness, though at this level, there is no consensus in the literature. Sherer and colleagues (2005) found

that, in traumatic brain injury, the location of lesions was not associated with impairments in self-awareness, though the number of lesions was; this is consistent with findings that severity of impairment is associated with deficits in self-awareness. Similarly, in Alzheimer's disease or other dementias, there is a progressive loss of awareness as the severity of the dementia increases (Feher, Mahurin, Inbody, Crook, & Pirozzolo, 1991; Gil, Arroyo-Anllo, Ingrand, Gil, Neau, Ornon, et al., 2001; McDaniel, Edland, Heyman, Harrel, Henderson, Wiederhold, et al., 1995; Starkstein, Jorge, Mizrahi, & Robinson, 2006). This suggests that the severity of the injury or disorder is more significant to unawareness than a specific brain region.

However, other research has implicated specific brain regions as being associated with deficits in self-awareness. FMRI studies of healthy subjects performing self-reflective tasks found activation in the anterior medial prefrontal cortex and the posterior cingulate gyrus, suggesting that these regions are part of the neural system for self-reflective thought (Johnson, Baxter, Wilder, Pipe, Heiserman, & Prigatano, 2002). Salmon et al. (2006) found that impaired self-awareness was linked to the orbital prefrontal cortex and medial temporal structures. These areas work in conjunction to compare current information with autobiographical information and make semantic judgments (Salmon, Perani, Herholz, Marique, Kalbe, Holthoff, et al., 2006); this is consistent with Stuss' (1991) theory that awareness requires a comparison of objective and subjective information. While differences in definitions and measurement of self-awareness might contribute to variations in its neuroanatomical correlates, the involvement of the frontal lobes in self-awareness, specifically related to self-monitoring abilities and executive function, is a consistent finding across research (Auchus, Goldstein, Green, & Green, 1994; Reed, Jagust, & Coulter, 1993; Starkstein et al., 1995).

In addition to anatomical correlates of self-awareness, previous research has investigated the impact of specific cognitive domains. Impairments in anterograde memory and verbal comprehension were both correlated with poor self-awareness in Alzheimer's disease, though severity of dementia was the factor that was predictive of poor self-awareness (Starkstein et al., 1995). Hoofien, Gilboa, Vakil, and Barak (2004) suggest that awareness in specific cognitive domains may be more predictive of functional outcomes than overall awareness. They also propose that individuals are more likely to be aware of concrete cognitive abilities, such as memory, than abstract abilities, such as verbal comprehension (Hoofien, Gilboa, Vakil, and Barak, 2004).

1.2.2 Psychosocial factors

Psychosocial factors include age, education, attitudes, and culture (Halligan, 2006). Stuss, Gallup, and Alexander (2001) found that deficits in self-awareness were not related to IQ or years of education. Overall, very little evidence has been found to indicate whether or not psychosocial factors play a role in self-awareness.

1.2.3 Psychogenic factors

Psychogenic factors refer to non-conscious defense mechanisms, such as denial (Weinstein, 1991; Halligan, 2006). Ownsworth, McFarland, and Young (2002) found that personality-related denial had an impact on self-disclosure in a clinical setting, which links denial to

measures of self-awareness. Other psychogenic factors that have been linked to deficits in awareness include delusions (Kazui et al., 2006), apathy (Starkstein, Jorge, Mizrahi, & Robinson, 2006), and depression (Clare, Wilson, Carter, Roth, & Hodges, 2004; Feher et al., 1991; Sevush & Live, 1993). Those who overestimate their abilities have been found to report more psychiatric symptoms than those who demonstrate good self-awareness (Hoofien, Gilboa, Vakil, & Barak, 2004).

Overall, the literature suggests that brain dysfunction is somehow involved in poor self-awareness, with much of the evidence pointing toward the frontal lobes and aspects of executive functioning. However, there is an indication that awareness may be differentially affected by different disease processes, which may account for the discrepancies in results (Ecklund-Johnson & Torres, 2005). One factor that is consistent across the literature is that poor self-awareness is progressive over time and is related to the severity of cognitive impairment.

1.3 MEASUREMENT OF SELF-AWARENESS

The measurement of self-awareness can be broken down into five categories: clinician ratings, questionnaire-based ratings, performance-based ratings, phenomenological methods, and multi-dimensional or combined methods (Clare, Markova, Verhey, & Kenny, 2005). The most common method is to measure the discrepancy between individual (personal) ratings and some kind of standard (Clare, Markova, Verhey, & Kenny, 2005). Historically, this standard has been the rating of a clinician, caregiver, or family member. Studies that measure the difference between self-report of cognitive impairment and caregiver report of cognitive impairment have provided much of the basis for empirical research on self-awareness. In a population with

Alzheimer's Disease (AD) or Mild Cognitive Impairment (MCI), a discrepancy was found between self-reported complaints of cognitive impairment and caregiver complaints, with caregivers registering more complaints than individuals with dementia (Farias, Mungas, & Jagust, 2005; Kalbe, Salmon, Peranie, Holthoff, Sorbi, Elsner, et al., 2005). However, more recent studies have been using neuropsychological and other evaluative tests as a standard for comparison (Brown, Dodrill, Clark, & Zych, 1991; Christodoulou, Melville, Scheri, Morgan, MacAllister, Canfora, et al., 2005; Hoofien, Gilboa, Vakil, & Barak, 2004; Mattos, Lino, Rizo, Alfano, Araujo, & Raggio, 2003). While this method seems to be the most accurate measure of determining objective functioning, it has limitations in that individuals are typically asked very general questions related to functioning, while tests are very specific, focused, and unfamiliar (Ecklund-Johnson & Torres, 2005). In a population with Alzheimer's disease, neuropsychological tests were found to be moderately predictive of functional performance when measured by both self-report and informant report (Farias, Harrell, Neumann, & Houtz, 2003). However, the specific tests and domains that correlated with performance differed for the self-report and informant report, suggesting that some tests were more predictive than others. Research findings on the ecological validity, or ability to predict real-world functioning, of neuropsychological tests is inconsistent, and even when relationships are found, they are only moderately associated at best (Chaytor, Schmitter-Edgecombe, & Burr, 2006).

1.4 SELF-AWARENESS IN HIV/AIDS

Questions of impaired self-awareness have often been raised in populations with diseases or disorders prone to dementia. However, very little research has been done in a population with

HIV/AIDS regarding impairments of self-awareness and their relationship to rehabilitation outcomes. The advent of new treatments, such as Highly Active Anti-Retroviral Therapy (HAART), has changed the pattern of cognitive deficits in HIV/AIDS, but the rate of mild neurocognitive disorder has remained the same (Cysique, Maruff, & Brew, 2004). Fewer individuals are experiencing more severe cognitive impairments that require the intervention of caregivers, while more people are living longer with mild impairments in cognition. These impairments include memory deficits, slowed speed of information processing, motor deficits, problems with attention and concentration, and impairments in verbal abstraction and learning efficiency (Paul, Cohen, Navia, & Tashima, 2002; Reger, Welsh, Razani, Martin, & Boone, 2001).

Anatomically, HIV/AIDS is associated with white matter abnormalities and atrophy in the caudate nucleus (Paul, Cohen, Navia, & Tashima, 2002). Degeneration of the caudate nucleus has been found to be correlated significantly with poor performance on tests of memory, slowed speed of information processing, poor learning efficiency, and executive dysfunction (Paul, Cohen, Navia, & Tashima, 2002). Given this pattern of cognitive impairment, one would expect to find deficits of self-awareness in this population.

Differences have been found between self-complaints of cognitive impairment and performance on a neuropsychological test battery in an HIV+ population (Hinkin, van Gorp, Satz, Marcotte, Durvasula, Wood, et al., 1996). Rourke, Halman, and Bassel (1999) found that frontal executive impairments and mood disturbance were the two greatest determinants of a difference between cognitive complaints on the Patient's Assessment of Own Functioning (PAOF) and neuropsychological test performance. Likewise, depressive symptoms have been

found to account for the majority of the variance in neurocognitive complaints among HIV+ individuals (Rourke, Halman, & Bassel, 1999).

An estimated 30% of individuals in the asymptomatic stages of HIV have some neuropsychological deficits (Heaton, Grant, Butters, White, Kirson, Atkinson, et al., 1995; Villa, Solida, Mora, Tavolozza, Antinor, Deluca, et al., 1996). Despite the advances in pharmacology that control or postpone the outward symptoms of HIV/AIDS, individuals are still affected on a neurological level. Cognitive impairments in this population have been found to negatively affect performance in the areas of cooking, shopping, financial management, medication management, and vocational abilities (Heaton, Marcott, Mindt, Sadek, Moore, Bentley, et al., 2004). Failure of functioning in these areas was best predicted by impairments in executive functioning, learning, attention and working memory, and verbal abilities, and was associated with increased dependence on others and increased rate of unemployment (Heaton, Marcott, Mindt, Sadek, Moore, Bentley, et al., 2004). The knowledge that self-awareness decreases as cognitive deficits become worse is particularly important for addressing self-awareness deficits in their early stages. Understanding the underlying factors that contribute to deficits in self-awareness will enable rehabilitation professionals to better predict and plan ahead to address these deficits early.

1.5 SPECIFIC AIMS

Focusing on the neurogenic, psychosocial, and psychogenic domains, this study will explore numerous personal factors in an attempt to determine which contribute to or are associated with deficits in self-awareness of cognitive impairment. These personal factors include impairments

in specific cognitive domains as measured by performance on individual neuropsychological tests, psychosocial factors including age, drug and alcohol abuse, race, and years of education, and the psychogenic factor of depression. In addition, the presence of HIV/AIDS will also be examined to determine if a specific disease process is related to deficits in self-awareness.

2.0 METHODS

2.1 STUDY PARTICIPANTS

2.1.1 Inclusion/exclusion criteria

Participant data were obtained from the Allegheny County Neuropsychological Survey study and was approved by the University of Pittsburgh's Institutional Review Board. Subjects were recruited based on the presence of an AIDS defining illness in the case of the HIV+ subjects and on the perceived risk for contracting HIV in the HIV- subjects. All subjects had to be at least 18 years of age and capable of giving their own informed consent. Subjects were excluded if they were experiencing active psychosis or had a history of stroke, brain tumor, or any head injury resulting in a loss of consciousness. For the purposes of this study, subjects were selected from the larger study on the basis of having complete data on the self-report measure and a clinical impairment rating from the clinical adjudication process.

2. Subject demographics: 75 subjects' data were used for this study. 52 were HIV+ and 23 were HIV-. The breakdown of subject information is shown in Table 1.

Table 1. Subject Characteristics

	All	HIV+	HIV-
Number	75	52	23
Age	47.27 (10.18)	49.11 (8.76)	43.12 (12.03)
Sex (% Male)	65 (86.7)	47 (90.4)	18 (78.3)
Race (% White)	47 (62.7)	36 (69.2)	11 (47.8)
Years of Education	14.44 (2.39)	14.71 (2.23)	13.83 (2.68)
NART-IQ	112.48 (11.54)	113.84 (10.67)	109.50 (13.00)
Impairment Group (%) (Normal, Borderline, Severe)	12 (16), 24 (32), 39 (52)	8 (15), 17 (33), 27 (52)	4 (17), 7 (30), 12 (53)
Drug Abuse (%) (None, Current, Full Remission, Partial Remission)	43 (57), 2 (3), 22 (29), 8 (11)	33 (63), 2 (4) , 12 (23), 5 (10)	10 (43), 0 (0), 10 (43) , 3 (4)
Alcohol Abuse (%) (None, Current, Full Remission, Partial Remission)	37 (49), 3 (4), 29 (39), 6 (8)	25 (48), 3 (6), 20 (38), 4 (8)	12 (52), 0 (0), 9 (39), 2 (9)
Depression (%) (None, Current, Full Remission, Partial Remission)	27 (36), 11 (15), 28 (37), 9 (12)	20 (39), 9 (17), 14 (27), 9 (17)	7 (30), 2 (9), 14 (61), 0 (0)

2.2 MEASUREMENTS/INSRUMENTATION

2.2.1 Psychosocial information

A demographic questionnaire provided information about age, education, race, and a 24-hour history of drug and alcohol use. A psychosocial interview based on the Structured Clinical Interview for DSM-III-R (SCID)(Spitzer, Williams, Giggon, & First, 1990) was conducted to determine history and current status of depression, psychosis, and drug and alcohol abuse. Depression, drug abuse, and alcohol abuse were coded into four levels, based on results from the psychosocial interview. These levels were: none, current, full remission, and partial remission (See Table 1). For purposes of analyses, these factors were recoded into two categories, combining none and full remission into a category of “not present” and current and partial remission into a category of “present”.

2.2.2 Clinical measure of cognitive impairment

Subjects underwent a neuropsychological test battery sensitive to the cognitive impairments associated with aging and HIV/AIDS (Becker, Juengst, Aizenstein, Cochran, & Lopez, 2005). This battery was composed of several specific cognitive domains, as shown in Table 2.

Table 2. Neuropsychological test battery

<u>DOMAINS</u>	<u>TESTS</u>
Memory	California Verbal Learning test (Delis, 1987), Rey-Osterrieth Complex Figure (Rey, 1941), Digit Span
Language	Boston Naming Test (Goodglass, 1987), Verbal Fluency (Benton, 1983)
Visual Construction	WAIS-R Block Design (Wechsler, 1981); Rey Figure Copy (Rey, 1941)
Psychomotor Speed	Trailmaking Part A (Reitan, 1958), Digit Symbol Substitution Task (Wechsler, 1981), Simple Reaction Time (Miller, 1991)
Motor	Grooved Pegboard
Executive Functions	Trailmaking Part B (Reitan, 1958), Booklet Category Test (MacInnes, 1983).

A global cognitive impairment score was determined through a clinical adjudication process and was based on neuropsychological test performance and a neurological medical exam. The neuropsychological tests' scores reflecting six cognitive domains were transformed into t-scores using normative data adjusted for age, education, sex and race (Heaton & Taylor, 2004; Mitroshima, Boone, Razani, & D'Elia, 2005). An impairment score ranging from 1 ('Above Average') to 9 ('Severe Impairment') was assigned to each domain (Woods et al., 2004). In order to determine a global cognitive impairment score, these individual scores were

then presented at a clinical adjudication meeting, which included a neuropsychologist, a psychiatrist, and a neurologist. The resulting global impairment score was also on a 1-9 scale, with 1-3 indicating normal cognition (group 0), 4-5 indicating borderline cognition (group 1), and 6-9 indicating impaired cognition (group 2; See Table 4).

Cognitive impairment in specific cognitive domains was measured through performance on individual neuropsychological tests. T-scores were generated for all of the tests, except for the Digit Span and Digit Span Pointing tests, which were scored as percentiles. In addition, a verbal IQ was generated from the American National Adult Reading Test (AM-NART; Grober & Sliwinski, 1992).

2.2.3 Self-report of Cognitive Impairment

Subjects completed the Patient's Assessment of Own Functioning (PAOF) as a measure of self-report of cognitive functioning. The PAOF has been found to be a valid and reliable instrument for measuring self-reported cognitive functioning (Heaton, 1981; Chelune, Heaton, & Lehman, 1986). A score for self-report of cognitive impairment was determined by the total score on the PAOF. There were 33 questions related to difficulties in functioning, with answers ranging from 1-6 (1=almost always and 6=almost never). Answers to the items were then totaled, with a range=33-198, with 33 indicating the highest degree of impairment and 198 indicating no perceived impairment.

Subjects were then classified into three self-report of cognitive impairment categories based upon their total PAOF score. Categories were created using normalized percentiles determined by Tukey's proportion estimate formula (See Table 3). Subjects whose totals were in the 50th percentile or higher were classified as normal (Self-report group 0). Those classified

between the 25th and 50th percentile were classified as borderline impairment (Self-report group 1). Those whose scores fell below the 25th percentile were classified as reporting impaired cognition (Self-report group 2; See Table 3 and Table 4).

Table 3. Percentile Breakdown of Self-report of Cognitive Impairment Scores

	Percentiles:	5	10	25	50	75	90	95
Weighted Average	TOTAL	101.70	110.80	139.50	171.50	182.00	191.60	198.00
Tukey's Hinges	TOTAL			140.00	171.50	182.00		

2.2.4 Self-awareness of cognitive impairment

Self-awareness of cognitive impairment was determined by comparing the clinical impairment group and the self-report of cognitive impairment group. Individuals whose self-report group matched their clinical impairment group were categorized as Aware (group 0). Those whose self-report group was normal and whose clinical impairment group was borderline were classified as Limited Awareness (group 1). Those whose self-report group was borderline and whose clinical impairment group was severe were also classified as Limited Awareness (group 1). Individuals whose self-report group was normal and whose clinical impairment group was severe were classified as Poor Awareness (group 2; See Table 4). Subjects whose self-report group indicated a higher degree of impairment than their clinical impairment group were classified as Aware (group 0); while these individuals did display a discrepancy between clinical testing and self-report, previous findings indicate that outcomes for those who underestimate their abilities to not differ significantly from those with good awareness (Hoofien, Gilboa, Vakil,

& Barak, 2004). This self-awareness of cognitive impairment classification was used as a measure of self-awareness.

Table 4. Self-awareness Group Determination

Self-Report of Cognitive Impairment

		Normal	Borderline	Impaired	Total
Clinical Cognitive Impairment	Normal	0 (n=9)	0 (n=2)	0 (n=1)	n=12
	Borderline	1 (n=16)	0 (n=5)	0 (n=3)	n=24
	Impaired	2 (n=13)	1 (n=11)	0 (n=15)	n=39
	Total	n=38	n=18	n=19	N=75

0 = Aware ; 1 = Limited Awareness ; 2 = Poor Awareness

3.0 RESULTS

3.1 SELF-REPORT OF COGNITIVE IMPAIRMENT VS CLINICAL IMPAIRMENT

Table 5 summarizes the distribution of self-reported impairment across clinical impairment groups. A Pearson Chi-Square test was found to be significant ($p=.025$). These results show that those who are clinically impaired have the greatest amount of difference in regards to self-report of cognitive impairment.

Table 5. Self-report of Cognitive Impairment by Clinical Impairment

Self → Clinical	Normal	Borderline	Impaired
Normal	9	2	1
Borderline	16	5	3
Impaired	13	11	15

3.2 PAOF CORRELATIONS

Spearman's rho correlations were run in order to determine what factors were correlated with self-report scores (PAOF). Factors that were correlated with PAOF scores included the NART-IQ ($r=.309$, $p=.008$) and depression status ($r=-.509$, $p=.000$). Subjects who had a higher verbal IQ as measured by the NART rated themselves as being less impaired. Those with current symptoms of depression rated themselves as more impaired than those with no history or no symptoms of depression. Neuropsychological tests that were significantly correlated with PAOF scores included Trails B ($r=.256$, $p=.050$), Trails A ($r=.237$, $p=.040$), CVLT 1-5 ($r=.411$, $p=.001$), CVLT Long Delay Free Recall ($r=.370$, $p=.002$), WR-Blocks ($r=.301$, $p=.011$), and Rey Figure Copy ($r=.254$, $p=.030$). This indicates that higher t-scores on these neuropsychological tests are associated with higher scores on the PAOF; higher scores on the PAOF represent less perceived impairment. All other neuropsychological tests were not significantly correlated with PAOF scores ($p's >.05$).

3.3 SELF-AWARENESS OF COGNITIVE IMPAIRMENT GROUP ANALYSIS

Spearman's rho correlations were run to determine if there was an association between various personal factors and self-awareness as measured by the self-perception of cognitive impairment score (0=aware, 1=limited awareness, 2=poor awareness). These personal factors included HIV status, age, years of education, alcohol abuse, drug abuse, depression, NART-IQ, and all of the neuropsychological tests performed. Significant results are summarized in Table 6.

Table 6. Factors Correlated with Self-awareness of Cognitive Impairment

Factor	Significance	Correlation Coefficient
Age	.006	-.313
Drug Abuse	.029	.252
Digit Symbol	.022	-.265
Simple Reaction Time	.003	-.354
	Borderline Significance	
Digit Span	.058	-.223
Rey Figure Immediate Recall	.064	-.215
Depression	.062	-.216

In the case of age, a negative correlation signifies that being older is correlated with being more self-aware. With regard to drug abuse, current use or abuse is associated with being less self-aware. Those who were currently using or abusing drugs did not differ significantly on any other factor from those who were not using drugs. For the neuropsychological tests that were borderline or significant, poorer performance on these tests was associated with less self-awareness.

Given that self-perception of cognitive impairment is a categorical variable with three levels, a one-way ANOVA was run in order to determine the differences between groups. Factors that were found to differ significantly between groups included performance on the Digit Symbol test ($F = 5.17, p=.008$) and the Rey Figure Immediate Recall ($F = 3.38, p=.040$).

However, the LSD post hoc analyses showed further differences. These results are shown in Table 7.

Table 7. LSD post Hoc Analysis: Personal Factor Differences Between Self-awareness of Cognitive Impairment Groups

	Aware vs Poor Awareness	Limited Awareness vs Poor Awareness
Age	.017	.123
Means:	(49.58 , 41.73)	(46.95 , 41.73)
Drug Abus	.024	.162
Means:	(0.057 , 0.308)	(0.148 , 0.308)
Digit Symbol	.003	.005
Means:	(51.11 , 41.38)	(51.00 , 41.38)
Digit Spa	.043	.207
Means:	(59.9% , 39.3%)	(52.4% , 39.3%)
Digit Span Pointing	.061	.039
Means:	(49.7% , 30.0%)	(52.7% , 30.0%)
Rey Figure Immediate Recall	.020	.018
Means:	(50.34 , 40.77)	(50.89 , 40.77)
Rey Figure Direct Recall	.045	.043
Means	(49.49 , 41.85)	(49.89 , 41.85)
Grooved Pegboard	.038	.076
Means:	(44.40 , 37.38)	(43.59 , 37.38)

In each of these factors except Digit Span Pointing, there was a significant difference between the Aware and Poor Awareness groups. There were also significant differences between the Limited Awareness and Poor Awareness groups in performance on the Rey Figure Immediate and Direct Recall, the Digit Symbol, and the Digit Span pointing tests. There were no significant differences found between the Aware and Limited Awareness groups. With regard to age, individuals in the Aware group were, on average, older than those in the Poor Awareness group. For drug abuse, those in the Poor Awareness group were more likely to be current users or abusers than those in the Aware group. On all of the neuropsychological tests, those in the Poor Awareness group had lower t-scores than those in the other groups with which there was a significant difference. This supports the results reported earlier that those who are more clinically cognitively impaired demonstrated poorer self-awareness.

Additional ANOVA were run to examine whether or not there were differences between those who were HIV positive and those who were HIV negative in regards to factors associated with self-awareness. The LSD post-hoc analyses (see Table 8) found that the effect of age was only present in the HIV positive group, indicating that those in the Poor awareness group were younger than those in the Aware group ($p = .005$) and the Limited awareness group ($p = .048$).

Table 8. The Effect of Age in HIV Positive versus HIV Negative Subjects

	HIV Positive				HIV Negative		
	Aware	Limited	Poor		Aware	Limited	Poor
Number	24	21	7		11	6	6
Age (Mean)	51.83	48.59	41.34		44.66	41.21	42.2

4.0 DISCUSSION

4.1 SIGNIFICANCE TO REHABILITATION

The present study examined self-awareness by testing differences between self-reported cognitive impairment and clinically tested cognitive impairment in a population of individuals with and without cognitive impairment due to a variety of factors including HIV/AIDS, age, and/or substance abuse. We then examined associations between self-awareness and several personal factors.

There are multiple applications of this research. Defining self-awareness by contrasting self-report and clinical test performance provides an objective method for measuring impairments of self-awareness. Being able to evaluate self-awareness and understand its etiology will allow for the creation of individualized rehabilitation plans (Fleming & Ownsworth, 2006). In addition, it provides a basis of judgment for counselors when determining whether or not to trust self-reports of functioning. Understanding factors associated with poor self-awareness may be useful for designing focused cognitive rehabilitation interventions. If the personal factors that contribute to deficits in self-awareness are known, then these factors can be targeted in the rehabilitation plan. Addressing self-awareness will allow counselors to help clients set realistic goals and develop appropriate compensatory strategies. Goal-setting becomes

particularly important when related to long-term planning for progressive diseases or conditions, such as HIV/AIDS.

4.2 SUMMARY OF RESULTS

In the present study, individuals with poor awareness differed from those with good awareness and those with limited awareness in several factors. In addition to age, another psychosocial factor that was associated with self-awareness was drug abuse. Those who were currently using or abusing drugs demonstrated poorer awareness than those who were not currently using or had never used drugs (in both HIV+ and HIV- subjects). Given the prevalent comorbidity of HIV/AIDS and drug abuse, this is a significant factor to consider when relying on self-reported data or addressing self-awareness. With regard to psychogenic factors, depression was correlated with self-reported impairment, but only had borderline significance for self-awareness. Considering that those who were depressed were more likely to report impairment, one would expect that individuals who were severely impaired and depressed would be more likely to report impairment accurately or underestimate themselves. Given this expectation, the borderline significance of depression as a factor contributing to deficits in self-awareness should not be ignored. More specific definitions of depression status may yield significant results.

There were several neurogenic factors contributing to poor self-awareness. Individuals with poor self-awareness differed from those with good awareness in their performance on the digit span test and grooved pegboard test. They differed significantly from both those with good awareness and limited awareness in their performance on the digit-symbol test, the Rey Figure immediate recall, and the Rey Figure direct recall. The overall pattern of performance on these

neuropsychological tests points to deficits in working memory, learning, and executive function as being associated with poor self-awareness. The impact of executive functioning is consistent with findings across the literature (Ecklund-Johnston & Torres, 2005). The significance of working memory and learning may be related to the questions that were asked in the self-report and the cognitive domains being measured by the neuropsychological tests; these differences have previously been suggested to account for discrepancies in the literature on self-awareness.

4.3 IMPORTANCE TO HIV/AIDS

This is the first study to examine self-awareness deficits in the HIV/AIDS population. The findings of this study indicate that HIV status alone does not impact degree of self-awareness. However, HIV/AIDS is a disease that often causes severe cognitive impairments in younger individuals. The most significant finding in relation to HIV/AIDS, then, is that younger individuals who are severely impaired are more likely to have poor self-awareness than older individuals who are equally impaired. This was found to be true in those with HIV/AIDS, but not in those who were HIV negative. This suggests that the disease process itself plays a role in this age effect on self-awareness. In addition to the effects of age, awareness decreases as the severity of cognitive impairment increases. This is apparent in the severely impaired group, which had the greatest variety in self-report of cognitive impairment. Given the progressive nature of HIV/AIDS, the likelihood of increased severity of cognitive impairment is high, particularly as individuals age. This is important to consider when creating long-term rehabilitation plans for individuals with HIV/AIDS.

Because there is limited research on cognitive rehabilitation for individuals with HIV/AIDS, these findings provide the first insights into the rehabilitation implications for this population. It is important for clinicians to understand the degree to which they can trust self-reports and what factors may be influencing self-awareness. In addition, evidence suggests that individuals with asymptomatic HIV may also be experiencing cognitive impairment, which is predictive of future cognitive decline (Villa et al., 1996).

The HIV/AIDS population presents particular problems in regards to measuring self-awareness and addressing its deficits from a rehabilitation perspective. First, it is difficult to obtain any objective standard against which to compare self-reports. Many individuals in this population do not have caregivers or even close family members who can provide a report on everyday cognitive functioning. Neuropsychological tests are expensive and are often inaccessible to individuals with HIV/AIDS as a result. Finally, this is a population that is served largely in medical facilities and often does not encounter rehabilitation agencies. In order for rehabilitation professionals to have contact with individuals in this population, they must be able to justify the necessity of rehabilitative services. The first step in this process may be in addressing medication compliance. Individuals with HIV/AIDS who are experiencing poor self-awareness may have difficulty following through with complicated medication regimes or understanding the need for medications at all. Given the importance of medication compliance in this population, rehabilitation professionals could provide the proper training and support to increase treatment compliance.

Being able to address cognitive impairment in its early stages and create rehabilitation plans that address the progressive nature of HIV/AIDS may help to circumvent the barriers of poor self-awareness in the future. Based on our findings, additional research is needed to

examine the extent of cognitive impairment and its sequelae and the effectiveness of cognitive rehabilitation in this population.

4.4 LIMITATIONS

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. As with previous research, a limitation of this study is its inability to clearly define self-awareness. Hoofien, Gilboa, Vakil, and Barak (2004) suggested that overall self-awareness is not as significant to or predictive of functional outcomes as self-awareness in specific domains. Measurements of clinical impairment and self-report in this study were derived to be globally representative; perhaps a more accurate measure would be to compare self-report of specific functions with impairment in those specific areas (e.g. memory). Also, by grouping individuals into categories according to self-awareness as opposed to deriving a continuous measure, much of the power and specificity of the analyses were lost.

Another limitation to this and other studies that measure self-awareness as a differential between self-report and some objective measure is the difference between what is being asked in a self-report and what is being objectively measured. Neuropsychological tests of memory may be measuring a different construct than that which is being reported (Prouteau et al., 2004). As previously discussed, neuropsychological tests may not provide the most ecologically valid data. As such, functional assessments, which are based on functioning in real-

world situations, may provide more appropriate and accurate objective standards for defining self-awareness. Functional assessment allows for the assessment of the specific demands of an individual's environment and the individual's performance in regards to those demands; this would provide a more ecologically valid measure for objective performance (Chaytor, Schmitter-Edgecombe, & Burr, 2006).

4.5 FUTURE DIRECTIONS

The next step in the research process would be to investigate more specific definitions of self-awareness; this could include investigating self-awareness of specific cognitive domains. In addition, future research must attend to the relationship between what is being asked in a self-report and what is being measured via the objective measure.

Expanding the number of contributing personal factors that are being investigated may provide a clearer picture of self-awareness. First, including a neurological examination would add additional biological factors such as viral load, sensory impairments, and motor impairments. Including imaging data would also add to the robustness of this research and provide an additional clinical measure for cognitive impairment. Expanding to different populations, such as persons with traumatic brain injury, individuals with attention deficit disorder, or persons with different etiologies of dementia may provide more detailed data for application to clinical practice. Finally, in order to better address rehabilitation planning and create appropriate goals, self-awareness of the impact of cognitive impairment on functioning could be measured by the difference between self-report of functioning and performance in real-world tasks as measured by functional assessment.

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