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Education Effects on the International HIV Dementia Scale

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Human immunodeficiency virus/acquired immunodeficiency syndrome (HIV/AIDS) within the Indian subcontinent continues to spread. Although the primary clade of HIV in India differs from that of most Western countries, recent evidence suggests that the Indian clade (Clade C) also impacts neurocognitive functioning. India also has extremely high illiteracy rates that may confound detection of neurocognitive impairment, since many assessments to detect such impairment are heavily influenced by formal schooling. Among those with HIV/AIDS who have had limited educational opportunities and who are in the early stage of infection, the confounding effects of education on tests for neurocognitive impairment may be particularly salient. We therefore tested influence of HIV serostatus and education on a commonly used tool to screen for cognitive impairment, the International HIV Dementia Scale (IHDS), among Indian men and women in the catchment area of the Post Graduate Institute of Medical Education and Research (PGIMER) located in Chandigarh, India. Adjusted analyses showed that from a sample of 295 HIV-positive and HIV-negative individuals, only education was significantly associated with performance on the IHDS. HIV-negative and HIV-positive individuals, who were in the early stages of infection, performed similarly. Further development of this test to account for the effects of education on cut-off scores used to indicate possible dementia are needed, particularly for use in resource-limited settings such as India where low levels of education are widespread. *Journal of NeuroVirology* (2010) **16,** 264–267.

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Introduction

As human immunodeficiency virus (HIV) continues to spread across Asia, more information on the progression of the disease relevant to that geographic region, as opposed to the highly studied Western populations, is increasing. Neuropsychological complications resulting from HIV/AIDS have been reported in India (Das Gupta *et al,* 2007) where an officially estimated 2.47 million people are infected (UNGASS, 2008). Early reports from the country stated that severe neuropsychological complications and HIV-associated dementia (HAD) were not highly prevalent in the country (Teja *et al,* 2005; Wadia *et al,* 2001); however, Riedel *et al* (2006) reported that the prevalence of HAD may be higher in Indian populations than previously expected. Study on the incidence and prevalence of neuropsychological complications associated with HIV infection in India are ongoing.

An important consideration in the assessment for neurocognitive impairment in the Indian context is the educational level of a given patient. India has the

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largest illiterate population of any nation on earth (Rediff, 2007), although rates vary considerably by region. Most tests to measure neurocognitive functioning are strongly related to educational quality and attainment (Heaton *et al,* 1986) and may then obscure the veracity of results from neurocognitive testing in groups with limited to no formal education. In cases in which HIV disease is not advanced, the consideration of a patient's education in determining risk for neurocognitive impairment may be particularly relevant.

Screening for possible cognitive impairment in HIV-infected individuals is important because such deficits may impede successful self-management of the disease. A positive screening test suggests the need for a comprehensive neuropsychological evaluation that is both time-consuming and potentially costly. "False positives," cases that test positive for a condition that do not actually have the condition, can create unnecessary burden on clinic staff and resources. Improving the accuracy of screening tests for neurocognitive impairment in HIV-infected individuals is needed to best allocate staff and clinical resources to those cases most in need of further evaluation.

Limited access to formal education is common in many regions in India and many neuropsychological tests are heavily influenced by educational attainment. This study examined the relative influence of HIV serostatus and education on a commonly used tool to screen for cognitive impairment, the International HIV Dementia Scale (IHDS), among Indian men and women. We hypothesized that education would have a greater influence on IHDS test scores than HIV status.

Results

Of the 295 participants included in this study, there were a significantly greater proportion of HIV-positive women than HIV-negative women. The average age of participants was 30.42 years and 61% had completed high school. We grouped educational attainment into three categories: less than high school (<HS), high school (HS), and greater than high school (>HS). Table 1 displays demographic characteristics by education.

Chi-square analysis showed that a greater proportion of HIV-positive individuals scored ≤10 on the IHDS than HIV-negative individuals ($\chi^2(df, 1) = 10.01$, $p = 0.002$); however, there was a significantly greater proportion of individuals with <HS education who were also HIV positive ($\chi^2(df, 2) = 37.26$, $p < .001$) and a greater proportion of these also scored ≤10 on the IHDS ($\chi^2(df, 2) = 27.12$, $p < .001$).

Results of logistic regression analysis to test the effect of HIV status and education on IHDS scores are presented in Table 2. The overall model was significant ($\chi^2 = 37.98$, $p < .001$). Adjusted findings show that HIV status and age were unrelated to IHDS score.

Table 1 Demographic characteristics of study participants by education level

	<High school education	High school education	>High school education
Gender			
Men	52	53	55
Women	62	41	32
Marital status			
Single	20	19	32
Married	71	63	45
Widowed	21	12	9
Divorced	1	0	0
Separated	1	0	1
HIV serostatus			
Positive	97	58	38
Negative	17	36	49
Mean age	29.89	30.41	27.85

Table 2 Logistic regression of age, gender, education, and HIV serostatus on International HIV Dementia Scale Score Impairment Index

			95% CI			
Predictor	β	SE	Odds ratio	Lower	Upper	*p*
Age	−.011	.023	.989	.945	1.036	.643
Gender	.824	.294	2.280	1.280	4.061	.005
Education						
<HS	-	-	-	-	-	-
HS	1.216	.350	3.375	1.700	6.699	.001
>HS	1.649	.381	5.202	2.465	10.976	.001
HIV serostatus	.467	.305	1.595	.877	2.898	.126
$\chi^2 = 37.98$						<.001

Compared to those with <HS education, participants with a HS education had a 3.4 greater odds of scoring above the cut-off for possible cognitive impairment (≤10). Those with greater than a high school education had a 5.2 greater odds of scoring above the impairment cut-off. Women, in the sample, had a 2.3 greater odds of scoring in the unimpaired range compared to men; however, this may represent the greater proportion of HIV-seropositive men in the sample.

Discussion

This study illustrated the influence of education on performance on the International HIV Dementia Scale, a screening measure for HIV-associated dementia (HAD), designed to reduce the effects of language on test performance. Although in its development, the test was determined to be sensitive to detecting potential dementia among HIV-infected individuals with more advanced disease than those in this study, our results indicate that in the early stages of infection, lower levels of education have a significant impact on performance on this test, more so than whether or not

one is HIV positive or HIV negative. In resource-limited settings, appropriate distribution of services for those most in need is important to effectively manage patient case loads, particularly in clinics serving a large number of HIV-infected individuals.

In patients tested in Pune, India, Reidel *et al* (2006) found significant differences between HIV-positive and HIV-negative patients in IHDS scores. No differences in education were found between the groups. Their sample included HIV patients with substantially lower CD4 cell counts than in the current study with all patients having a CD4 cell count of <200 cells/mm^3. In patients with more advanced HIV disease, the effect of education on IHDS performance may be reduced; however, because the groups in the Reidel *et al* (2006) study had similar levels of education, this assumption requires further testing. Our study suggests that, at least in patients without advanced HIV disease, consideration of education level on IHDS performance is critical.

Our findings do not diminish or negate the utility of the IHDS. As an easily administered and unencumbered tool for detecting the possible presence of dementia across a number of languages and cultures, the IHDS appears to be quite valuable. Rather, the intent of this study was to illustrate that low educational attainment can also lower performance on this measure and may result in a number of false-positive cases, resulting in unnecessary expenditure of valuable resources. Recently, the original HIV Dementia Scale (Power *et al,* 1995), which is limited in international use due to its reliance on the alphabet and writing skills, was further developed to include a system to take an individual's education and age into account when determining a cut-off indicative of possible dementia (Morgan *et al,* 2008). In other words, no one cut-off is used for all persons but rather the particular cut-off for a given individual depends on his or her age and education. The findings from the present study strongly support the contention that a similar system for assigning cut-off scores for the International HIV Dementia Scale needs to be developed.

In summary, this study found that performance on a commonly used tool for screening for HIV-associated dementia (HAD), the International HIV Dementia Scale (IHDS), is affected by educational attainment. Further development of this test to incorporate the effects of education on cut-off scores used to indicate possible dementia are needed, particularly for use in resource-limited settings such as India where low levels of education are widespread.

Methods

Participants

Participants screened for this study (n = 295) were HIV-1–seropositive and HIV-1–seronegative men and women residing within the catchment area of the Post Graduate Institute of Medical Education & Research (PGIMER) in Chandigarh, Northern India. Participants were disqualified due to previous head trauma, drug or alcohol dependence. Among HIV-positive participants, current or preexisting central nervous system (CNS) opportunistic infections were grounds for exclusion and individuals with a CD4 cell count greater than 400 cells/ml were enrolled. Seropositive (n = 193) participants were recruited from the Special Immunology Clinic of the PGIMER and seronegative (n = 102) participants were drawn from the local population as part of a larger longitudinal study. Prior to enrollment, participants provided informed consent, and serostatus was confirmed by enzyme-linked immunosorbent assay (ELISA) and Western Blot. All assessments were conducted individually in the Neurology and Psychiatry Departments of the PGIMER.

Measures

The International HIV Dementia Scale (IHDS) (Sacktor *et al,* 2005) consists of three tasks, each rated on a 4-point scale. The first item assesses memory registration. The patient is given four words to recall (we used Red, Water, Dog, Table, as did Riedel *et al* [2006] in a study carried out in Pune, India), taking about 1 s to say each word. The patient is asked to repeat the words (this is repeated if the patient cannot repeat all words). After completion of the motor tasks, the patient is asked to recall each of the four words. For words that are not freely recalled, a semantic clue is provided (e.g., "something to drink" for water). One point is given for spontaneously recalled words and .5 points given for words recalled after the semantic clue. For the assessment of motor speed, patients are asked to tap the first two fingers of the dominant hand as widely and as quickly as possible. Scoring was conducted according to the original IHDS (Sacktor *et al,* 2005) ranging from 0 to 4 on this item. Psychomotor speed was determined by having the patient perform the following movements in succession with the nondominant hand as quickly as possible: (1) clenching the hand in a fist on a flat surface; (2) putting hand on flat surface with palm down; and (3) putting the hand perpendicular to flat surface on the side of the 5th digit. Scoring was again as directed by Sacktor *et al* (2005). Total possible scores range from 0 to 12. This test was developed with HIV-positive and HIV-negative samples in the United States and in Uganda. In both of these samples, a cut-off of ≤10 to indicate HIV dementia provided the optimal sensitivity (suggested to be >80% to minimize false-negative results) and specificity.

Data analysis

Group differences were tested using bivariate or univariate analysis as appropriate. In order to test the effects of education and HIV status on IHDS test performance, we conducted a logistic regression with HIV status and the three education groups as

independent variables and a cut-off of ≤10 on the IHDS as the dependent variable. Analyses were also adjusted for age and gender.

Declaration of interest: The authors report no conflicts of interest. The authors alone are responsible for the content and writing of the paper.

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