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An Exploratory Factor Analysis of a Brief Self-Report Scale to Detect Neurocognitive Impairment among Participants Enrolled in Methadone Maintenance Therapy

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Abstract

The present study examines the factor structure of the existing Neuropsychological Impairment Scale (NIS) through the use of exploratory factor analysis (EFA). The NIS is a brief self-report measure originally designed to assess neurocognitive impairment (NCI) by having patients rate a range of items that may influence cognitive functioning. Stabilized patients on methadone maintenance therapy (MMT; N=339) in New Haven, CT who reported drug- or sex-related HIV risk behaviors in the past 6 months were administered the full 95-item NIS. An EFA was then conducted using principal axis factoring and orthogonal varimax rotation. The EFA resulted in retaining 57 items, with a 9-factor solution that explained 54.8% of the overall variance. The revised 9-factor measure - now referred to as the Brief Inventory of Neuro-cognitive Impairment (BINI) - showed a diverse set of factors with excellent to good reliability (i.e., F1 $\alpha = 0.97$ to F9 $\alpha = 0.73$). This EFA suggests the potential utility of using the BINI in the context of addiction treatment. Further research should examine the utility of this tool within other clinical care settings.

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Keywords

Neuropsychological Impairment Scale; neurocognitive impairment; exploratory factor analysis; addiction; methadone maintenance therapy; HIV

1. Introduction

Illicit drug use is a significant public health problem in the United States and elsewhere. In 2013, there were over 24.6 million current illicit drug users, representing over an 8% increase in the number of drug users since 2002 (Substance Abuse and Mental Health Services Administration, 2014). Studies on the neurocognitive effects of drug use have shown that chronic drug use is strongly correlated with a host of neurocognitive impairments (NCI). For example, individuals with opioid use disorders (OUDs) have documented deficits in executive function, attention, working memory, and episodic memory (Anand, Springer, Copenhaver, & Altice, 2010; Baldacchino, Balfour, Passetti, Humphris, & Matthews, 2012; Rapeli et al., 2006; Schiltenwolf et al., 2014; Verdejo-García, López-Torrecillas, Giménez, & Pérez-García, 2004). Cocaine and methamphetamine use is also correlated with lasting changes in brain structure and neurological functions, resulting in impaired executive function, memory, attention, new learning, information-processing speed, and visual-spatial perception (Anand et al., 2010; Nordahl, Salo, & Leamon, 2003; Norman, Basso, Kumar, & Malow, 2009; Shrestha, Huedo-Medina, & Copenhaver, 2015; Spronk, van Wel, Ramaekers, & Verkes, 2013; Vonmoos et al., 2014). Likewise, lifetime alcohol dependence has been found to impair attention, memory, and learning (Anand et al., 2010; Sabine Loeber et al., 2009; Solfrizzi et al., 2007; Stampfer, Kang, Chen, Cherry, & Grodstein, 2005). Within HIV clinical care settings, NCI can be compounded when patients use alcohol or drugs (Anand et al., 2010) and this can greatly impact treatment outcomes like linkage and retention in care and antiretroviral therapy (ART) adherence (Altice, Kamarulzaman, Soriano, Schechter, & Friedland, 2010; Kamarulzaman & Altice, 2015).

Neurocognitive deficits have been found to affect multiple behavioral predictors of intervention efficacy, including motivation and behavioral skills (Anand et al., 2010; Bates, Pawlak, Tonigan, & Buckman, 2006; Blume, Davis, & Schmaling, 1999; Morgenstern & Bates, 1999; Nakagami, Hoe, & Brekke, 2010), which must be accounted for during behavioral intervention development and adaptation (Ezeabogu, Copenhaver, & Potrepka, 2012). Moreover, impaired neurocognitive abilities including executive function, memory, attention, new learning, and information processing observed in persons with substance use disorders may prevent appropriate acquisition and retention of behavioral content conveyed in customary risk-reduction programs (Anand et al., 2010). Thus, deficits in neurocognitive abilities among people who use drugs (PWUD) are important predictors of overall risk-reduction program participation and outcomes. For example, Ezeabogu et al. found differential treatment outcomes (i.e., ART adherence and drug risk reduction) following an HIV prevention intervention: PWUD with a lower degree of NCI demonstrated better treatment outcomes (Ezeabogu et al., 2012). Similarly, an earlier study observing PWUD with comorbid psychiatric conditions demonstrated that lower executive, memory, and intellectual function corresponded closely with lower motivation to change substance use

behaviors (Blume et al., 1999). Given the persistence of NCI among PWUD, there is a growing need to improve screening for NCI, and when detected, to more effectively accommodate NCI in the delivery of interventions.

Despite the need to identify and address NCI when providing addiction treatment and related services, training of clinical staff does not typically include the requisite knowledge and skills to rapidly and accurately assess clients' neurocognitive status in order to make appropriate modifications, if needed, to treatment approaches (Copenhaver, Avants, Warburton, & Margolin, 2003; Fals-Stewart, 1997; Weinstein & Shaffer, 1993). Furthermore, cognitively impaired individuals often develop adaptive mechanisms to socially disguise their impairment, making casual observation of cognitive problems quite challenging (M. Copenhaver et al., 2003; Fals-Stewart, 1997). Therefore, despite the availability of a number of diagnostic instruments designed to measure NCI, many of which are complex and time-consuming, recent studies have stressed the importance of rapid self-report screening tools for this purpose (Schouten, Cinque, Gisslen, Reiss, & Portegies, 2011; Shrestha et al., 2015).

The Neuropsychological Impairment Scale (NIS), a self-report measure, was originally developed as a quick and convenient way to help elicit diagnostically relevant information about NCI (O'Donnell, DeSoto, & Desoto, 1994). The structured, easily administered NIS inventory addresses both general neurocognitive impairment and specific symptoms areas (i.e., attention, memory, linguistic functioning, etc.) generating inherent advantages over lengthy and formal clinical interviews. The NIS was designed to assess NCI by having patients rate a range of items that may influence cognitive functioning. The scale has been primarily used as a screening tool in HIV-negative, psychiatric treatment settings in order to identify patients who may be experiencing significant signs of cognitive impairment relative to normative scores from a non-clinical population.

In the original validation of the 95-item NIS, the psychometric structure was evaluated through two principal components analyses (PCA), which yielded initial solutions of 22 and 24 factors for the nonclinical and clinical samples, respectively (O'Donnell et al., 1994). Despite the large number of factors for both PCAs, a visual inspection of the scree plot was used to justify a 5-factor solution for both the clinical and nonclinical samples. This procedure placed an *a priori* restriction on the number of factors –or in this case, components – that may be empirically observed, violating the established rule of retaining factors with eigenvalues greater than 1, especially in the initial analyses (Bryant & Yarnold, 1995). Upon review of the 5-factor solutions, O'Donnell and colleagues divided individual factors into multiple factors, based on different item content. This procedure was done most evidently with the Attention and Memory subscales of the NIS (see page 51 of NIS manual) (O'Donnell et al., 1994). Furthermore, other subscales of the NIS were composed of items from multiple factors, as was done with the Learning-Verbal and Academic Skills subscales which, again, appears to have been done "by hand" based on visual inspection of item content rather than by statistically relevant factor loadings.

Due to these limitations and because we implemented the NIS with drug-involved participants stabilized on methadone maintenance therapy (MMT), in contrast to the clinical

(i.e., a sample of 534 neuropsychiatric patients) and non-clinical (i.e., a sample of 1,000 healthy adults) samples with which the scale was originally developed, our objective was to conduct an exploratory factor analysis (EFA) of the NIS with a new sample (O'Donnell et al., 1994). In the present study, we examined the factor structure of the NIS using data from participants enrolled in MMT and, based on the analysis, have recommended revisions to the original scale for optimal use with this population.

2. Methods

The present EFA of the NIS was embedded within a larger randomized clinical trial (RCT) of the Community-friendly Health Recovery Program (CHRP) (see: https://clinicaltrials.gov/ct2/show/NCT01741350), a behavioral HIV-risk reduction intervention that is designed to reduce HIV transmission risk behavior (M. M. Copenhaver, Lee, & Baldwin, 2013). CHRP is an abbreviated, manual-guided intervention strategy comprised of four group sessions that address sex-and drug-related HIV risk behaviors among individuals with opioid use disorders (OUDs) and enrolled in MMT (http://www.nrepp.samhsa.gov/ProgramProfile.aspx?id=11). Because of the higher degree of NCI reported among drug-involved persons on MMT (Ezeabogu et al., 2012; Shrestha et al., 2015), we were interested in examining NCI within our study sample. The study protocol was approved by the Investigational Review Board (IRB) at the University of Connecticut, the Human Investigation Committee at Yale University, and received board approval from the APT Foundation MMP, Inc.

2.1. Participants

Participants were recruited from a MMT program in New Haven, Connecticut, if they were: 18 years or older, met DSM-V criteria for OUDs and newly enrolled in MMT, reported drug- or sex-related HIV risk behaviors in the past 6 months, able to read and understand the questionnaires, could provide informed consent form, available for the duration of the study, and not actively suicidal, homicidal, or psychotic. All subjects were reimbursed for the time required to participate.

2.2. Neurocognitive Impairment Measure

Following informed consent and enrollment, the structured baseline survey, including the NIS, was self-administered to participants using Audio Computer-Assisted Self-Interview (ACASI) (M. M. Copenhaver et al., 2013; Macalino, Celentano, Latkin, Strathdee, & Vlahov, 2002) battery of questionnaires. The original NIS is composed of 95 items rated on a 5-point scale, ranging from 0 (not at all) to 4 (extremely). As recommended by the NIS manual (O'Donnell et al., 1994), the interviews were conducted in a private room. Individuals were asked to read each statement and indicate the degree to which it applied to them during the last 30 days. Some items referred to experiences during the past few days or weeks, and others referred to experiences at any time in the past (O'Donnell et al., 1994). There was no time limit to complete the NIS, although respondents required an average of 10–12 minutes.

2.3. Procedures and analyses

Prior to our EFA, we evaluated the peer-reviewed literature on the development and validation of the original (O'Donnell, de Soto, & Reynolds, 1984; O'Donnell, Reynolds, & de Soto, 1983, 1984) and revised (O'Donnell, de Soto, & de Soto, 1993) versions of the NIS (O'Donnell et al., 1993; O'Donnell, de Soto, et al., 1984; O'Donnell et al., 1983) as well as the NIS user manual. We noted that 15 of the 95 NIS items are designed to function as "validity checks" to distinguish a participant's potential response set or psychological symptoms that are unrelated to neurocognitive impairment, yet may cloud the ability to detect it, including: Defensiveness (e.g., "I am always happy" and "I always tell the truth") and Affective Disturbance (e.g., "I tend to worry all the time" and "I feel quite discouraged about my future"). We elected to retain these items in the factor analysis.

An EFA was conducted on the full 95-item NIS using principal axis factoring and orthogonal varimax rotation (IBM Corp., 2013). Reliability was measured using Cronbach's alpha. All analyses were performed using IBM SPSS version 22.0 (IBM Corp., 2013).

3. Results

The characteristics of the 339 enrolled participants are described in Table 1. Participants were generally female (51%), white (74.6%), never married (66.1%), completed high school (73.4%), unemployed (94.1%) and with a mean age of 34.1 (SD=9.5) years. The majority of the participants were HIV-negative (87.3%), long-term drug users, reporting both cocaine (50.1%) and opioid (73.4%) use in the last month. Almost one in every six participant reported living in a controlled environment, such as jail or treatment facilities, in the past 30 days. All participants were maintained on a stable methadone dose, with the mean daily methadone dose of 57.5 (SD=25.7) mg.

The initial rotated solution revealed a 19-factor solution that explained 59.4% of the variance. Inclusion of the 15 validity check items in this analysis, which were dispersed across the 19 factors and did not contribute meaningfully to the factor structure, posed a likely confound to the solution, and were therefore removed. The remaining 80 items were submitted to a second EFA using the same procedure, yielding a 12-factor solution that accounted for 55.6% of the variance. Despite the slight reduction in variance explained, this model condensed the factor structure from 19 to 13. Twelve items showed loadings below 0.40. Given the high number of items retained, items with loadings below 0.40 or items with shared loadings of equal strength across multiple factors were eliminated, leaving 57 items. The same EFA procedure was repeated on the 57 retained items, resulting in a 9-factor solution that explained 54.8% of the overall variance.

The final rotated factor matrix for the EFA is presented in Table 2. Item-to-factor correlations were checked by creating composite mean scores to represent each factor and loading all items and composite scores into a bivariate correlation matrix. Results showed each item correlated strongest with the factor to which it was assigned. As shown, factors that were identified ranged from generalized cognitive problems to more specific symptoms of impairment (Table 2).

Factor 1 included 22 items emblematic of generalized cognitive impairment (e.g., “I have difficulty paying attention” and “I get lost easily”) and was therefore labeled “Global Impairment.” Factor 2 contained 8 items that address cognition-related tasks and learning (e.g., “I count with my fingers” and “I have trouble learning new things” and was named “Learning-related”. Factor 3 contained 5 items that focused on speech, communication, and language (e.g., “My words get mixed up”), which was labeled “Language-related.” Factor 4 contained 4 items that address memory (e.g., “I have trouble remembering people’s names”) and was named “Memory-related.” Factor 5 included 5 items about motor behaviors (e.g., “I am very clumsy”) and was labeled “Psychomotor/Physical.” Factor 6 contained 5 items that center around body-related impairment (e.g., “I have trouble with the left side of my body”) and was named “Psychomotor/Perceptual.” Factor 7 contained 3 items regarding temperament-related issues (e.g., “I have urges to break and smash things”), which was named “Anger-related”. Factor 8 was made up of 3 items that reflect pain and pain-related consequences (e.g., “I have severe headaches”) and was named “Pain-associated Impairment.” Last, factor 9 included 2 items about head injuries (e.g., “I have been knocked unconscious”) and was named “Traumatic Head Injury-related.” (Table 1).

The revised 57-item tool - now referred to as the Brief Inventory of Neuro-cognitive Impairment (BINI) - showed a diverse set of factors as well as excellent overall reliability ($\alpha = 0.97$). The reliability of the 9 factors ranged from excellent to good (F1 α=0.97; F2 α=0.89; F3 α=0.82; F4 α=0.76; F5 α=0.79; F6 α=0.75; F7 α=0.75; F8 α=0.74; F9 α=0.73).

4. Discussion

Chronic use of illicit drugs, such as opioids, cocaine or amphetamine, is associated with a greater likelihood of neurocognitive impairment (NCI) (Anand et al., 2010; Baldacchino et al., 2012; Ezeabogu et al., 2012; Nordahl et al., 2003; Norman et al., 2009; Rapeli et al., 2006; Schiltenwolf et al., 2014; Shrestha et al., 2015; Spronk et al., 2013; Verdejo-García et al., 2004; Vonmoos et al., 2014). The severity of NCI in drug users may play an important role in the efficacy of treatment and prevention services among PWUD: those with a higher degree of NCI may engage less in the treatment process and have poorer treatment outcomes (Anand et al., 2010; Bates et al., 2006; Blume et al., 1999; Morgenstern & Bates, 1999; Nakagami et al., 2010). Given the increased prevalence of drug use and higher degree of NCI among PWUD (Ezeabogu et al., 2012; Shrestha et al., 2015), it is not only important to screen for NCI at treatment entry, but to also provide treatment approaches and interventions specifically designed to accommodate patients with NCI. Thus, the aim of this study was to examine the factor structure of the NIS in order to consider its potential utility as a screening tool for detecting NCI in a group of drug-involved individuals in treatment.

Our EFA shows that the BINI is structured to detect NCI in our sample, ranging from generalized neurocognitive symptoms to more specific forms of impairment (e.g., Learning-related; Psychomotor/Perceptual, Traumatic Head Injury-related) as captured by other factors within the scale. The BINI showed excellent overall reliability and captured diverse areas of NCI that would appear useful to treatment providers. Given its ease of administration, sound psychometric properties, and straight-forward interpretation, the BINI may serve as a helpful, abbreviated instrument to screen for NCI in patients entering or

involved in addiction treatment, and for detecting signs of NCI over time. Administration of the BINI in the context of treatment could illuminate neurocognitive deficits, which may impact patients' overall treatment participation and outcomes. Furthermore, elevated scores on any of the specific factors could guide providers to follow up with more in-depth neuropsychological testing in order to better understand and accommodate deficits in the context of treatment.

This EFA is also encouraging in terms of pointing to the potential convenience of the BINI in the context of real world treatment settings. With fewer items to complete, it is less-time consuming as compared to the original NIS. Further research is warranted, however, to establish the acceptability and utility of this tool in the course of clinical care among other risk populations and within other clinical care settings.

The findings from this study should be realistically considered in light of some limitations. The sample used to test the EFA is modest for such studies and thus had relatively moderate statistical power. The study is cross-sectional in nature, so it is impossible, based on these data, to fully know the extent to which the resulting factor structure may vary over time. The study is also limited by the use of data that were exclusively self-reported during the intake process. As such, the data are subject to potential biases associated with the desire to misrepresent levels of awareness about particular items in the questionnaire. Furthermore, a number of studies have demonstrated that methadone alone may contribute to NCI (Darke, Sims, McDonald, & Wickes, 2000; Mintzer & Stitzer, 2002; Rapeli et al., 2007; Verdejo, Toribio, Orozco, Puente, & Perez-Garcia, 2005), and show a dose effect (S. Loeber, Kniest, Diehl, Mann, & Croissant, 2008; Rapeli et al., 2007). Thus, it may be challenging for treatment providers to determine whether deficits in neurocognitive abilities are specifically driven by the direct effects of methadone, drug use, or a combination of multiple factors. Therefore, it is essential to screen patients for possible NCI upon entry and also reassess when patients achieve their effective treatment dose. Those who are found to have severe forms of NCI at intake may consider alternative treatments, such as buprenorphine maintenance treatment (BMT) or extended- release naltrexone (XR-NTX) (Altice et al., 2010), which are likely to influence NCI less.

Nonetheless, the study does offer initial information about the psychometrically valid factor structure of the revised NIS among a portion of the population wherein very limited research has been conducted. Future research is needed to evaluate the convergent and divergent validity of the revised NIS and also its predictive validity with objective NCI measures, such as Trail Making Tests, Wechsler Adult Intelligence Scale Revised (WAIS-R) Digit-Symbol Subtest, CogState tools, etc. In addition, studies should test the factor structure among this sample across time in order to test for factor structure invariance. Furthermore, future studies should test the utility and reliability of this scale among larger and more diverse populations, such as people living with HIV, and within different clinical settings.

5. Conclusion

Since neurocognitive impairment negatively influences addiction treatment outcomes and cognitive abilities are often impaired in chronic drug users, screening will likely prove

important not only in the treatment of drug-involved individuals, but also in tailoring intervention approaches. The EFA conducted in this study produced a psychometrically sound, revised NIS factor structure, which is better equipped to detect neuropsychological symptoms among drug-involved individuals in treatment. Distinct from the original NIS, which was originally developed among different samples and had fundamental psychometric limitations, this revised instrument may be a useful tool for clinicians and researchers to identify NCI among high-risk drug users and to inform enhanced treatment approaches. Future research is needed to further explore and validate the BINI as a tool for NCI screening and for guiding treatment within other clinical settings.

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Highlights

- Neurocognitive impairment (NCI) negatively influences addiction treatment outcomes.
- Neuropsychological Impairment Scale (NIS), a self-report measure, was originally developed to assess NCI among patients in psychiatric treatment settings.
- We examined the factor structure of the NIS using data from participants enrolled in methadone maintenance therapy.
- The revised 9-factor measure - now referred to as the Brief Inventory of Neurocognitive Impairment (BINI) - showed a diverse set of factors with good to excellent reliability.
- Results suggest the potential utility of using the BINI in the context of addiction treatment.

Table 1

Characteristics of participants (N = 339)

Characteristic	*n* (%)
Mean years of age ± SD	34.1 ± 9.5
Gender (male)	166 (49.0)
Ethnicity	
White	253 (74.6)
African American	30 (8.8)
Hispanic or Latino	49 (14.5)
Other	7 (2.1)
Finished high school	249 (73.4)
Current marital status	
Married	38 (11.2)
Never married	224 (66.1)
Separated	22 (6.5)
Divorced	50 (14.7)
Widowed	5 (1.5)
Income	
0 – $10,999	281 (82.9)
$11,000 – $20,999	24 (7.1)
$21,000 – $30,000	24 (7.1)
Over $30,000	10 (2.9)
HIV status	
Negative	296 (87.3)
Positive	18 (5.3)
Don’t know	25 (7.4)
Methadone dose ± SD	57.5 ± 25.7
Stayed in controlled environment [a]	58 (17.1)
Drug use (past 30 days)	
Ever used opioid	249 (73.4)
Avg. opioid use – bag	123.6 ± 183.4
Avg. opioid use – days	13.2 ± 11.2
Ever used cocaine	170 (50.1)
Avg. cocaine use – bag	40.8 ± 94.1
Avg. cocaine use – days	6.3 ± 8.4

Note:

[a] Indicates jail/prison, inpatient alcohol/drug treatment, medical treatment, and psychiatric treatment (in the last 30 days).

Table 2

Factor loadings from exploratory factor analysis of the original NIS[a]

Item	Factor/label[b]								
	1 Global Impairment	2 Learning	3 Language	4 Memory	5 Psychomotor/P hysical	6 Psychomotor/Perception	7 Anger	8 Pain	9 Head Injury
I have trouble concentrating.	0.729	0.323	0.131	0.089	0.168	0.006	0.032	0.103	0.160
My mind won't stay on any one thing.	0.708	0.110	0.101	0.070	0.169	0.081	0.193	0.092	0.118
I have difficulty paying attention.	0.698	0.264	0.091	0.218	0.162	0.027	0.005	−0.050	0.147
My mind tends to wander.	0.685	0.066	0.199	0.221	0.085	0.059	0.081	0.141	0.116
I often feel restless.	0.671	0.144	0.108	0.084	0.134	0.064	0.262	0.298	0.006
I am easily distracted.	0.669	0.156	0.125	0.113	0.125	−0.115	0.163	0.016	0.196
I have trouble making up my mind.	0.635	0.224	0.134	0.142	0.183	0.030	0.096	0.246	0.053
I have difficulty making decisions.	0.614	0.231	0.162	0.243	0.194	0.098	0.084	0.092	0.051
I forget what I read.	0.589	0.232	0.284	0.160	0.027	0.130	0.040	0.091	0.118
I feel frustrated quite often.	0.571	0.085	0.089	0.181	0.057	0.061	0.319	0.229	−0.094
My judgment is poor.	0.566	0.201	0.191	0.139	0.013	0.137	0.240	0.119	0.112
Something is wrong with my mind.	0.546	0.167	0.200	0.201	0.161	0.218	0.257	0.082	0.027
I have trouble remembering important things.	0.540	0.269	0.077	0.499	0.110	0.090	0.153	−0.009	0.237
My thinking becomes blocked.	0.536	0.237	0.179	0.292	0.137	0.153	0.163	0.056	0.086
I fall apart under pressure.	0.531	0.322	0.188	0.120	0.130	0.135	0.172	0.279	−0.006
I tend to give up easily.	0.515	0.173	0.140	0.149	0.126	0.047	0.114	0.029	−0.047
I forget where I put things.	0.496	0.145	0.098	0.433	0.174	0.106	0.156	0.031	0.112
I feel everything is an effort.	0.457	0.300	0.193	0.026	0.108	0.117	0.173	0.154	0.096
I often lose things.	0.452	0.241	0.108	0.369	0.249	0.031	0.125	0.041	0.135
I get lost easily.	0.449	0.293	0.114	0.254	0.343	0.093	0.168	0.039	0.042
My mind frequently goes blank.	0.446	0.357	0.301	0.296	0.141	0.115	0.118	0.061	0.163
My reactions are slow.	0.434	0.394	0.345	0.158	0.103	0.300	0.216	−0.014	0.063
My arithmetic is poor.	0.290	0.740	0.127	0.104	0.132	0.017	0.082	0.140	0.031
Doing simple math problems in my head is difficult.	0.236	0.738	0.181	0.058	0.045	−0.008	0.096	0.075	0.093

Item	Factor/label[b]								
	1 Global Impairment	2 Learning	3 Language	4 Memory	5 Psychomotor/P hysical	6 Psychomotor/Perception	7 Anger	8 Pain	9 Head Injury
I count with my fingers.	0.324	0.529	0.104	0.084	0.123	0.001	0.109	0.192	−0.120
I do things slowly.	0.265	0.527	0.318	0.183	0.225	0.238	0.146	0.033	0.061
My mind is dull.	0.369	0.523	0.277	0.145	0.094	0.159	0.149	0.037	0.063
I forget the names of common things.	0.319	0.464	0.318	0.206	0.138	0.144	0.200	−0.026	0.148
I have trouble learning new things.	0.297	0.457	0.185	0.193	0.046	0.222	0.123	−0.075	0.176
I have forgotten much what learned in school.	0.401	0.418	0.230	0.238	0.072	0.067	0.122	0.103	0.089
My words get mixed up.	0.321	0.217	0.584	0.100	0.155	0.047	0.145	0.091	0.082
I have trouble writing sentences.	0.063	0.351	0.581	0.094	0.056	0.126	0.039	0.018	0.081
My mind works slowly.	0.237	0.270	0.560	0.245	0.186	0.113	0.072	−0.040	0.052
My hearing has become worse.	0.228	0.025	0.520	0.126	0.195	0.181	0.026	0.171	0.045
I have trouble following conversations.	0.333	0.280	0.519	0.176	0.118	0.086	0.102	−0.061	0.126
I have serious memory problems.	0.332	0.221	0.272	0.629	0.112	0.123	0.054	0.130	0.081
I am forgetful.	0.342	0.100	0.341	0.522	0.206	−0.080	−0.002	0.044	−0.014
I have trouble remembering people's names.	0.328	0.197	0.155	0.486	0.074	−0.008	0.085	0.039	0.143
I have forgotten many things from my childhood.	0.168	0.036	0.076	0.463	0.120	0.058	0.052	0.081	0.070
I am very clumsy.	0.319	0.225	0.164	0.190	0.614	0.060	0.225	0.034	0.019
I drop things frequently.	0.286	0.025	0.143	0.162	0.609	0.132	0.152	0.047	0.051
I bump into things.	0.272	0.080	0.454	0.171	0.584	0.000	0.126	0.166	−0.001
I fall down sometimes.	0.150	0.237	0.066	0.118	0.498	0.233	0.036	0.156	0.172
I faint sometimes.	0.042	0.120	0.173	0.040	0.377	0.112	0.051	0.054	0.155
I have trouble with the left side of my body.	0.060	−0.020	0.131	0.031	0.056	0.626	−0.006	0.106	0.071
Part of my body is paralyzed.	−0.003	0.019	−0.017	−0.001	0.012	0.609	−0.011	−0.050	−0.028
Part of my body feels numb.	0.209	0.113	0.160	0.060	0.067	0.597	0.078	0.199	0.273
I have trouble walking.	0.032	0.166	0.266	0.076	0.191	0.539	0.076	0.166	0.192
I have trouble with the right side of my body.	0.030	0.332	0.016	0.071	0.162	0.424	0.102	0.194	0.219

Item	Factor/label[b]								
	1 Global Impairment	2 Learning	3 Language	4 Memory	5 Psychomotor/P hysical	6 Psychomotor/Perception	7 Anger	8 Pain	9 Head Injury
I have a bad temper.	0.254	0.167	0.045	0.038	0.078	0.021	0.649	0.118	0.055
I have urges to break and smash things.	0.221	0.146	0.097	0.074	0.185	0.093	0.621	0.034	0.078
I get into arguments frequently.	0.280	0.098	0.109	0.101	0.123	−0.032	0.575	0.142	0.148
I have trouble sleeping.	0.339	0.062	0.104	0.106	0.013	0.148	0.165	0.590	0.062
I suffer from severe pain.	0.197	0.147	0.025	0.019	0.191	0.336	0.113	0.547	0.266
I have severe headaches.	0.243	0.232	0.033	0.150	0.218	0.124	0.121	0.445	0.223
I have had a head injury.	0.152	0.101	0.091	0.141	0.112	0.265	0.068	0.170	0.657
I have been knocked unconscious.	0.259	0.054	0.123	0.114	0.066	0.136	0.134	0.075	0.604

Note: EFA excluded: ‘validity scale’ items, items with loadings below 0.40, and items with shared loadings of equal strength across multiple factors

[a] Total percent of variance = 54.8%

[b] Shaded areas represent the criteria that correspond to each factor