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A Self-Report Measure to Detect Neurocognitive Impairment among Incarcerated People Living with HIV in Malaysian Context: An Exploratory Factor Analysis

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Abstract

While neurocognitive impairment (NCI) among people living with HIV (PLWH) who use drugs and its impact on HIV treatment outcomes continue to be widely investigated, there remains a critical gap in NCI assessment among HIV-infected people who use drugs (PWUD) in Malaysian context. The present study, therefore, sought to improve the utility of the existing Neuropsychological Impairment Scale (NIS) as a screening tool for assessing NCI by establishing its psychometric properties in the Malaysian context. The NIS is a brief, self-report measure originally designed to assess NCI by having individuals rate a range of items that may influence cognitive functioning. HIV-infected male prisoners (N=301) administered the full 95-item NIS. An exploratory factor analysis (EFA) was conducted using principal axis factoring and orthogonal varimax rotation. Reliability was measured using Cronbach's alpha. The EFA resulted in an abbreviated, psychometrically sound, eight-factor structure (54-item) revised NIS — now referred

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Conflict of Interest: The authors declare that they have no conflict of interest.

Ethical approval

Institutional review boards at the University Malaya Medical Centre and Yale University approved the protocol for the parent study. The protocol was also reviewed and approved by the Office of Human Research Protection at the US Department of Health and Human Services (DHHS) as it involved federally-funded research with prisoners. All procedures performed in studies involving human participants were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki declaration and its later amendments or comparable ethical standards.

Informed consent

Informed consent was obtained from all individual participants included in the study.

to as the Brief Inventory of Neuro-cognitive Impairment—Malaysia (BINI-M). It is better designed to detect NCI in PLWH, ranging from generalized neurocognitive symptoms to more specific forms of impairment with excellent to average reliability. The BINI-M may serve as a useful tool for clinicians and researchers to assess NCI in PLWH and can inform enhanced treatment strategies in the Malaysian context.

Keywords

Neuropsychological Impairment Scale; neurocognitive impairment; exploratory factor analysis; opioid dependence; prisoners; Malaysia

Introduction

People who use drugs (PWUD) continue to be a key population that contributes significantly to HIV transmission around the world. There are estimated 12.7 million PWUD worldwide, with 1.7 million (13%) being people living with HIV (PLWH) (Joint United Nations Programme on HIV/AIDS, 2015). HIV and PWUD are inextricably intertwined throughout Southeast Asia, especially in Malaysia (Kamarulzaman, 2009; Todd, Nassiramanesh, Stanekzai, & Kamarulzaman, 2007; Wickersham, Zahari, Azar, Kamarulzaman, & Altice, 2013). Malaysia, a prototypical country in Southeast Asia, is one of six major countries where HIV is concentrated in PWUD and where despite a global reduction in HIV incidence in mortality in the last decade (Degenhardt et al., 2014), mortality in PLWH has increased by 20% (Joint United Nations Programme on HIV/AIDS (UNAIDS), 2014). Multiple factors may have contributed to these suboptimal outcomes in PLWH in Malaysia, this may in part have derived its harsh, punitive government policies, which prioritized incarceration rather than prevention measures and rehabilitation of PWUD (UNAIDS, 2014). In 2005, in response to its Millennium Development Goals, Malaysia significantly changed its HIV prevention strategy to include opioid agonist therapies (OAT) with methadone and buprenorphine and needle/syringe programs (NSP) officially recognizing drug use as a priority health issue (UNAIDS, 2014). Consequently, strategies that effectively engage PLWH with substance use disorders to optimize their engagement in treatment, especially if neurocognitive impairment is present (Anand, Springer, Copenhaver, & Altice, 2010; Heaton et al., 2010; Meyer, Althoff, & Altice, 2013; Tozzi et al., 2005).

As in other parts of the world, the HIV epidemic among PWUD is disproportionately concentrated among Malaysian prisoners, where HIV testing is mandatory (Al-Darraj, Kamarulzaman, & Altice, 2014; Choi et al., 2010). HIV prevalence among Malaysian prisoners is several-fold higher in prisoners (4.8%) than in the general adult population (0.4%) (Choi et al., 2010). Furthermore, people with substance use disorders are similarly concentrated among prisoners — nearly 30-fold higher in prisoners compared to the general population (38% vs 1.33%) (Zahari et al., 2010). Nearly all Malaysian prisoners with HIV (97%) meet criteria for opioid dependence, making substance use disorders, especially with opioids, a significant contributor to the HIV epidemic (Bachiredy et al., 2011; Choi et al., 2010).

Malaysian prisoners, especially PLWH and opioid-dependent, are highly vulnerable to adverse health outcomes, yet important targets for several different interventions. Substance use disorders are chronically relapsing conditions that contribute to deficits across a range of different neuropsychological domains. Independent from HIV, individuals with opioid use disorders (OUDs) experience marked differences in their cognitive flexibility, memory, executive function, attention, and psychiatric features (Anand et al., 2010; Baldacchino, Balfour, Passetti, Humphris, & Matthews, 2012; Pani et al., 2014; Rapeli et al., 2006; Shrestha, Huedo-Medina, & Copenhaver, 2015; Shrestha, Huedo-Medina, Krishnan, Altice, & Copenhaver, 2016; Shrestha, Karki, et al., 2017; Verdejo-García, López-Torrecillas, Giménez, & Pérez-García, 2004). In PLWH, NCI can be compounded by the effects of HIV itself (Mind Exchange Working Group, 2013) and further exacerbated when patients use alcohol or drugs (Anand et al., 2010; Shrestha, Weikum, Copenhaver, & Altice, 2016). Together, these factors greatly impact treatment outcomes such as treatment engagement through accessing and being retained in care and adherence to antiretroviral therapy (Altice, Kamarulzaman, Soriano, Schechter, & Friedland, 2010; Ferro et al., 2014; Kamarulzaman & Altice, 2015; Shrestha, Karki, Huedo-Medina, & Copenhaver, 2016; Weikum et al., 2016). Moreover, neurocognitive impairment influences multiple behavioral predictors of intervention efficacy, including processing of accurate information and motivation and behavioral skills (Anand et al., 2010; Bates, Pawlak, Tonigan, & Buckman, 2006; Blume, Davis, & Schmaling, 1999; Huedo-Medina, Shrestha, & Copenhaver, 2016; Nakagami, Hoe, & Brekke, 2010), which can ultimately impact program participation and outcomes (Ezeabogu, Copenhaver, & Potrepka, 2012; Huedo-Medina et al., 2016; Shrestha & Copenhaver, 2016; Shrestha, Karki, et al., 2016).

Given this background, there is a growing need to optimize NCI screening and more effectively address NCI in the form of behavioral interventions. Despite the availability of a number of diagnostic instruments designed to measure NCI, many of which are complex and extremely 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). One such example is the Neuropsychological Impairment Scale (NIS), which addresses both general NCI and specific symptoms areas (i.e., attention, memory, linguistic functioning, etc.) by having patients rate a range of items that may influence cognitive functioning (O'Donnell, DeSoto, & Desoto, 1994). The original scale contains 95-item; 80 describe neuropsychological symptoms, 10 measure affective disturbance, and 5 gauge test-taking attitudes. Importantly, the test produces one Global Measure of Impairment (GMI; the total raw score sum of the 80 neuropsychological items) and seven subscale scores in specific areas of impairment — critical items, cognitive efficiency, attention, memory, frustration tolerance, learning-verbal, and academic skills. The higher score on each item represents higher levels of neuropsychological impairment (O'Donnell et al., 1994). This self-report measure was originally developed to assess neuropsychological symptoms and deficiencies among patients in psychiatric treatment settings.

The original scale, however, was found to have some inherent limitations, such as “hand-picking” of factors based on visual inspection of item content rather than by statistically relevant factor loadings, as described in a recent study (Copenhaver, Shrestha, Wickersham, Weikum, & Altice, 2016). The factor structure of the original NIS has recently been refined

among individuals in an addiction treatment setting in the U.S., resulting in a substantially shortened and revised the scale now referred to as the Brief Inventory of Neurocognitive Impairment (BINI) (Copenhaver et al., 2016). This scale has not been revised, however, outside U.S. settings and a recent study of prisoners with HIV and OUDs allowed for the first time exploratory factor analysis of the NIS within the Malaysian context. Here, the factor structure of the NIS was assessed, with recommended revisions to the original scale for optimal use in this context.

Methods

The present study utilized baseline (pre-intervention) data from a randomized controlled trial comparing pre-release methadone maintenance treatment (MMT), an adapted behavioral intervention based on the (Holistic Health Recovery Program, HHRP+) or both (Shrestha, Copenhaver, et al., 2017; Shrestha, Weikum, et al., 2016). Participants were recruited from January 2010 – December 2014 and the original NIS was translated and back-translated using standardized procedures (Brislin, 1970) to ensure interpretation. Because of the higher degree of NCI reported among PLWH, particularly among those incarcerated and with substance use disorders (Burdo et al., 2013; Dwyer et al., 2014; Kavanagh, Rowe, Hersch, Barnett, & Reznik, 2010; Shrestha et al., 2015), the NIS structure was assessed to help guide future interventions.

Participants and Setting

Among the 311 people recruited, 301 had complete NIS data collected. Eligibility criteria for the parent study included: i) age ≥ 18 years; ii) HIV-infected; iii) pre-incarceration opioid dependence using DSM-IV criteria; iv) Malaysian citizenship; and v) returning to Klang Valley (greater Kuala Lumpur) after release. Although both men and women were eligible for the study, only male prisoners were ultimately recruited from Malaysia's largest prison, a male correctional facility located near Kuala Lumpur, because HIV-infected women in the adjacent women's facility were very uncommon and did not meet eligibility criteria. Kajang Prison, the largest in Malaysia (average census = 4200), is located in Klang Valley, has a dedicated HIV unit where prisoners where PLWH are segregated and has an onsite medical unit.

Procedures

The study was approved by the Institutional review boards at the University Malaya Medical Centre and Yale University. In addition, the protocol was reviewed and approved by the Office of Human Research Protection at the US Department of Health and Human Services (DHHS) as it involved federally-funded research with prisoners. The study is registered at www.clinicaltrials.gov (NCT02396979).

Experienced research assistants (RAs) underwent extensive training on study methods and confidentiality procedures. Prison staff within the HIV unit referred to our research team any sentenced, HIV-infected prisoners who were expected to be released within 90–180 days. Interested individuals were screened further in a private room for eligibility. Participants who met inclusion criteria, and who were willing to participate, were provided a description

of the study and invited to provide informed consent, followed by a baseline assessment. All assessments were conducted face-to-face by research staffs using standardized instruments that were translated and back-translated to Bahasa Malaysia using standardized procedures (Brislin, 1970) and adapted to the Malaysian context. No participant was paid for study participation during their incarceration, but was paid for their time for all post-release assessments. No incentives or disincentives were provided based on decision to participate.

Measures

Demographic variables—These included characteristics of the participants including age, sex, ethnicity, religion, marital status, educational status, employment status, sex- and drug-related practices, type of offence for current incarceration, length of current incarceration, visit to psychiatrist, duration since HIV diagnosis, and currently on ART, and CD4 count.

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) (Copenhaver, Lee, & Baldwin, 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.

Data analyses

Using SPSS (version 22.0), descriptive statistics were calculated for demographic variables to characterize the sample (IBM Corp., 2015). EFA was conducted on the full 95-item NIS using principal axis factoring and orthogonal varimax rotation, after first confirming that the data was suitable for factor analysis. Given our objective of using the EFA to examine the latent structure of the items and subscales comprising the NIS, PAF seemed the more appropriate technique (Kahn, 2006). The number of factors to be retained was guided by two decision rules: Kaiser's criterion (eigenvalues above 1) (Kaiser, 1960) and visual inspection of the scree plot. The reliability of the subscales was measured using Cronbach's alpha coefficients. Pairwise deletion was used in order to maximize power in analyses (Warner, 2012).

Results

Sample characteristics

The characteristics of the participants are shown in Table 1. The mean age of the participants was 38.9 years (± 6.8), with most participants being Malay (72.2%) and Muslim (76.3%). Approximately two-third of the participants reported being single (63.8%) and were employed full-time before incarceration (63.1%). In terms of educational status, only 14.7%

of the participants reported completing secondary or higher level of education. The majority of the participants reported a history of unprotected sexual contact (85.3%) and injection of opioids (94.3%) prior to the present incarceration and had been incarcerated for an average of 34 months lifetime at the time of the interview. The most common reason for the current incarceration was a substance-related offense. Only 5.4% of the participants reported having visited a psychiatrist prior to incarceration. The average time since HIV diagnosis was 8.3 years (± 5.3). Of the total participants, only 12% reported currently being on ART and the mean CD4 count was 445 (± 286.5).

Exploratory factor analysis

The original 95 NIS items were subjected to principal axis factoring and orthogonal varimax rotation with Kaiser Normalization. The suitability of data for factor analysis was assessed before performing the EFA. Inspection of the correlation matrix revealed the presence of many coefficients of 0.3 and above. The Kaiser overall Kaiser-Meyer-Okin (KMO) value was 0.894, exceeding the recommended value of 0.6 (Kaiser, 1974) and Bartlett's test of Sphericity reached statistical significance (Bartlett, 1954), thus supporting the factorability of the correlation matrix.

Prior to conducting factor analyses, we consulted the NIS user manual and the peer-reviewed literature on the development and validation of the original NIS (O'Donnell, de Soto, & Reynolds, 1984; O'Donnell, Reynolds, & de Soto, 1983, 1984). We noted that 15 of the 95 original NIS items were designed to function as "validity checks" to address a number of factors that shape the context for interpreting the impairment scores and are unrelated to neuropsychological symptoms, yet may cloud the ability to detect NCI, including: Defensiveness scale (10 items: provide an indication of test-taking attitude and distortion of social judgment) and Affective Disturbance Scale (5 items: provide an estimation of the presence of affective disturbance — anxiety, depression, or poor stress tolerance — that typically results in inconsistent reporting of neuropsychological symptoms).

The initial rotated solution revealed a 22-factor solution that explained 60.4% of the variance. Inclusion of the 15 validity check items in this analysis, which were dispersed across the 22 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 an 18-factor solution that accounted for 55.6% of the variance. Despite the slight reduction in variance explained, this model condensed the factor structure from 22 to 18. 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 54 items.

The same EFA procedure was repeated on the 54 retained items, resulting in an 8-factor solution that explained 53.6% of the overall variance. Examination of the scree plot suggested that an eight-factor solution provided the best fit. The suitability of an eight-factor solution was also evident from initial eigenvalues and total variance associated with the eight individual factors. The final rotated factor matrix for the EFA is presented in Table 2. 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 cognitive impairment (Table 2).

Factor 1 included 30 items representative of generalized cognitive impairment (e.g., “I have trouble remembering important things”) and was therefore labeled “Global Impairment.” Factor 2 contained 4 items that addressed patient’s abilities to read, spell, and calculate (e.g., “I have trouble writing sentences”) and was named “Academic Skills-related”. Factor 3 contained 3 items that focused on speech, communication, and language (e.g., “My words get mixed up”), which was labeled “Language-related.” Factor 4 contained 3 items that addressed cognition-related tasks and learning (e.g., “My arithmetic is poor”) and was named “Learning-related”. Factor 5 contained 7 items that center around body-related impairment (e.g., “Part of my body feels numb”) and was named “Psychomotor/Perceptual.” Factor 6 contained 3 items regarding temperament-related issues (e.g., “I have a bad temper”), which was named “Frustration tolerance-related”. Factor 7 included 2 items about head injuries (e.g., “I have had epileptic seizures”) and was named “Traumatic Head Injury-related.” Last, factor 8 contained 2 items that address memory (e.g., “I have forgotten many things which have happened in my childhood”) and was named “Memory-related” (Table 1). Furthermore, the observed pattern suggests that a composite score may be useful if the aim is to capture multiple domains of NCI combined. Thus, the EFA from this study resulted in an abbreviated 54-item NIS with eight factors, including a composite score (total NCI).

The revised 54-item scale — now referred to as the Brief Inventory of Neuro-cognitive Impairment — Malaysia (BINI-M) — showed a diverse set of factors as well as excellent overall reliability ($\alpha=0.96$). The reliability of the 8 factors ranged from excellent to average (F1 $\alpha=0.96$; F2 $\alpha=0.86$; F3 $\alpha=0.99$; F4 $\alpha=0.82$; F5 $\alpha=0.73$; F6 $\alpha=0.66$; F7 $\alpha=0.48$; F8 $\alpha=0.67$).

Discussion

NCI has been well-characterized among PLWH with substance use disorders, particularly among incarcerated individuals, and has been associated with adverse clinical consequences, including increased HIV risk-taking, (Anand et al., 2010; Shrestha & Copenhaver, 2016; Shrestha, Karki, et al., 2016) difficulty in performing daily tasks (Albert et al., 1995; Hinkin et al., 2004), shorter survival, (Mind Exchange Working Group, 2013; Villa et al., 1996) and reduced health-related quality of life (HRQoL) (Shrestha, Weikum, et al., 2016; Stern et al., 2001; van Gorp, Baerwald, Ferrando, McElhiney, & Rabkin, 1999). The severity of NCI may play an important role in the efficacy of treatment and prevention services among this high-risk population, such that those with a higher degree of NCI may engage less in the treatment process and experience poorer treatment outcomes (Anand et al., 2010; Bates et al., 2006; Nakagami et al., 2010; Shrestha, Karki, et al., 2016). Given the higher degree of NCI among this population, it is imperative to screen for NCI upon entry into the prison and/or clinical care, so that timely treatment approaches and appropriate interventions to optimize these strategies can be delivered to address or accommodate the presence of various levels of NCI. The present study sought to improve the utility of the original NIS as a screening tool for assessing NCI among incarcerated, HIV-infected PWUD by establishing its psychometric properties in Malaysian context.

Importantly, findings here suggest an eight-factor structure of the BINI-M, structured to detect NCI, ranging from generalized neurocognitive symptoms to more specific forms of impairment (e.g., Academic-related, Language-related, Learning-related; Psychomotor/Perceptual, Frustration-related, Head injury-related, and Memory-related) as captured by other factors within the scale. Compared with the original scale, the revised scale is significantly abbreviated (95 vs. 54 items) and includes additional subscales that expand the conceptual range of the original constructs — such as language-related, psychomotor/perceptual, health injury-related impairment were not included in the original NIS. Another change in the model was dropping of validity scores and summary scores, which did not contribute meaningfully to the neuropsychological assessment. Furthermore, the BINI-M fit better than the original NIS, showed better reliability (0.96 vs. 0.90), and explained a much higher percentage of the overall variance in assessing neurocognitive deficits (33.4% vs. 53.6%). Overall, the BINI-M has improved psychometric properties with increased empirical support as compared to the original version.

The composition of factors of the BINI-M overlap significantly — but not completely — with those of the BINI, the revised NIS from a recent US study among PWUD enrolled in addiction treatment) (Copenhaver et al., 2016). For example, all the factors in BINI-M corresponded with that of the BINI, except for the Psychomotor/physical-related impairment. Nevertheless, there are some minor differences between the two. For example, the 9-factor structure BINI retained 57 items that explained 54.8% of the overall variance (Copenhaver et al., 2016), whereas, the BINI-M resulted in 8-factor solution with 54 items explain 53.6% of the total variance. This is not surprising, however, given that the BINI was optimized to be used with HIV-negative PWUD in drug treatment in the US, in contrast to incarcerated, HIV-infected PWUD in Malaysian context in our sample.

The BINI-M — a brief, self-report measure of NCI optimized for use with incarcerated, HIV-infected PWUD in Malaysian context — exhibited excellent overall reliability and characterized diverse areas of cognitive deficits. Given its wide-ranging psychometric properties, ease of administration and analysis, and straight-forward interpretation, the BINI-M may serve as a helpful tool to assess NCI of individuals entering or involved in prison and/or treatment in Malaysia. This may, in turn, greatly help clinicians and researchers to deliver preventative and treatment services that are specifically tailored to accommodate individuals with NCI, thus improving their overall treatment participation and outcomes. For examples, those with higher levels of NCI might need cognitive remedial interventions that would promote better retention in treatment or improved antiretroviral therapy adherence. Additionally, elevated scores on any of the specific sub-scales could caution providers to follow up with more in-depth neuropsychological battery in order to better assess cognitive deficits and address accordingly.

The results of our EFA is encouraging in terms of pointing to the potential convenience of the BINI-M in the context of real-world settings. The findings from the current study should, however, be realistically considered in light of some limitations. First, our sample included soon-to-be-released incarcerated, HIV-infected opioid dependent Malaysian men. This may have limited our ability to generalize results to diverse population groups in different settings. Second, we used self-report assessments, which may have introduced some

potential biases associated with the desire to misrepresent levels of awareness about particular items in the NIS survey. This may have been diminished, however, by the use of the ACASI data collection strategy, which provided participants with a high level of privacy. Third, the cross-sectional nature of data precluded our ability to fully follow the extent to which the resulting factor structure may vary over time. Fourth, the sample used to test the EFA is modest for such studies and thus had relatively moderate statistical power. Fifth, the design of the study prohibit us to determine whether cognitive deficits are specifically driven by the direct effects of disease process (e.g., HIV infection), methadone, longstanding addiction (all participants had a negative results on urine drug testing at the time of the baseline survey), or a combination of multiple factors. Furthermore, external factors such as history, maturation, experimental mortality may pose a threat to internal validity. Though it is not possible to eliminate all threats to internal validity, the randomized controlled trial design of the parent study allows us to minimizing such threats over the course of the study.

Despite the identified limitations, the results of the current study have several implications for research and clinical practice. The newly structured, psychometrically valid BINI-M offers a preliminary tool for assessing NCI among a portion of the population where very limited research has been done. Because of the aforementioned limitation of the current study, future refinement of this scale might need to evaluate the convergent and divergent validity of the BINI-M. Furthermore, future studies would benefit from refining and testing this instrument with similar samples using confirmatory factor analysis (CFA) to determine whether the same factor structure is supported. Additionally, future studies should assess the influence of key participant characteristics (e.g., age, history of drug injection, time since HIV diagnosis, ART status) on the factor structure of the scale, and also test the utility and reliability of this scale among larger and more diverse populations and within different settings.

Conclusion

Although NCI is well-characterized among HIV-infected PWUD, very little is known about the extent of NCI among high-risk populations (e.g., HIV-infected, incarcerated, PWUD) in the Malaysian context. Moreover, brief, self-report measures are urgently needed. Since NCI negatively influences treatment engagement and outcomes and HRQoL, having access to a rapid and low-cost screening tool for NCI will likely prove beneficial to assess NCI and to tailor intervention approaches. The EFA conducted in the present study produced an abbreviated, psychometrically sound, revised NIS factor structure — now referred to as the BINI-M — which is better designed to detect NCI, ranging from generalized neurocognitive symptoms to more specific forms of impairment. The BINI-M may serve as a useful tool for clinicians and researchers to assess NCI of individuals entering or involved in prison and/or treatment and to inform enhanced treatment approaches. Future research is needed to further explore and validate the BINI-M as a tool for NCI screening and for guiding treatment within other settings.

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Table 1Characteristics of the participants ($N = 301$)

Variable	Frequency	%
Age		
Mean ($\pm$ SD)	38.9 (6.8)	
Range	21–58	
Ethnicity		
Malay	216	71.8
Chinese	28	9.3
Indian	50	16.6
Other	7	2.3
Religion		
Muslim	228	75.7
Other ^a	73	24.3
Marital status		
Single	192	63.8
Married	34	11.3
Widow	58	19.3
Divorced	17	5.6
Employed full-time before incarceration		
No	111	36.9
Yes	190	63.1
Highest level of education		
Primary or below ^b	58	19.4
Incomplete secondary ^c	197	65.9
Secondary or higher ^d	46	14.7
Unprotected sexual contact prior to incarceration		
No	44	14.6
Yes	257	85.4
History of drug injection prior to incarceration		
No	17	5.6
Yes	284	94.4
Type of offense(s) for current incarceration		
Homicide	1	0.3
Violent-related crime	23	7.7
Property-related crime	50	16.7
Substance-related offence	204	68.2
Sexual-related crime	1	0.3
Others	18	6.0
Ever visited psychiatrist prior to incarceration		
No	283	94.0

Variable	Frequency	%
Yes	18	6.0
Months of incarceration ^e		
Mean ($\pm$ SD)	34.0 (49.4)	
Range	4–290	
Time since HIV diagnosis (years)		
Mean ($\pm$ SD)	8.3 (5.3)	
Range	0.02–24	
Currently on antiretroviral therapy		
No	264	87.7
Yes	37	12.3
CD4 count		
Mean ($\pm$ SD)	445.04 (286.54)	
Range	8–1752	

Notes:

^a Includes Christian, Buddhist, Hindu, and other

^b Includes participants without any formal education and those with primary education

^c Includes Form 1–5

^d includes participants holding SPM, STPM/Diploma, and higher level of education

^e Months of incarceration at the time of interview

Table 2

Factor loadings from exploratory factor analysis of the original NIS^a

Items	Factor/Label ^{b,c}							
	1	2	3	4	5	6	7	8
My thinking becomes blocked.	.722	.034	.084	.116	.253	-.087	.023	.015
I have trouble remembering important things.	.715	.117	.024	.169	-.030	.112	.128	.206
My brain becomes tired easily.	.707	-.091	.012	.121	.238	.124	-.015	-.076
My mind tends to wander.	.688	.260	-.046	.160	.009	.199	.175	-.049
My mind frequently goes blank.	.686	.129	.074	.076	.255	-.015	-.059	.172
I have trouble concentrating.	.679	.203	.089	.142	.053	.149	.183	.040
I get confused easily.	.674	.195	-.041	.196	.122	.108	.246	.051
My mind is dull.	.671	.091	.002	.148	.062	.005	-.014	.001
I have difficulty paying attention.	.671	.182	-.047	.131	.045	.184	.312	.085
I am easily distracted.	.655	.222	-.019	.216	.058	.268	.111	.009
My mind works slowly	.641	.018	.059	-.081	.257	-.035	.122	-.064
My reactions are slow.	.625	.161	-.008	.089	.192	.186	-.060	.153
Something is wrong with my mind.	.617	.100	.074	.208	.177	.077	-.016	.174
I feel easily annoyed and irritable.	.615	.042	-.071	.182	.224	.189	-.060	-.007
I have trouble making up my mind.	.612	.219	.082	.368	-.028	.091	.147	.091
I have trouble thinking.	.603	.090	.102	.281	.221	.109	-.129	-.036
I have serious memory problems.	.601	.066	.037	-.091	.351	-.033	.038	.079
I get lost easily.	.578	.135	.087	.120	.102	.156	.156	.130
I am forgetful	.571	.045	-.053	.024	.120	.121	.045	.120
I have difficulty making decisions.	.565	.148	.029	.306	.005	.090	.013	.111
I have trouble following conversations.	.556	.234	-.057	.034	.035	.024	-.085	.028
I have trouble learning new things.	.548	.302	.025	.220	.074	-.049	.200	.162
My mind won't stay on any one thing.	.543	.186	.092	.370	.042	.219	.117	-.085
I feel frustrated quite often.	.543	.163	-.014	.071	.160	.163	.117	-.020
I forget what I read.	.542	.383	-.026	.253	.126	.231	-.019	.018
I often feel restless.	.532	.132	-.067	.141	.140	.186	-.015	.201

Items	Factor/Label ^{a,c}							
	1	2	3	4	5	6	7	8
	GLOB	ACAD	LANG	LERN	PSYP	FRUS	HDIJ	MEMR
My judgment is poor.	.508	.239	.018	.434	-.019	.116	-.012	.123
I often lose things.	.497	.033	.043	.034	.193	.281	.241	.155
I forget the names of common things.	.480	.080	.038	-.053	.230	.315	-.065	.268
I have a hard time remembering people's names.	.441	.432	-.027	.136	.098	.018	-.021	.181
I have trouble writing sentences.	.255	.804	-.021	.040	-.134	.068	-.035	.012
My handwriting has become worse.	.115	.785	.155	.074	.124	.059	-.002	.105
I have trouble spelling.	.144	.784	.035	.099	-.023	.078	.080	.100
I have trouble understanding what I read.	.269	.573	-.019	.187	.125	.117	.076	-.020
My words get mixed up.	.026	.042	.994	.041	-.005	-.009	.074	.009
I have trouble talking.	.026	.042	.994	.041	-.004	-.009	.074	.009
My speech has become worse.	.026	.042	.994	.041	-.004	-.010	.074	.009
My arithmetic is poor.	.293	.076	.039	.834	.065	-.014	.071	.122
Doing simple math problems in my head is difficult.	.208	.153	.046	.750	.079	-.034	-.014	.067
I count with my fingers.	.221	.083	.014	.522	.153	.002	-.011	.117
Part of my body feels numb.	.105	-.073	-.047	.003	.685	.174	.198	.044
Part of my body is paralyzed.	.115	.090	-.040	-.039	.648	-.031	.315	-.027
I have trouble making change with money.	.169	.108	.113	.101	.517	.147	-.042	.119
My hands shake and tremble	.234	.236	-.025	.011	.435	.081	-.093	-.169
My muscles twitch and jump.	.255	-.002	.044	.043	.429	.129	-.007	.010
I have trouble with the right side of my body.	.013	-.083	-.057	.177	.417	-.041	.292	.000
I have trouble with the left side of my body.	.198	-.023	-.024	.105	.411	.060	-.133	-.011
I have a bad temper.	.231	.101	.012	-.107	.172	.643	.141	.130
I get into arguments frequently.	.292	.113	-.035	.045	.161	.499	-.004	-.002
I have urges to break and smash things.	.362	.193	-.032	.152	.233	.408	.043	-.124
I have had epileptic seizures.	.079	-.058	.184	-.007	.067	.090	.588	-.052
I have been knocked unconscious.	.300	.238	.037	.018	.143	.028	.534	.023
I have forgotten many things which have happened in my childhood.	.301	.097	-.032	.246	-.015	.102	-.114	.653
I have forgotten much of what I have learned in school.	.219	.251	.068	.240	-.005	-.005	.092	.431

Notes:

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

Total percent of variance = 53.6%

Shaded areas represent the criteria that correspond to each factor

GLOB: Global impairment; ACAD: Academic-related impairment; LANG: Language-related impairment; LERN: Learning-related impairment; PSYP: Psychomotor/Perception-related impairment; FRUS: Frustration Tolerance/Anger-related impairment; HDII: Head Injury-related impairment; MEMR: Memory-related impairment