EFFECTS OF HIV STATUS AND LINGUISTIC MEDIUM ON TEST PERFORMANCE OF LOW LITERACY RURAL ADULTS: IMPLICATIONS FOR NEURO PSYCHOLOGICAL TEST DEVELOPMENT IN ZAMBIA

DISSERTATION

BY

LAZAROUS NDHLOVU

A DISSERTATION SUBMITTED TO THE UNIVERSITY OF ZAMBIA IN PARTIAL FULFILMENT OF REQUIREMENTS FOR THE AWARD OF THE DEGREE OF MASTER OF SCIENCE IN CLINICAL NEUROPSYCHOLOGY

MAY 2014

COPYRIGHT

© 2014

By

Lazarous Ndhlovu

All rights reserved. No part of this dissertation may be reproduced, stored or transmitted in any manner without prior permission in writing from the author or the University of Zambia.

DECLARATION

I **Lazarous Ndhlovu** do hereby declare that this dissertation is a product of my individual effort; however scholarly content obtained from various literatures has been acknowledged. This dissertation has not been submitted previously at this University or indeed any other University elsewhere for a degree qualification.

Signature: .....Date.....

CERTIFICATE OF APPROVAL

This dissertation by **Lazarous Ndhlovu** has been approved as partial fulfilment of requirements for the award of the Degree of **Master of Science in Clinical Neuropsychology** by the University of Zambia.

Signature.....Date.....

Signature.....Date.....

Signature.....Date.....

.

DEDICATIONS

I dedicate my work to my beloved wife Selina Ndhlovu, my children Chikaiko, Tasila, Thelma, Lazarous Junior (commonly known as Daddy), Blessings and Emmanuel, (commonly known as Ba Emma), my nephews John Ndhlovu, Peter Tembo and George Tembo and my niece Grace Ndhlovu. Dedications should also go to my mother Fridah Zulu, my mother in-Law Maligelita Manyoni, Uncles Edward Manyoni and Jabesi Mvula, my sisters Alice, Mary, and Martha, my only brother John Ndhlovu,. Let me also dedicate this work to my brothers in-Law; Lawrence Zulu, Charles Zulu, John Zulu and Lyson Tembo, my sister in marriage bana Lawrence, my former pupils Diana Chongo and Eneless Kalenje and all my family members for their support and encouragement during my studies at the University of Zambia despite the many challenges they faced in my absence.

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

LIST OF APPENDICES

LIST OF ACRONYMS

AIDS – Acquired Immunodeficiency Syndrome

ANOVA – Analysis of variance

ART – Antiretroviral Therapy

BDI – Beck Depression Inventory

BVMT – Brief Visuospatial Memory Test

Chi – Chichewa version

CNS – Central Nervous System

COAWT - FAS Controlled Word Association Test

d' – Mean difference

Eng – English version

HAART – Highly Active Antiretroviral Treatment

HAND – HIV Associated Neurocognitive Disorders

HDMT – Hisock Digit Memory Test

HIV – Human Immunodeficiency Virus

HVLT – Hopkins Verbal Learning Test

HVLT ir – Hopkins Verbal Learning Test Immediate Recall

HVLTdr – Hopkins Verbal Learning Test Delayed Recall

Lingmed – Linguistic medium

Mc – Mean scores for Chichewa version

Mcfneg – Mean scores Chichewa version for HIV negative females

Mcneg – Mean scores Chichewa version for HIV negative

Mcpos – Mean scores Chichewa version for HIV positive group

Me – Mean scores for English version

Meneg – Mean scores English version for HIV negative group

Mf – Mean scores for females

Mfpos – Mean scores for HIV positive females

Mm – Mean scores for males

Mmneg – Mean scores for HIV negative males

Mmpos – Mean scores for HIV positive males

NP - Neuropsychological

PAOFI – Patience Assessment of Own Functioning Inventory

PASAT – Paced Auditory Serial Addition Test

SD – Standard Deviation

SIP – Speed of Information Processing

UNAIDS – United Nations AIDS Programme

UNZABREC – University of Zambia Biomedical Ethics Research Committee

WAIS – R – Wechsler Adult Intelligence Scale Rivised

WHO – World Health Organisation

WSCT – Wisconsin Card Sorting Test

WSM – III Wechsler Memory Scale

ZAT – Zambia Achievement Test

ACKNOWLEDGEMENTS

In order to conduct this research, the help rendered by lecturers, students, parents and other cooperating partners can not be overemphasised. At this juncture, let me express my heart felt gratitude to my supervisor, Prof. Robert Serpell who read my numerous revisions and helped make sense of the untold confusion. Endless thanks should go to Mr. Jason Mwanza (School of Humanities UNZA) for his tireless inputs, let me say "Brother Mwanza God be with you always". My sincere thanks should also go to the Project coordinator Dr. Anitha Menon who is also Head of Department of Psychology at the University of Zambia, as well as one of my lecturers, Dr. Ravi Paul (Head of Department Psychiatry School of Medicine UNZA, Dr. Mwanza Banda former Head of Department (Psychiatry UNZA), Dr. SOC Mwaba (NOMA Project Administrative Coordinator), Mr. Kalima Kalima (School of Education) and Dr. Prasha my former lecturer in Neuropharmachology (School of Medicine UNZA), Dr. Adhere, Dr. Goma Dean (School of Medicine UNZA), Dr. Nzala Assistant Dean (Post-Graduate School of Medicine UNZA). Prof. Shilalukey-Ngoma, Dr. Musuku and Mr Banda Assistant Dean Student Affaires.

Let me also thank the NOMA Foundation for introducing and sponsoring the Project. I sincerely thank the NOMA team particularly, Prof. Knut Hestad, Prof. Robert Heaton and Donald Franklin Jr, Lisa Kalungwana and Norma Kabuba who spent most of their time guiding me especially on the administration and statistical techniques of the Neuropsychological Test Battery. Endless thanks should go to the Clinical Neuropsychology class 2011-13, Joyce Sibanda, Joyce Ncheka, Jordan Nyirenda (class representative), Moonga Hakalyamba, Foster Kayungwa, Maj. Jonathan Chinyama, Mazuba Hamwene, Prispa Mwila and Chilwesa Lutunti.

I should also thank the clinical staff from the three Rural Health Centres for the support rendered to me during data collection. I also thank the participants for enduring the two and a half hours of testing. Lastly, I say thanks to James Banda commonly known as (Uncle B) for helping me with transport whenever a I was at home in Chipata, Mr. Joseph Chipata and Sarah Dipa both at Magwero Deaf. I can not thank everyone who helped me, but I hope and trust that they will accept the will of did.

ABSTRACT

Studies in non-Western societies (China, India, Uganda, and Ethiopia) have reported differential performance on neuropsychological tests by HIV+ and HIV- groups. However, the impact of HIV on cognitive functioning has rarely been studied among individuals with low literacy, even though these represent the majority of individuals with HIV in most non-Western societies. One of the constraints is that most relevant tests are available only in English, which can be used only with persons with formal education. In addition, even when individuals are familiar with spoken English, it is possible that tests administered in a familiar language may be more sensitive to HIV-induced neurocognitive impairments than tests in English. This study followed an experimental design involving two versions of a set of tests – one in English and the other in Chichewa. The tests were Hopkins Verbal Learning Test for both immediate and delayed recall, Animal and Action Fluency tests of the Zambia Neurobehavioural Test Battery (ZNTB). The sample size comprised 28 HIV-infected (HIV+) (untreated with ART) and 22 uninfected (HIV-) rural residents (aged 40-65 years) with fewer than five years of education who tested as being illiterate in English, and who had Chichewa as their primary language but had some familiarity with English. These participants were recruited separately from the sample of the project as an extra sample to test their performance. Participants were tested twice, once in English and once in Chichewa. Counterbalancing of sequence was not planned but was done informally during data collection. The effects of HIV status, language of testing, and the interaction between HIV status and language, on individuals' test performance were determined by two-way ANOVAS, with repeated measures and t tests. HIV positive respondents scored significantly lower than HIV negative respondents on all the Neuropsychological tests and the mean scores on the English medium version were consistently lower than scores on the L1 (Chichewa) version across all tests and all groups. HIV status and linguistic medium showed a significant interaction, with the difference between HIV positive and HIV negative groups being larger with the L1 (Chichewa) version, indicating that, this version discriminated more sharply between HIV positive and negative individuals than the English version**.** The study has demonstrated empirically the significance of language use in the assessment of HIV-associated neurocognitive functional disorders that remain highly prevalent and continue to represent a significant public health problem in this part of the world.

Key Words: HIV status, linguistic medium, rural adults, neuropsychological test, Zambia.

CHAPTER ONE - INTRODUCTION

1.0 Background

Many neurological complications are thought to affect the central and peripheral nervous systems in cases of HIV infection. The vast majority of studies on HIV-related neurocognitive disorders were performed in developed countries on patients infected with HIV-1 subtype B. Two-thirds of the estimated 33.2 million individuals currently living with the human immunodeficiency virus (HIV) acquired immunodeficiency syndrome (AIDS) worldwide are in sub-Saharan Africa (SSA) and are infected with mostly non-B HIV subtypes Kanmogne et al. (2010). Thus, it is important to diagnose and categorize HIV effects on the central nervous system in these developing countries.

The disease burden of HIV has been associated with the impairment of cognitive processes. Studies done by Hemelaar et al. (2006), have confirmed that HIV has hit third world countries more than the western countries. Zambia being one of the third world countries little is known on the neuropsychological effects of HIV, hence the introduction of the International Neuropsychological Test Battery.

Although psychometric properties of Western tests generally have been well established in the US and other Western countries, little is known about the reliability and validity of such instruments in the rest of the world. For example, when establishing the norms in Zambia one of the challenges encountered was the exclusion of non-literate adults with little or no formal education prominent in rural areas and yet they constitute a large proportion of the general population of Zambia. Hence, the need to explore a complementary measure that is sensitive to HIV infection in this neglected segment of the general population by translating the verbal measures into a familiar local language that would possibly assist with the accurate assessment of neurocognitive functioning in this group of people.

As a result of the HIV pandemic, the government of Zambia through the University of Zambia has introduced neuropsychological assessment with the purpose of finding out the neurocognitive impairment directly attributable to HIV and determining if neurocognitive impairment is associated with co-morbid factors such as psychiatric illness, nutritional deficiencies, or co-infections such as cerebral malaria meningitis

and Tuberculosis. The government also needs to explore the relationships between neurocognitive impairment and HIV disease variables such as history of immunodeficiency (current and nadir CD4 count), viral load, and biomarkers of HIV neuropathogenesis, neuroimaging, and brain pathology. Furthermore it needs to explore the relationship between HIV-associated neurocognitive impairment and everyday functioning within different populations around the country. It also needs to establish implications for treatment including adherence and use of Central Nervous System penetrating antiretroviral regimens. In addition, the government emphasizes the need to determine when the patient can start treatment to protect the Central Nervous System from damage and promote continued quality of life/productivity over the lifespan, and of providing feedback to patients and clinicians on progress of disease and treatment effects. Neuropsychological assessment evaluates sensation and perception, gross and fine motor skills, basic and complex attention, visual spatial skills, receptive and productive language abilities, recall and recognition memory, and executive functions such as cognitive flexibility and abstraction, thought content and clarity.

Adelina et al. (2011) in their study that was carried out in Zambia reported that though there has been an introduction of neuropsychological assessment, currently there are insufficient data on the neurocognitive effects of HIV status in Zambia. Ogden et al 2003) reported that "Neuropsychological studies that have been carried out thus far are marked by inconsistent methods, test batteries, and rating systems for levels of cognitive impairment. These differences in methods, along with genetic variability of both virus and host, differences in co-infections and other co-morbidities, differences in language and culture, and infrastructural deficiencies in many settings create challenges to the assessment of neurocognitive functioning and interpretation of neuropsychological data. Identifying neurocognitive impairment directly attributable to HIV, exploring relationships between HIV-associated neurocognitive impairment, disease variables, and everyday functioning, evaluating differences in HIV subtype associated neuropathology, and determining implications for treatment remain complicated and challenging goals. Endeavours to establish a more standardized approach to neurocognitive assessments across international studies in addition to accumulating appropriate normative data that will allow more accurate rating of

neuropsychological test performance will be crucial to future efforts attempting to achieve these goals".

To help assess individuals infected with HIV, the Zambia government with the help of the Norwegian government through the University of Zambia has introduced a fourteen item test battery called the Zambia Neurobehavioural Test Battery that is divided into seven neuropsychological domains which include: **the visual episodic memory domain** comprising the Brief Visual Memory Test Revised for Learning and delayed recall, **the verbal episodic memory domain** comprising the Hopkins Verbal Learning Test Revised – learning and delayed recall, **the verbal fluency domain** comprising the Controlled Oral Word Association Test – FAS, Category Fluency Test (Animals) and the Action (verb) Fluency Test and the Stroop Word, **speed of information processing** comprising Trail Making Test Part A, Colour Trails One, WAIS Digit Symbol, WAIS Symbol Search and Stroop Colour, **the executive functioning domain** comprising the Colour Trails 2, Halstead Category Test, Wisconsin Card Sorting Test and Stroop Colour – Word, **the working memory and attention domain** comprising the Paced Auditory Serial Addition Test and the WAIS-III tests, the **motor dexterity domain** comprising the Grooved Pegboard Test that involves the dominant and non-dominant hands.

Despite the introduction of the test battery, challenges to interpreting neuropsychological assessments in international settings arguably are more difficult than those impeding the performance of assessments and conducting studies in western, English-speaking countries. One of the challenges encountered is the translation and adaptation of tests to be appropriate for a different language, level of education and culture, for the patient population in the new area (Akani et al 2010). In light of the variable pattern of neurocognitive impairment across HIV-infected individuals, group mean comparisons both across and within populations may not be sufficient.

1.1 Problem statement

Studies in non-Western societies (China, India, Uganda, and Ethiopia) have reported differential performance on neuropsychological tests by HIV+ and HIV- groups (Heaton, et al., 2009; Rosselli**,** et al., 1990; Rosselli & Ardila, 1993**;** Masliah et al.,

2000; Alirezaei et al., 2007; Antinori et al., 2007; Berger and Avison: 2004; Adelina et al., 2011; Hestad et al., 2012**).** However, the impact of HIV on cognitive functioning has rarely been studied among individuals with low literacy, even though these represent the majority of individuals with HIV in Zambia. One of the constraints is that most relevant tests are available only in English, which can be used only with persons with formal education. In addition, even when individuals are familiar with spoken English, it is possible that tests administered in a familiar language may be more sensitive to HIV-induced neurocognitive impairments than tests in English. Although a study by Heaton et al. (2009) in China used the international Neuropsychological Test Battery that was translated and administered in the local Chinese dialect to participants with an average low education of less than five years, research comparing the results of neuropsychological tests administered in two languages has not been conducted. This study examined whether administration of neurocognitive tests in a local language could contribute to the performance of individuals with low-literacy.

1.2 Research Aim, Questions, Objectives and Hypotheses

The aim of this study was to determine whether the familiar language (Chichewa version) could contribute to the early diagnosis of neurocognitive dysfunctions and develop a battery of locally valid tests capable of detecting early changes in the cognitive profile of neurocognitive dysfunctions among low-literacy rural HIV positive adults.

In order to achieve this aim, the study was designed to answer the following research questions:

1) What is the difference in performance between HIV negative and HIV positive individuals when they are subjected to the four verbal tests of the neuropsychological test battery using the English and Chichewa versions?

2) What is the difference in mean scores between the English and Chichewa versions when individuals who are HIV negative and HIV positive are subjected to the four verbal tests of the neuropsychological test battery?

3) What is the interaction effect between the influences of HIV status and linguistic medium on the four verbal tests of the neuropsychological test battery?

In order to show the link between research, questions, objectives and hypotheses, a research design matrix was developed below to provide a guide.

Table 1: Design Matrix

Research Questions	Research Objectives	Research Hypotheses
What is the difference in performance between HIV negative and HIV positive individuals when they are subjected to the four verbal tests of the neuropsychological test battery using the English and Chichewa versions?	Using ANOVA, to determine the difference in performance between HIV negative and HIV positive individuals when they are subjected to the four verbal tests of the neuropsychological test battery using the English and Chichewa versions.	There will be a difference in performance between HIV negative and HIV positive individuals when subjected to the four verbal tests of the neuropsychological test battery using the English and Chichewa versions. The hypothesis is that HIV+ will perform less well than HIV- individuals.
What is the difference in mean scores between the English and Chichewa versions when individuals who are HIV negative and HIV positive are subjected to the four verbal tests of the neuropsychological test battery?	Based on paired samples t tests, to determine the difference in mean scores between the English and Chichewa versions when HIV negative and HIV positive individuals are subjected to the four verbal tests of the neuropsychological test battery.	There will be a difference in mean scores between the English and Chichewa versions when individuals are subjected to the four verbal tests of the neuropsychological test battery. The hypothesis is that the Chichewa version will generate higher scores than the English version.
What is the interaction effect between the influences of HIV status and linguistic medium on the four verbal tests of the neuropsychological test battery?	Using a 2x2x2 Factorial designs ANOVA, to determine the interaction effect between the two independent variables, HIV status and linguistic medium, on the four verbal tests of the neuropsychological test battery.	There will be an interaction effect between the two independent variables HIV status and linguistic medium on the four verbal tests of the neuropsychological test battery. It was hypothesised that the effect of HIV status would be greater on performance on the neuropsychological tests in a familiar linguistic medium than on performance of the same tests in English.

1.3 Conceptual Framework

The assessment and interpretation of neuropsychological (NP) performance is influenced by several factors, including age, education, gender, ethnicity, and cultural variables such as socio-economic status, and acculturation (Heaton, Ryan, & Grant, 2009). More recently, bilingualism has been identified as a factor that needs to be considered when administering and evaluating neuropsychological measures (Bialystok, Craik, Green, & Gollan, 2009; Rivera Mindt et al., 2008). People who are bilinguals perform poorer on the tests in a second language than in the first language. This has been demonstrated on measures of verbal performance, where bilinguals perform less efficiently on tasks such as speech production, picture naming, animal and action naming relative to monolinguals. It is also stated that bilinguals have a smaller vocabulary and lexical retrieval in each of the two languages compared to monolinguals (Gollan, Montoya, Fennema-Notestine, & Morris, 2005). However, the concept of bilingualism could not be considered in this study as our participants were not balanced bilinguals due to the fact that their level of English competence was so low.

1.4 Operational Terms

Adult: Persons between the ages 20 and 65.

Brief Period of residence**:** Period of residence in locality for not more than four years.

Education: self-reported time spent in a formal institution learning how to read

Illiterate: someone who may or may not have attained an education level but has not acquired literacy skills.

Linguistic medium: The language used in the test administration, in this case, the English and Chichewa versions.

Literacy: ability to read, write and application of the skills in everyday life.

Literate: someone who has acquired literacy

Longest Period of residence**:** Period of residence in locality between 24 and 65 years.

Moderate Period of residence**:** Period of residence in locality between 15 and 24years.

Neuropsychological test battery: a compilation of different tests that measure brain functioning and Nervous System

Neuropsychological test performance: Cognitive performance on the Neuropsychological Test Battery.

Reliability of an assessment: refers to whether or not the results on a test or questionnaire remain consistent for an individual or group, either within an administration or over separate administrations.

Short: Period of residence into locality between 5 and 14 years.

Study population: A group of people sampled in a research project.

The target population: A group of participants expected to be studied or considered likely to take part in the study.

Validity of an assessment: refers to whether or not the test, question, or skill at hand has a common, shared meaning or existence in the minds of both test-maker and test-taker.

1.5 Identification of Variables

Independent variables: The independent variables included:

- HIV status
- Linguistic medium (English and Chichewa versions)

Dependent variables: The dependent variables included:

- Performance on neuropsychological tests and ZAT

CHAPTER TWO- LITERATURE REVIEW

2.0 Prevalence of HIV

Zambia experiences a generalized national HIV prevalence rate of 14% percent among adults ages 15 to 49. Infection rates are highest in cities and towns along major transportation routes and lower in rural areas with low population density. The prevalence rates in rural areas are 12.7 and 3.8 percent, respectively. In general men and women with higher education have higher HIV prevalence than those with lower education (UNAIDS, 2008).

Studies done by Hemelaar et al (2006) have confirmed that HIV has affected roughly about 33.3 million people all over the world with 4% representing developed countries such as United States, Western Europe and Oceania. Most of the HIV infection is more pronounced in developing countries where cultural values, social influences, educational opportunities and access to other resources are clearly distinct from the West. For example, Africa and the Middle East account for over 66% of worldwide infections, Asia for over 20%, Eastern Europe and Central Asia for approximately 4%, and Latin America and the Caribbean for around 6%. These figures imply that in the whole of the Western Europe and North America the % is only 4% of the total.

2.1 Effects of HIV on neuropsychological functioning

Recent studies estimate that up to 50% of those infected with Human immunodeficiency Virus (HIV) have associated neurocognitive disorders and this rate is likely higher among older patients. Cognitive impairment usually affect adherence, activities for daily living .and has also been linked to all-cause mortality providing some impetus for early detection. There are currently insufficient data to inform solid recommendations on screening methods. Most HIV-specific screening tools have poor performance characteristics for all impairments but the most severe form is dementia and accounts for <5% of cases. Reliance on self reported symptoms is likely to miss a substantial proportion of individuals with HIV- associated neurocognitive disorders due to poor insight, confounding mood disturbances, and lack of well-informed

proxies. In the aging HIV-positive population, broader screening tools may be required to allow sensitivity for both HIV and neurodegenerative disorders (Ellis et al., 2007).

Masliah et al ((2000), carried out a study that indicated that the brain is the organ that is second most frequently affected by HIV infection. They established that following HIV infection, the virus rapidly crosses the blood-brain barrier and enters the brain, and affects brain macrophages and microglia. Toxic HIV proteins and cytokines secreted by infected mononuclear phagocytes in the brain can cause dysfunction of other Central Nervous System cells and neuronal death (Alirezaei et al., 2007). This HIV induced brain pathology often results in behavioural, motor and cognitive abnormalities referred to as HIV associated neurocognitive disorders (Antinori et al., 2007). Normally, the blood brain barrier serves as a protective mechanism by preventing entry of foreign substances. Disruption of the brain blood barrier by HIV contributes to the progression of infection. (Berger and Avison: 2004). Other cells that can get infected include the astrocytes, which can trigger bystander cellular dysfunction and apoptosis, further compromising the blood brain barrier. The toxicity spreads through a gap junction-dependent mechanism.

Neuroimaging and Neurocognitive studies that were done by Melrose et al. (2008) in China showed that HIV in the brain is associated with cognitive impairments. Damage to the fronto-striatal system may underlie cognitive problems including executive function and sequencing tasks. Cysique et al. (2007b) carried out a pilot study investigating the neurobehavioral effects of HIV-1 infection in China. They reported a pattern of deficits in abstraction/executive function, information processing speed, and learning consistent with Western studies A larger former plasma donor study in rural China by Heaton et al. (2009) where they administered the same international test battery to 203 HIV+ and 198 HIV− adults who were mostly farmers with low-average the education = 5.6 years, indicated that participants who were classified as impaired reported more cognitive difficulties in their everyday lives and decreased independence in performing instrumental activities of daily living such as financial management, shopping, housekeeping, and cooking.

Heaton et al. (2004), indicate that learning, memory and executive functioning are core components of comprehensive neuropsychological assessment batteries. Accurate classification of neuropsychological impairment in these domains is especially important for the differential diagnosis of many neurologic conditions. Unfortunately, some of the most widely used neuropsychological tests do not have available norms that are corrected for race/ethnicity differences, despite research showing differential ethnicity backgrounds affect neuropsychological performance, along with other demographic variables such as age, education, and gender. Inadequate normative sampling and standards may lead to neuropsychological misclassification and may particularly contribute to misdiagnosis of persons with little or no education.

A study evaluating the neuropsychological test performance in a sample of HIV positive patients and HIV negative control subjects was conducted in Uganda. Results revealed significant group differences on measures of verbal learning and memory, speed of processing, attention and executive functioning (Robertson et al. (2007b). Gupta et al. (2007) compared a sample of 119 adults in India infected with HIV-1 subtype C who were not on antiretroviral therapy, with normative data derived from an Indian sample of 540 healthy volunteers (with comparable gender distribution, age, and education) and with a matched cohort of 126 healthy, HIV-1-seronegative individuals. They found a high rate (60.5%) of mild to moderate cognitive deficits in the HIV patients but no evidence of true dementia. The neuropsychological profile was characterized by deficits in fluency, working memory, and learning and memory, once again similar to patterns that have been observed in the West.

A study that was conducted in Ethiopia by Clifford et al. (2007) examined a group of workers and found that HIV+ patients had slowed finger-tapping speed, but that the HIV+ and HIV- groups performed similarly in timed gait, Grooved Pegboard, and verbal fluency tests. Similarly, they found that performance of HIV- and HIV+ groups on the Grooved Pegboard, and on tests of verbal fluency, and on Trail making-A or Color Trails-I and II did not differ significantly. In contrast, their more comprehensive NP battery found that HIV+ persons (mainly those with advanced disease) performed significantly worse than HIV- controls on tests of working

memory (PASAT and WMS-III Spatial Span) and higher level executive functions (Category Test and WCST-64), with smaller (non significant with the current sample sizes) effect sizes in the same direction on tests of speed of information processing (WAIS-III Digit Symbol and Symbol Search, and Stroop Colour Naming speed) and visual episodic memory (BVMT-R).

Interestingly, in contrast to the latter result with visual episodic memory and findings in developed countries, their measures of verbal episodic memory (HVLT-R learning and recall) did not even show a small HIV effect. A smaller HIV effect for their verbal than visual episodic memory measures also was seen in rural China (Heaton et al: 2008) and may suggest that the visual measures are more generalizable across cultures. Several studies had demonstrated that demographic effects such as age, education, cultural and ethnic differences affect NP test performance (Sacktor, et al., 2007). A study of neuropsychological impairment among HIV+ individuals in South Africa showed that older age, lower education level, post-traumatic stress disorder, and alcohol use affected neuropsychological performance (Joska et al., 2009). As expected, demographic effects were also present in their data as computation of Pearson's r showed that age and education significantly influenced neuropsychological performance, especially in the HIV- group, while gender had no major effect.

2.2 Effects of Education on the Neuropsychological Test Performance

Literature indicates that illiterate individuals represent a non-neglectable proportion of the world population. It is estimated that about one third of the world people have education level of less than five years while others have completely no education. It is evident that literacy may be reflected in the performance of those tasks used not only in psychological, but also neuropsychological evaluation. According to Ardila and Rossa (1989), educational level represents a crucial variable in psychological test performance. Educational attainment significantly correlates with scores on standard tests of intelligence. This correlation ranges from about 0.57 to 0.75 Correlations with verbal intelligence subtests are usually higher (from about 0.66 to 0.75) than correlations with performance (non-verbal) intelligence subtests (from about 0.57 to 0.61). In consequence, it can be assumed that psychometric measures of intelligence

are strongly biased (facilitated) by our current schooling system. Several studies have proved a strong association between educational level and performance on various neuropsychological measures (e.g., Heaton, et al., 1986; Rosselli et al., 1990). In general, some tests have been observed to be notoriously more sensitive to educational variables (such as language tests) than others (for example, the Wisconsin Card Sorting Test; (Rosselli & Ardila, 1993). They found that educational level has a substantial relationship with performance on verbal learning tests but were not systematically related to everyday problem solving, that is functional criterion of intelligence.

To investigate the effect of schooling on neuropsychological test performance in diverse abilities, Ardila et al. (1989) reported that there was a significant effect of schooling on memory, language, problem solving, constructional abilities, motor skills, and calculation abilities. They further stated that without a careful consideration of the educational variables, neuropsychology runs the risk of finding brain pathology where there are only educational differences. As an illustration of this point, Ardila and colleagues selected a 530-subject sample of individuals with diverse educational background. They noted not only that educational level represented an extremely significant predictor in the Mini-Mental State Exam (Folstein et al.: 1975) scores, but also that the cut-off point for illiterates should be set at only 13 points out of 30. This 13-point score is usually considered as significantly abnormal for any schooled subject (Lezak, 1995).

It has also been suggested that literate people acquire skills to organize and process information in less idiosyncratic and more efficient ways compared with illiterate people (Luria, 1976; Manly et al., 1998). Thus, educated literate people have, in addition to the basic literacy skills of reading and writing, (thus, schooling also provides familiarity with test taking), acquired cognitive skills and strategies for efficient processing of information. Among other things, this entails that literacy and level of education can influence the outcome on specific psychological and neuropsychological tests. Consistent with this suggestion, several behavioural studies have demonstrated that literacy level influences the performance on tests commonly used in neuropsychological assessment (Ardila et al., 1989). Taken together, this

shows that literacy and formal education provide cognitive skills in addition to mastery of reading and writing.

To analyze the effects of literacy across different age ranges on neuropsychological test performance in a sample of 1,600 adults collected in Colima City, Mexico, Ardila and colleagues found that there was a significant educational effect on most of the neuropsychological tests. The largest educational effect was noted in constructional abilities such as figure copying as well as language comprehension, conceptual functions and verbal fluency. Manly and colleagues (1998) carried out a longitudinal aging study in New York City on which they selected a sample of 136 English-speaking African American, Caucasian, and Hispanic elders. After accounting for age at baseline and years of education, the results revealed that elders with low levels of education had a steeper decline in both immediate and delayed recall of a word list over time as compared to those with high levels of education. These findings suggest that literacy or educational skills are protective against memory decline among elders with no cognitive impairments.

Another study was carried out in the Northern Manhattan community of the USA by Manly et al. (1998). They compared neuropsychological test performance among 580 non- demented literate and illiterate elders and they found a significant overall effect for literacy status (literate *vs.* illiterate) on neuropsychological test performance even when groups were matched on years of education, and that the overall effect of literacy status remained significant after restricting the analyses to elders with no formal education, and even after controlling for the effects of language of test administration. They also compare cognitive test performance among illiterates and literates with no formal education, twenty-six literate and 47 illiterate non-demented elders with no formal education, who were equivalent on age and functional status. Multivariate analyses revealed significant effects of both language and literacy on overall test performance, with no significant interaction effect. Univariate testing showed that, independent of language, illiterates obtained significantly lower scores on BVRT recognition memory, WAIS-R Similarities, BDAE Repetition, and BVRT matching than literates.

It was concluded that overall, illiterates obtained significantly lower neuropsychological test scores than education-matched literates. The overall effect of literacy status remained significant when the analysis was limited to those with no formal schooling and when the potential effect of language of test administration was controlled. Because their sample included individuals who had learned to read and write, yet had received no formal schooling.

Another study comparing illiterate and literate participants was carried out in Mexico City by Ostrosky, Ardila & Rosselli, (1997). Two different samples of illiterates were selected. The first sample was collected during the standardization and normalization study of the NEUROPSI neuropsychological test battery. Twenty seven illiterate subjects were recruited in Mexico City during this norm setting study. The rest of the illiterate subjects were collected in Colima City (Mexico). All schooled subjects were selected in Mexico City. Their results revealed that verbal tests such as animal, naming action and Hopkins Verbal Learning Tests were not influenced by years of schooling.

2.3 Effects of Linguistic Medium on the Verbal Fluency Test

The success of any neuropsychological test depends on the use of a familiar linguistic medium. Testing bias should therefore be reduced by using indigenous test instruments that are administered in the local language. The existence of so many subgroups within some countries and regions of the world creates considerable impediments to translating tests and establishing normative data for those regions. When clinical study sites are dispersed throughout the various regions of the world or country, tests may need to be translated into any one of the other official languages, depending on the dominant language of that area.

To test the effects of the familiar language of the translated battery from English version to Luganda version, a study took place at two sites in Kampala, Uganda. One hundred ten HIV+ (WHO Stage 2, n = 21; WHO Stage 3, n = 69; WHO Stage 4, n = 20) participants were recruited from the IDC. 100 HIV seronegative individuals were also recruited from the client base. HIV negative subjects were selected to match the mean age and education of the randomly selected HIV+ sample. All the tests had their instructions and content translated into Luganda. Tests were administered in either

Luganda or English, depending on a formal assessment of the main language of the subject. Most of the subjects (81% HIV- and 77% HIV+) were tested in Luganda. An ANCOVA found no difference for main language and no significant differences for main language within HIV groups on the neuropsychological tests when years of education were adjusted for. The language of administration depended on how familiar that language was to the test taker (thus, administration was based on the language usage

Another study was conducted in India to examine the effect of languages on the executive functions and verbal fluency in two major languages Marathi and Hindi, with a considerable cognate overlap (Kamat et al., 2012). A total of 174 native Marathi speakers from Pune, India, with varying levels of Hindi proficiency were administered tests of executive functioning and verbal performance in Marathi. Participants were administered six measures assessing executive functioning and verbal skills within the context of a more comprehensive fixed-order test battery, which took approximately three hours. All tests and questionnaires were translated from English, back-translated, and administered in Marathi. To have a common metric for performance on these fluency and executive function tests, demographically uncorrected scaled scores were calculated based upon a large Indian normative sample which included the current cohort (n = 5248); the scaled scores have a mean of 10 and a standard deviation of 3. The results revealed that the Hopkins Verbal Learning Test (HVLT) had a significant age effect but not educational effect in this study of older patients. In obtaining normative data by age and education on the COWAT (FAS) and Category Verbal Fluency Test (Animal Naming), Tombaugh et al. (1999), found that regression analyses performed on scores from individuals who had completed both verbal fluency tests demonstrated that for FAS education accounted for more variance than age (education 21.7% vs. age 11.8%) while for Animal Naming the opposite relationship existed (education 13.6% vs. age 23.4%).

To taste the verbal skills, another study was carried out in India. Three standardized tests of phonemic and semantic fluency tests were administered. In the test of phonemic fluency (Benton et al., 1994) participants were to retrieve words using

phonemic processing. Based on previous studies of phonemic fluency (e.g., Ratcliff et al., 1998) three Marathi phonemes (denoted in English as /p/[‘‘paa’’], /a/[‘‘a’’], and /s/[‘‘saa’’]) were used in this task and participants were asked to generate words that started with the sounds associated with these letters in the 60-s time limit. Animal fluency (Benton et al., 1994) in this task, retrieval processing at a semantic level is required. Participants were asked to name as many animals as they could in 60 s. The number of correct responses was then calculated. Action fluency (Piatt et al., 1999) is another measure in which retrieval processing must occur on a semantic level. Participants must rapidly generate as many verbs (i.e., ‘‘things that people do’’) as possible in 60 s. They were to generate only single verbs (e.g., eat) and avoid repeating verbs that were generated earlier with only a different ending (e.g eating, eaten). The number of correct responses was calculated. An examination of the two languages’ effect on tests of verbal fluency revealed a significant effect on two of the three tests administered after adjusting for education, age and gender, (all p’s .05).

To find the effects of linguistic variables such as word length (Kempler et al., 1998) or frequency of words beginning with the given letter, and familiarity with the given semantic category that might influence the performance when testing participants from other cultural contexts, Rosselli et al. (2002) studied semantic and phonemic word fluency in groups of Spanish–English bilingual or monolingual groups and found differences between monolinguals and bilinguals and also between Spanish and English speakers. It was reported that monolinguals (English or Spanish) performed similarly on phonemic fluency overall, but differed with regard to the category of words they used.

Kempler et al. (1998) in his study of word length for verbal fluency tests for English-speaking people found that the norms for people who spoke a different language could not be used because linguistic factors affected verbal fluency test performance. With respect to semantic verbal fluency tests, he found that Spanish speakers generated the smallest number of animal names in comparison to Chinese and English speakers, and Vietnamese speakers generated the most animal names. The researchers related these differences to differences in the length of words for animal names in these languages, with animal names being longest in Spanish and shortest in

Vietnamese. Studies with phonemic verbal fluency tests on the other hand suggested that the difference in the number of generated words was related to the frequency of words beginning with the given letter in a language: Spanish speakers generate fewer words beginning with the letters *F*, *A*, and *S* in comparison to English speakers because these letters are less common in Spanish than in English (Lopez & Taussig: 1991). In general to these linguistic factors, culture-specific factors, such as the degree of familiarity with testing (Ardila, 1995), may also affect semantic and phonemic verbal fluency test performance.

To find the effect of language familiarity, another study was conducted by Zhou and Nakamoto (2007) at the Institute of Textiles and Clothing, The Hong Kong Polytechnic University, in Hong Kong where they compared the use of free recall and recognition format in assessing brand knowledge for different languages and product categories. Verbal fluency Test was used for evaluating expressive language ability. Participants were invited to generate types of some categories and an example of how to generate items of flowers was given. The participant was also reminded to give the name of each flower type only once and to generate as many types as he/she could. Correlation analyses were conducted to explore the factors that could affect their free recall and recognition performance of English and Chinese brand names and across product categories of fashion in English and Chinese The results suggested that across product categories, their free recall and recognition performance of English and Chinese brand names was not correlated with their intellectual functioning, memory or language ability ($p > .05$). However, within product category of fashion, their free recall performance of English brand names was significantly correlated with their free recall performance of Chinese brand names ($r\ (40) = 0.544$, $p < .001$).

The literature above has established differential performance on neuropsychological tests by HIV positive and HIV negative groups in non-Western societies. However, the impact of HIV on the cognitive functioning was not studied among illiterate adults in Zambia because the tests that are available are in the English medium which is unfamiliar to them. Furthermore, research has not been reported on the possibility that tests administered to illiterate, rural adults in a familiar language may be more sensitive to HIV-induced neurocognitive impairments than tests in a less familiar

language that is primarily restricted to educational and other formal urban settings. Research comparing neuropsychological tests results in two linguistic media even among individuals who are HIV positive and HIV negative have not yet been done in order to include respondents who are not fluent speakers in a foreign language. Gender differences in neurocognitive vulnerability to HIV infection have been reported in some studies but not in others within this age group.

CHAPTER THREE- METHODOLOGY

3.0 Introduction

This chapter outlines the methods of data collection and data analysis.

3.1 Study design

The study was an experimental design assessing the neuropsychological effects of HIV and linguistic medium on the test performance; four verbal tests from the seven neurocognitive domains were translated into Chichewa. The translated tests included the Hopkins Verbal Learning Test Revised for both immediate and delayed recall as well as phonemic category and action fluency, Animal and Action Naming. These tests were selected because they did not require reading and controlled for literacy.

3.2 Study sites and number of participants

We recruited 28 HIV positive participants who were not on antiretroviral therapy because it was assumed that none of these had had AIDS and were at reduced risk for HAND. Those on antiretroviral therapy were excluded for fear of drug effects on the neuropsychological performance. We also recruited 22 HIV negative individuals as a control group. This sample of respondents was recruited from typical rural clinics of Chipata, in Eastern Province of Zambia where people spoke Chichewa as a familiar language (See Appendices M, N and O for details of the Chichewa versions, and J, K and L for the English. versions of the tests).

3.3 Sampling Procedure

In order to ensure a representative sample of participants in the rural clinics, a simple random technique was employed. To select those who were HIV positive, the clinic register was used and names of participants were picked at an interval of 1. Those on ART were excluded from the HIV positive group by the help of the clinic staff as they had reliable records for those on ART and those who were not. This was to avoid other confounding factors like drug therapy.

To select HIV negative participants, simple random sampling method was employed at an interval of 1. The recruitment was done as patients came for Voluntary Counselling and Testing. Due to other conditions that might have excluded the participants, we had to enrol more than 20 at each clinic.

A Randomised Post-test Only Control Group design was used in this study. Each study members in a group, those who were HIV positive and HIV negative were assigned at random in two arms for study. The assignment and randomisation was blinded to the researcher. The project team members, that is staff in the health centres assigned group members to avoid bias. Participants were screened for reading ability using a reading test called the Zambia Achievement Test (ZAT). The other techniques employed were to greet them ask them a few questions in English. All those who scored between five and eight scores were included for having knowledge of spoken English that could enable them understand test instructions while those who scored between nine and ten were excluded as being literate.

3.4 Exclusion and inclusion criteria

The purpose of the study, and research procedures were fully explained to participants and were given a written consent that allowed them to participate in the study. The exclusion criteria were 1) present or past history of Central Nervous System disease unrelated to HIV, 2) head trauma, 3) current alcohol intoxication (alcohol status of each participant was measured by using a Chinese substance abuse questionnaire, 4) known psychiatric disease or treatment with antipsychotic drugs, and 5) ongoing systemic illness. All participants to be enrolled were to speak Chichewa as their primary language and interviews were conducted in Chichewa. All participants provided demographic information; underwent a thorough neurological assessment and a complete medical history and physical examination. This was done by clinicians before neuropsychological testing was done to detect any focal neurological deficit suggestive of Central Nervous System opportunistic infection. This thorough clinical assessment of each participant combined with review of his or her prior medical history and laboratory data, was to ensure that potential confounding factors such as Central Nervous System opportunistic infections are ruled out.

3.5 Translation

Translation was done by the researcher using Nida's dynamic equivalence theory of translation. Nida bases his theory on some linguistic achievements made by Jackobson and Chomsky. The duo make claims that a dynamic dimension can be

added to language structure through the use of transformation. Drawing from them, Nida argues "Anything that can be said in one language can certainly be said in another language…", with reasonable accuracy by establishing equivalent points of reference in the receptor's culture and matching his cognitive framework by restructuring the constitutive elements of the message (Nida, 1984: 13). Using dynamic equivalence, the researcher had to reproduce "in the receptor language (Chichewa) the closest natural equivalence of the source-language message (English language), "(See Nida and Taber, 1969: 12).

The researcher identified key words that were "closest", "natural" and "equivalence". By "closest", Nida indicates that owing to the impossibility of absolute equivalent, the "closest" equivalence is the most ideal one. Drawing on the works by stressing that "a natural rendering must fit the receptor language and culture as a whole; the context of the particular message; and the receptor-language audience," the researcher translated each test into Chichewa. To put it plainly, either the meaning or form should not sound "foreign". Among all languages, Chichewa was preferred because according to Central Statistical Office data, Chichewa was the second most widely used language in Zambia after Bemba. Moreover, it was also the language that the researcher had competence in.

When a tool is translated into a local language, it will still be used with individuals within the same age groups and of the same level of literacy. The study was designed to assess neurocognitive functioning among rural adults 40-65 years of age and with 0-4 years of education.

3.6 Materials used

Screening instruments

All participants were subjected to various questionnaires that helped gather information on their demographic variables, neuropsychological performance, daily living functioning, psychiatric history, depression and drug abuse. That information would also provide be relevant to other researchers (See appendix Q and U). The following instruments were used to collect data:

Zambia Achievement test: This was a test that asked the participants to read and understand English words (See appendix Q). Participants who read mor than five words were excluded as they were considered literate.

Psychiatric and Drug Abuse Assessment: Uses the Composite International Diagnostic Interview (CIDI) that provides results in the presence or absence of DSM-IV-T /ICD-10 diagnosis of the past or present history of substance disorders. It takes about 30-60 minutes (See appendix U).

Beck Depression Inventory: Collect information regarding the severity of depressive symptoms, It is a 21-item self-report scale consisting four response options of graded severity. Its time frame is the past 2 weeks. The range of scores between 0 - 13 signify ‘‘minimal’’ depressive symptoms; 14 - 19, mild; 20 - 28, moderate; and 29 - 63, severe symptom severity (Beck et al., 1996) (See appendix U).

Assessment for everyday functioning: Measures everyday functioning of the participants and involves three assessment scales which include:

- The Frontal Systems Behaviour Scale (FrSBe) (See appendix U).
- Independent Activities of Daily Living Scale (ADL) questionnaire (See appendix U).
- The Patient’s Assessment of Own Functioning Inventory (PAOFI) (See appendix U).

3.7 The components of the neuropsychological test battery (Appendix U)

The researcher did not use the whole battery but only used the following components of the tests: Hopkins Verbal Learning Test Revised-immediate recall, Hopkins Verbal Learning Test Revised – Delayed Recall, Phonemic Fluency test, Category Fluency (animals) and action (verb) Fluency. The neuropsychological test battery measures the seven domains which include:

Verbal fluency *Tests* included tests of verbal, animal and action naming which measure the ability of generating words beginning with a given letter or by category.

The following tests of the Battery **were not used as they demanded reading and writing:**

Executive functions tests: These included the Halstead Category Test (DeFilippis, 2002), Wisconsin Card Sorting Test-64 (WCST-64), and Colour Trails II. The WCST-64 is a measure of frontal lobe function that assesses the ability to learn concepts, perseverance and competence in abstract reasoning. The Category test is also a measure of frontal lobe function and includes 7 subtests: subtests I and II evaluate number counting and attention; subtests III and VI measure visual abstract reasoning and memory respectively; subtests IV and V measure visual perception and spatial orientation respectively, while subtest VII evaluates learning and retention of the concepts associated with other subtests (Kongs et al., 2000).

Speed of information processing tests: The Wechsler Adult Intelligence Scale (WAIS)-III Digit Symbol and WAIS-III Symbol Search tests (Wechsler, 1997 The Stroop Colour and Word tests (Golden., 1976). The Colour Trails and Trail making Test (D'Elia et al., 1996). The Wechsler Adult Intelligence Scale (WAIS)-III Digit Symbol and WAIS-III Symbol Search tests produce measures of processing speed, visual perception, attention, concentration, visual-motor coordination, motor and mental speed.

The Stroop Colour and Word tests: These measure cognitive processing and can provide valuable diagnostic information on brain dysfunction, cognition, mental speed and mental control. The Colour Trails and Trail Making Test produce measures of attention, visual searching, mental processing speed, and measure the ability to mentally control simultaneous stimulus pattern.

Memory learning and memory recall tests: These are divided into two, namely, the visual episodic memory and verbal episodic memory.

The visual episodic memory: Include the Brief Visuospatial Memory Test-Revised (BVMT-R) (Benedict, 1977) which measures visual learning and memory

The verbal episodic memory: This uses the Hopkins verbal Learning Test Revised (HVLT-R (Brandt and Benedict, 2001) which assesses verbal learning and memory. Both BVMT-R and HVLT-R also assess recognition and recall.

Working memory tests: Include Paced Auditory Serial Addition Test (PASAT)-50 and the Wechsler Memory Scale (WMS) Spatial Span. The Paced Auditory Serial Addition Test (PASAT)-50 is a measure of cognitive function that specifically assesses the processing speed of auditory information, concentration, flexibility, mental calculation and mental tracking abilities. The Wechsler Memory Scale (WMS) Spatial Span provides an estimate of general memory functioning and is sensitive to memory impairments associated with various clinical conditions (Gronwall, 1977).

Motor function test: Includes the Grooved Pegboard test (dominant and non-dominant hand) measures performance speed and requires complex visual-motor coordination (Klove, 1963).

3.8 Test administration Procedure

We administered the selected tests from the main battery of tests and not in the same order to each participant. During the test administration the researcher set apriority the data collection process beginning with an English assessment followed by the Chichewa assessment. The first justification was that the study was embodied in a larger student project using one standard tool was in English and therefore English should be given primacy since the whole project was using the English version. The second justification was that the researcher had an assumption that administering first in English would make no difference even if it was administered in Chichewa since the pilot study reviewed that sequencing had no impact on the results.

Post-tests using four verbal tests that were translated into Chichewa from the seven-neurocognitive domains were used. The translated tests included the Hopkins Verbal Learning Test for both immediate and delayed recall, Animal and Action Naming. The tests were administered to each group to determine if a difference between the two groups exists.

The Hopkins Verbal Learning Test (HVLT-R) is a brief verbal learning and memory test which has been shown to be sensitive to HIV in several developing countries (Cysique et al., 2007; Gupta et al., 2007; Robertson, et al. 2007); The test consists of three trials of free-recall of a 12-item, semantically categorized list which is read aloud to the participant at the rate of approximately one word every two seconds followed by yes/no recognition. The Immediate Recall test includes three learning trials. Delayed Recall is assessed 20 to 25 minutes after completion of the Immediate Recall test. Immediately after administration of the Delayed Recall trial, a forced-choice Recognition test is administered. The Recognition test includes the 12 target words, plus 12 distracters which include six semantically-related and six semantically-unrelated words. The Test administration time takes approximately seven minutes for the Immediate Recall test and three minutes for the Delayed Recall and Recognition tests (Benedict et al., 1998; Brandt & Benedict, 2001).

Trial 1: This is where the list of words is read to the participant while he/she listens carefully and asked to produce as many words as he/she can remember in any order at the end of the reading. The read list is at the rate of one word every two seconds. If participant does not spontaneously begin reporting words after the last word is read, he/she is asked to do so. When the participant is through, he/she can be gently prompted by asking if he/she can recall any other words.

Trial 2*:* After participant has indicated that he/she can recall no more words, the list is read to him/her again and asks whether he/she is able to remember the words including those she mentioned earlier in any order. The list is read at the rate of one word every two seconds.

Trial 3: When participant has indicated that he/she can recall no more words, the list is read one more time and asks him/her to produce as many of the words as he/can can remember, in any order, including the words he/she already mentioned.

Immediately participant indicates that he/she can recall no more words, record the clock time on the Time Trial 3 Completed line. Delay should be done 20-30 minutes after this time.

Delay: After 20 minute delay: The participant is asked to remember the list of words he/she tried to learn before.

Recognition: Immediately following the Delay trial a longer list of words is read to the participant. Some of the words are from the original list while some are not. After reading each word, the participant is asked to say "Yes" if it was on the original list or "No" if it was not."

Animal Naming Test

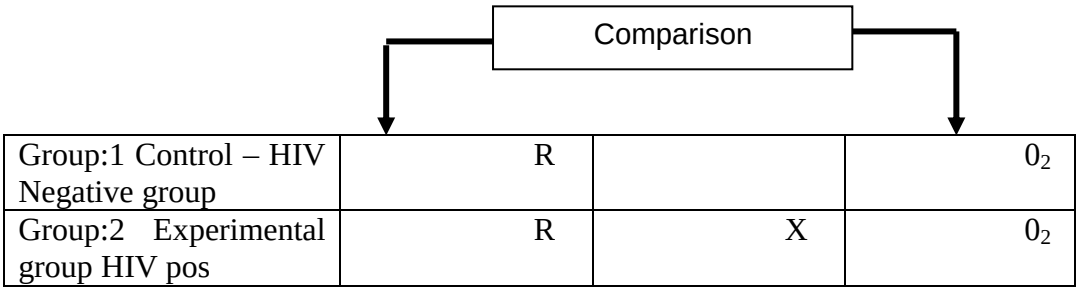
Animal Naming Test requires the participants to name all the types of animals that they may think of in sixty seconds. The categories of animals may also include reptiles, and insects but not humans. Only one response is aloud and the correct response is recorded as a score. The score is the total number of correct words produced within one minute.

Action Naming Test

Action Naming (AN) is a test of language that taps into frontal neural systems (Woods et al., 2005) and has been shown to be sensitive to the neurocognitive effects of HIV infection in subjects in both developed and resource-limited countries (Cysique et al., 2007). This task requires participants to generate as many action words (verbs) as they can within sixty seconds. The participants are advised not to use the same word with different endings, like eat, eating, eaten. They are also advised to give single words such as eat rather than a sentence. Only one response is aloud and the correct response is recorded as a score. The score is the total number of correct words produced within one minute.

The diagram for this design is as follows:

Figure 1*: Randomised Post-test Only Control Group design*



Group:1 Control – HIV Negative group	R		0_2
Group:2 Experimental group HIV pos	R	X	0_2

Because individual characteristics are assumed to be equally distributed through randomization, there is theoretically no real need for a pre - test to assess the comparability of the groups prior to the intervention. In this design, random assignment ensures, to some degree, that the two groups are equivalent before treatment so that any post treatment differences can be attributed to the treatment. This simple design encompasses all the necessary elements of a true randomized experiment: (1) random assignment, to distribute extraneous differences across groups; (2) intervention and control groups, to determine whether the treatment had an effect; and (3) observations following the treatment (Anderson, 2001).

In this experimental design each participant performed the same test twice but in different versions, and extraneous variables that could affect the results were controlled for example sequences. If the same test were administered twice for example, T1- English Animal naming, T2- Chichewa Animal naming, we would expect the score at T2 to be higher than at T1 due to "practice effect". For us to compare tests in a familiar language and the unfamiliar version some of the participants were tested first in English then in Chichewa and some were tested first in Chichewa then in English in all the tests. Though the participants had fewer than five years of education and tested as being illiterate in English, they had some familiarity with spoken English which they learned as they attended various club meetings, Kitchen parties and weddings, and as they mingled with their children, grand children and others who had gone to school. This enabled them gain some English vocabulary to understand test instructions.

Counterbalancing of sequence was not planned but was done informally during data collection. Approximately half of all participants received each of the possible sequences, as shown in the tables 4-6 on pages 36-38.

The duration of the battery, in total, did not exceed one and a half hours. Our battery included tests that are widely used as standardized measures of verbal fluency (phonemic, category and verbal fluency as well as the Hopkins Verbal Learning Test Revised for both immediate and delayed recall. Beck depression Inventory was also administered in Chichewa to determine the levels of depression in each participant and results have been indicated in Chapter 4.

These tests were administered to each participant by the researcher in the private, quiet and well-lit room that was provided by the clinic in-charge personnel. Following neurological, general medical assessment and neuropsychological testing, blood samples were not collected for serology due to processing difficulties and long distances.

The HIV status of each participant was determined by the medical practitioners who advised that they had used the rapid immunochromatographic HIV-1/2 test (Abbott Diagnostics, Chicago, IL, USA) and the Murex HIV antigen/antibody Combination ELISA (Abbott Diagnostics). A participant was considered HIV+ if they tested positive for the 2 tests and HIV- if negative for both tests, and discordant if positive for only one test. No discordant results were accepted to take part in the study.

3.9 Statistical analysis

Data collected was entered and analysed with the help of Statistical Package for Social Sciences (SPSS version 16 for Windows). Analysis of variance (ANOVA) was performed to ascertain whether HIV status, linguistic medium, gender and education had significant effects on the selected tests, the Main Univariate effects and interaction terms were examined and mean differences were determined by the One-Sample t-test. To examine the differences in performance between male and female participants and the effect sizes between the English and Chichewa versions a 2x2x2 Factorial Design ANOVA with Repeated Measures was conducted. In determining the type of linguistic medium that could have a greater influence on the performance,

the Paired Samples t-test was used. To explore the magnitude of other demographic effects on test performance, the individual effects of age, marital status and period of residence, ANOVA was conducted for each selected cognitive ability test.

3.10 Ethical Considerations

The research proposal was first submitted for review and approval to the University of Zambia Biomedical Research Ethics Committee (See appendix R, S and T). All participants provided written informed consent (See appendices E and G). The examiner read the form to all of them as they could not read themselves including those who claimed to have reached grade 4, and were treated according to the ethical guidelines set forth by the University of Zambia Bioethical and Research Committee. Issues of confidentiality were well explained. Participation in this study was purely voluntary and those who decided to withdraw would do so at anytime with no consequences attached. To reduce fatigue that could be experienced by participants, from a longer time of the assessment, they were free to ask for a short break at any time of their request.

3.11 Demographic information

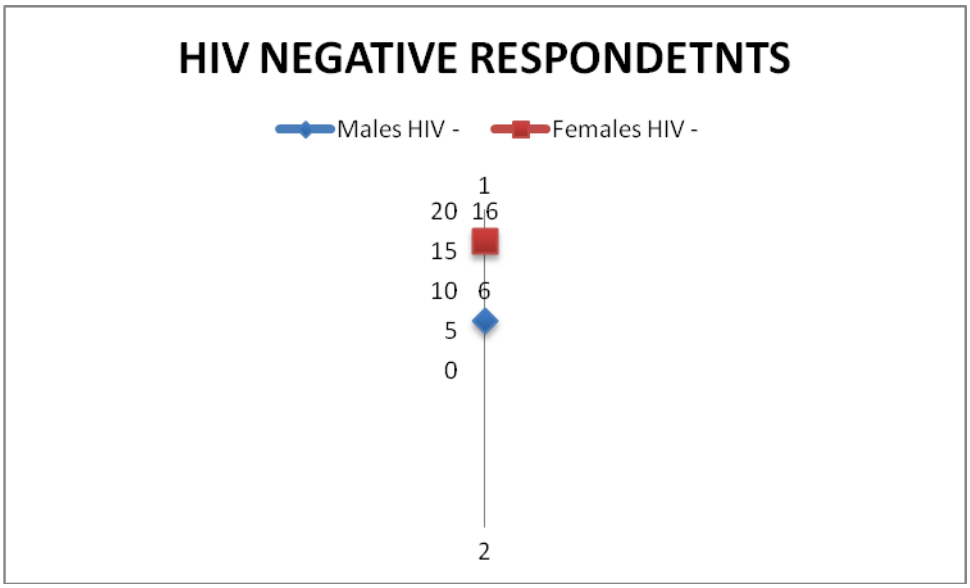
3.11.1 Gender and HIV status of respondents

34 (68.0%) were female respondents and 16 were male respondents who were represented by 32%. Participants *Mean* = 1.68 and *SD* = .471. Out of fifty participants, 22 (44.0%) were HIV negative while 28 (56%) were those who were HIV positive.

3.11.1.1 HIV negative participants

Figure 2 below indicates that the research study had 16 (72.7%) HIV negative females and 6 (27.2%) HIV negative males.

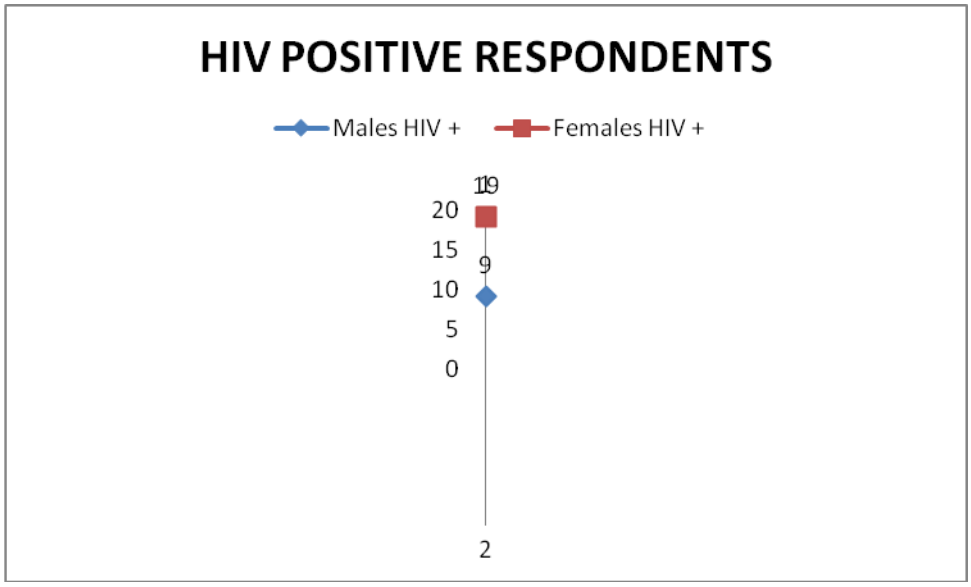
Figure 2 HIV negative respondents



3.11.1.2 HIV positive respondents

Figure 3 below shows that 19 (67.85%) were HIV positive females and 9 (32,14%) were HIV positive males.

Figure 3 HIV positive respondents



This indicates that the sample had a higher percentage of HIV positive individuals than the HIV negative respondents.

3.11.2 Age range of respondents.

The age of participants ranged from 40-65 years (M = 49.74, SD = 9.05). The highest number of respondents was aged 40 represented by 20.0% followed by 41, 42 and 64 years with 8.0% each.

Table 2: Age range of respondents

Age range	frequency	Percent
40-45- years	22	44.0
46-50 years	8	16.0
51-55 years	6	12.0
56-60 years	3	6.0
61-65 years	11	22.0
Total	**50**	**100.0**

Table 2 above shows that 22(44.0%) of the respondents were between the ages of 40 to 45 years, 8 (16%) aged between 46-50 years, 6 (12.0%) were between 51and 55 years, 3 (6%) aged between 56 -60 years while 11 (22%) were those between 60-65 years old.

3.11.3 Years of schooling of respondents

Table 3: Years of schooling of respondents

Education level		Frequency	Percent
Never went to school	0	12	24.0
Went up to grade	1	4	8.0
Went up to grade	2	7	14.0
Went up to grade	3	7	14.0
Went up to grade	4	20	40.0
Total		**50**	**100**

Table 3 shows that 40.0% of the respondents had completed grade 4, 24.0% were those who had not entered grade 1, 14% were those who had completed grade 3 while the other 14.0% was those who had gone up to grade 2. 4 (8.0%) were respondents who had completed grade one. Since we were interested in less than five years of education, we divided our participants into four groups based on their success on the reading screening test, as well as their self-reported school attendance. The five groups are described below:

Grade 0 or has never been to school [*n* = 12]. These participants failed to read letters, syllables, or words on the screening test and reported no formal schooling.

Went up to grade 1 [*n* = 4,]. These participants failed to read letters, syllables, or words on the screening test, despite their report that they had attended school for the period of 1 year).

Went up to grade 2 [*n* = 7]. These participants failed to read letters, syllables and words on the screening test successfully and reported that they had learned how to write their names while in grade 1.

Went up to grade 3 [*n* = 7]. These participants read a few letters, syllables, and words on the screening test and reported having attended school up to grade 3. Their reading levels did not reach criteria and were regarded as illiterate.

Went up to grade 4 [*n* = 20].These participants read a few letters on the ZAT, syllables, and words on the screening test and reported having attended school up to grade 4 but failed to reach our cut off point, hence, they were regarded to be illiterate.

Five participants from those who had pretended that they had never went to school after discovering that they were able to read up to ten words from the ZAT. No participants were excluded from those who went up to grade 1 and 2 because they all failed to reach the cut off point for reading levels. Three participants were excluded from those who claimed to have gone up to grade 3 while seven were excluded as being literate from those who went up to grade four as they scored higher on the ZAT

3.11.4 Marital status of respondents

The research study had 58% of the respondents who were married, 20.0% were widowed, 10.0% were those who divorced, 6.0% represented those who were on separation while the other 6.0% comprised the single group.

3.11.5 Period of residence in locality

In our study, 29 (58.0%) of the respondents grew up in this rural area while 13 (26.0%) had lived in this locality for moderate period of time, 4 (8.0%) of the respondents had lived there for a short period of time while another 4 (8.0%) had lived in the locality a brief period of time.

CHAPTER FOUR: RESEARCH FINDINGS

4.0 Introduction

This chapter presents the findings of the field research. The findings are presented according to the following themes and research questions.

1) HIV status and neuropsychological test performance
2) Linguistic medium and neuropsychological test performance
3) Interactions among HIV status, linguistic medium and gender on the neuropsychological test performance

These themes were analysed and the results were interpreted by means of tables and graphs. The test performance of the participants was based on the four selected tests which were presented both in the original English version and in a new version translated into Chichewa. The English and Chichewa versions are shown as **Eng** and **Chi** in the tables and figures. The four tests included the following:

1) Hopkins verbal Learning Test Revised - English and Chichewa versions: immediate recall.
2) Hopkins Verbal Learning Test Revised - English and Chichewa version: delayed recall
3) Category (animal) Fluency - English and Chichewa versions
4) Action (verb) Fluency - English and Chichewa versions

Before examining the research themes, the sequence counterbalancing of test administration was analysed and the effect of HIV status on the social demographic variables was examined. In order to examine whether each of the demographic variables (age range, number of years of schooling, marital status and period of residence) had a significant influence on any of the test scores, one-way analyses of variance (ANOVA) were conducted.

4.1 Sequence of Test Administration

4.1.1 Language of category (animal) Fluency

Table 4

Language of Testing	Frequency	Percent
Animal naming first in English and animal naming second in Chichewa	30	60.0
Animal naming first in Chichewa and animal naming second in English	20	40.0
Total	50	100.0

Table 4 above shows that for animal naming, 30 (60%) of the respondents were first tested in English while the remaining 20 (40%) were tested in Chichewa. The second sequence 20 (40%) of the respondents were tested in Chichewa and the 30 (60%) was tested second in English.

4.1.2 Language of Action (Verb) Fluency

Table 5

Language of Testing	Frequency	Percent
Action (verb) Fluency first in English and action (verb) Fluency second in Chichewa	24	48.0
Action (verb) Fluency first in Chichewa and action (verb) Fluency second in English	26	52.0
Total	50	100.0

From table 5 above shows that for the Action (verb) Fluency, 24 (48%) of respondents were first tested in English while the remaining number was tested in Chichewa. In the other instance, 26 (52%) of the participants were tested in Chichewa first while the other respondents were tested second in English.

4.1.3 Language of Hopkins Verbal Learning Test Revised

Table 6

Language of Testing	Frequency	Percent
Hopkins Verbal Learning Test Revised first in English and Hopkins Verbal Learning Test Revised second in Chichewa	23	46.0
Hopkins Verbal Learning Test Revised first in Chichewa and Hopkins Verbal Learning Test Revised second in English	27	54.0
Total	50	100.0

The results for the Hopkins Verbal Learning Test Revised (Table 6 above) indicate that 23 (46%) of the participants were first tested in English while the 23 (54%) was tested second in Chichewa. In the second instance, 27 (54%) of the respondents were tested in Chichewa first and 46% of the participants were tested second in English.

4.2 HIV status and Demographics

To examine the effect of HIV status and demographic variables one-way ANOVA: was conducted and results were HIV status * gender *(F* (1, 46) = .001, *p* = .981, *effect size* =.000. HIV status * age (*F* (1, 46) = 1.401, *p* = .200, *effect size* = .491. HIV status * marital status (*F* (1, 46) = 1.009, *p* = .413. *effect size* = .082. HIV status * period of residence (*F* (1, 46) = .088, *p* = .966, *effect size* = .006. HIV status * years of schooling (*F* (1, 46) = 1.021, *p* = .407, *effect size* = .083. as shown in table 6 below.

Table 7: HIV status and Demographics

HIV status and Demographics	*F*	*Sig*	*Effect size*
HIV status * Gender	.001	.981	.000
HIV status * Age Range	1.401	.200	.491
HIV status * Years of schooling	1.021	.407	.083
HIV status * Marital status	1.009	.413	.082
HIV status * Period of residence	.088	.407	.083.

The results in table 7 above show that HIV status had no any effect on all the demographic variables**.**

4.3 Demographics and Neuropsychological Test Performance

4.3.1 Gender and Neuropsychological Test performance

The difference in scores between males and females were calculated and the results are shown in table 8 below.

Table 8: Mean difference between males and females on the test performance

Gender	HVLT Eng	HVLTdr Eng	HVLT Chi	HVLTdr Chi	Anim Eng	Anim Chi	Act Eng	Act Chi	Beck D I
Male									
Mean	11.56	4.12	17.38	7.19	5.44	14.81	3.31	9.62	**6.75**
SD	3.52	1.96	5.21	2.34	2.56	4.28	1.96	2.96	**3.07**
Female									
Mean	11.50	4.06	16.18	6.91	4.53	14.21	3.09	10.12	6.76
SD	3.76	3.04	4.80	2.70	2.50	5.33	2.38	3.67	2.65
Total									
Mean	**11.52**	**4.08**	**16.56**	**7.00**	**4.82**	**14.82**	**3.16**	**9.96**	**6.76**
SD	**3.65**	**2.00**	**4.92**	**2.57**	**2.52**	**4.98**	**2.44**	**3.43**	**2.76**

When males and females were tested on all the neuropsychological tests, results show

that in most cases, males seemed to have scored higher means than the females. However, females performed better in the Action naming Chichewa version than males. The results for males were HVLT Chichewa version- immediate recall (*M* =11.56, *SD* = 3.52); HVLT Chichewa version- immediate recall (*M* = 17.38, *SD* = 5.21); HVLT- English version delayed recall (*M* = 4.12, *SD* = 1.96); HVLT Chichewa version delayed recall (*M* = 7.19. *SD* = 2.34); Animal Naming English version (*M* = 5.44 *SD* = 2.56); Animal Naming Chichewa version (14.81, *SD* = 4.28); Action Naming English version (*M* = 3.31, *SD* = 1.96); Action Naming Chichewa version (*M* = 9.62, *SD* = 2.96) while the Beck Depression Inventory was (*M* = 6.75, *SD* = 3.07).

The results for female respondents were HVLT Chichewa version- immediate recall (*M* =11.50, *SD* = 3.76); HVLT Chichewa version- immediate recall (*M* = 16.18, *SD* = 5.21); HVLT- English version delayed recall (*M* = 4.06, *SD* = 3.04)*;* HVLT-Chichewa version delayed recall *(M* = 6.91. *SD* = 2.70); Animal Naming English version (*M* = 4.53, *SD* = 2.50); Animal Naming Chichewa version (*M* = 14.21, *SD* = 5.33); Action Naming Test- English version (*M* = 3.09, *SD* = 2.38); Action Naming Test Chichewa version (*M* = 10.12, *SD* = 3.67); Beck Depression Inventory (*M* = 6.76, *SD* = 2.65).

Table 9: Gender of Respondents and Neuropsychological Test Performance

Test item	F	Sig	Eta^2
HVLT-Eng * gender	(1, 46) = 003	.956	.000
HVLTdr-Eng * gender	(1, 46) =.012	.914	.000
HVLT-Chi * gender	(1, 46) =.642	.427	.013
HVLTdr-Chi * gender	(1, 46) =.123	.727	.003
Animals Eng * gender	(1, 46) = .225	.638	.005
Animals Chi* gender	(1, 46) =1.424	.239	.029
Actions Eng * gender	(1, 46) = .108	.744	.002
Actions Chi * gender	(1, 46) = .159	.692	.005
Beck D I * gender	(1, 46) = .000	.986	.000

p < .05

The analysis of variance (ANOVA) was conducted to determine the effect of gender on the test performance. The results in table 9 above indicate that there was no statistically significant effect of gender on the neuropsychological test performance. The Beck depression Inventory for the levels of depression also revealed a non statistically significant result within gender. The results were: HVLT-Eng * gender (*F* (1, 46) = 003, *p* = .956, *effect size* = .000); HVLTdr-Eng * gender (*F* (1, 46) = .012, *p* = .914, *effect size* = .000); HVLT-Chi * gender (*F* (1, 46) = .642, *p* = .427, *effect size* = .013); HVLTdr-Chi * gender (*F* (1, 46) = .123, *p* = .727, *effect size* = .003); Animals Eng * gender (*F* (1, 46) = .225, p = .638, *effect size* =.029); Animals Chi* gender (*F* (1, 46) =1.424, *p* = .239, *effect size* =.005); Actions Eng * gender (*F* (1, 46) = .108, *p* = .744, *effect size* = .002); Actions Chi * gender (*F* (1, 46) =.159, *p* = .692, *effect size* = .005); Beck Depression Inventory (*F* (1, 46) = .000, *p* = .986, *effect size* = .000.

4. 3.2 Age Range and Neuropsychological Test Performance

A one-way ANOVA with alpha *p* = .05 showed a statistically non-significant effect of age range on the test performance. Thus, HVLT-Eng * age range (*F*(1,46) = .479, *p* = .751, *effect size* = .041); HVLTdr-Eng * age rang (*F* (1,46) =.494, *p* = .740, *effect size* = .042); HVLT Chi * age range (*F* (1,46) =1.160, *p* = .341, *effect size* = .093); HVLT dr Chi * age range (*F* (1,46) = 1.196, *p* = .326, *effect size* = .096); Animals Eng * age range (*F* (1,46) = .865, *p* = .492, *effect size* = .071); Animals Chi* age range (*F* (1,46) = 1.708, *p* = .165 *effect size* .132) Actions Eng * age range (*F* (1,46) = .366, *p* = .832, *effect size* = .031) Actions Chi * age range (*F* (1,46) = 1.240, *p* = .308, *effect size* = .099) (Appendix A, table 10). These results indicate that age range had no significant influence on the test performance.

4.3.3 Years of Schooling and Neuropsychological Test Performance

Table 11 below indicates the mean scores and standard deviations for each of the tests analysed as a function of 0 - 4years of schooling. When the number of years was computed for the effect on performance on the tests, the results revealed that there were variations in mean scores in all the grades including those who never went to

school. For all the five groups of respondents, the highest mean scores were higher in the new version (Chichewa) especially that English was not frequently used.

Table 11: Mean Test Scores according to Years of Schooling

Yrs of Schooling	HVLTir Eng	HVLTdr Eng	HVLTir Chi	HVLTdr Chi	Anim Eng	Anim Chi	Act Eng	Act Chi
0								
Mean	12.42	4.42	14.83	6.17	3.33	12.58	1.25	9.25
SD	3.99	2.71	4.67	2.66	1.83	5.18	.62	2.63
1								
Mean	9.50	2.35	12.75	2.25	2.25	10.25	1.25	7.25
SD	.58	.957	1.26	.957	.957	2.65	.50	2.22
2								
Mean	12.86	5.57	16.71	5.57	4.29	14.43	2.57	10.57
SD	4.78	2.88	5.82	2.51	1.80	5.53	.98	3.74
3								
Mean	13.39	4.29	17.29	7.27	4.00	16.00	2.57	10.14
SD	4.23	2.93	4.54	3.15	2.24	4.70	.976	4.34
4								
Mean	12.50	4.10	18.05	7.55	3.20	15.75	2.05	10.65
SD	3.62	2.47	4.98	2.48	2.02	4.71	1.10	3.57

HVLTir-Hopkins Verbal Learning Test –immediate recall; HVLTir-Hopkins Verbal Learning Test-delayed recall; Ani-Animal naming; Act-Action naming; Eng- English, Chi-Chichewa;

To examine the influence of years of schooling on the test performance, a test of significance using ANOVA was conducted. Although the mean scores were

descriptively different, statistical analysis results revealed that there was no significant difference in performance among the four groups of participants. Thus, years of schooling had a non significant effect on the tests except for the English version of the Action Naming Test that showed a significant effect. The results were: HVLT- English version (F (1, 49) = .686, p = .605, *effect size* = .057); Hopkins Verbal Learning Test delayed recall English (F (1, 49) = 622, p = .649, *effect size* was .057); Hopkins Verbal Learning Test immediate recall Chichewa (F (1, 49) = 1.534, p = .202, *effect size* = .120); Hopkins Verbal Learning Test delayed recall Chichewa (F (1,149) = 1.127, p = .356, *effect size* = .091); Animal Naming English (F (1,49) =.958, p = .440, *effect size* = .078); Animal Naming Chichewa (F (1, 46) = 1.740, p = .158, *effect size* = .134); Action Naming Eng (F (1,49) = 3.142, p = .023, *effect size* = ..218) and Action Naming Chichewa (F (1, 49) = 1.014, p = .410, *effect size* = .083.

Table 12: Years of Schooling and Neuropsychological Test Performance

Test item	*F*	*Sig*	*Eta*^{2}
HVLTir-Eng * Yrs of schooling	.686	.605	.057
HVLTdr-Eng * Yrs of schooling	.622	.644	.052
HVLTir-Chi * Yrs of schooling	1.534	.209	.120
HVLTdr-Chi * Yrs of schooling	1.127	.356	.091
Animal-Eng * Yrs of schooling	.958	.440	.078
Animal-Chi* Yrs of schooling	1.740	.158	.134
Actions-Eng * Yrs of schooling	3.142	**.023**	.218
Actions-Chi * Yrs of schooling	1.014	.410	.083
p* < *.05	.		.

4. 3.4 Marital status and Neuropsychological Test Performance

To determine whether marital status had an influence on performance, a one-way analysis of variance (ANOVA) was performed and results indicated that there was no statistically significant influence of marital status on the performance on all the tests.

HVLTEng * Marital status (F (1, 46) = 1.094, p = .371, *effect size* = .089); HVLTdr-Eng * Marital status (F (1, 46) = 1.322, p = .276, effect size = .105); HVLT-Chi * Marital status (F (1, 46) = 1.675, p = .172, effect size = .130); HVLTdr-Chi * Marital status (F (1, 46) = 1.434, p = .238, *effect size* = .113); Animals Eng * Marital status (F (1, 46) = 2.057, p = .102, *effect size* = .155); Animals Chi* Marital status (F (1, 46) = 1.922, p = .123, *effect size* = .146); Actions Eng * Marital status (F (1, 46) = 1.062, p = .386 effect size = .086); Actions Chi * Marital status (F (1, 46) = 1.433, p = .238, *effect size* =.113) (See appendix B table 13).

4. 3.5 Period of residence and Neuropsychological Test Performance

A one-way ANOVA of test performance was conducted with length of residence as the independent variable. The results showed that whether one stayed briefly, shorter, moderate or longest time in that area had no statistically significant effect on the test performance as shown in Appendix C, table 14. HVLT-Eng * Period of residence (F (1, 46) = .641, p = .593, *effect size* = .040); HVLTdr-Eng * Period of residence (F (1, 46) = .901, p = .448, *effect size* = .056); HVLT-Chi * Period of residence (F (1, 46) = .071, p = .975, *effect size* = .005); HVLTdr-Chi * Period of residence (F (1, 46) = .063, p = .979, *effect size* = .004); Animals Eng * Period of residence (F (1, 46) = .461, p = .711, *effect size* = .029); Animals Chi* Period of residence (F (1, 46) = .045, p = .982, *effect size* = .003); Actions Eng * Period of residence (F (1, 46) = .766, p = .519, *effect size* = .048); Actions Chi * Period of residence (F (1, 46) = .217, p = .884, *effect size* = .014).

Below now are the findings grounded in themes each of which relates to one of the project's research questions.

4.4 Theme I: HIV status and neuropsychological test performance

This theme addressed the first research question. The question was, 'what is the difference in performance between HIV negative and HIV positive individuals when subjected to the four verbal tests of the neuropsychological test battery using the English and Chichewa versions?' Table 14 presents the mean scores and standard deviations for each of the tests analysed as a function of HIV status.

Table 15 Mean scores on each test according to HIV status and linguistic medium

HIV status	HVLT Eng	HVLT Chi	HVLTdr Eng	HVLTdr Chi	Anim Eng	Anim Chi	Act Eng	Act Chi	Beck D I
HIV-									
M	14.50	21.23	5.64	9.64	6.50	9.50	4.55	13.23	4.45
SD	2.82	2.98	1.65	.902	2.20	1.92	2.02	1.85	2.35
HIV+									
M	9.18	12.89	2.86	4.93	3.50	10.3	2.07	2.39	8.57
SD	2.21	2.30	1.27	1.12	1.92	2.08	1.71	.18	1.35

(M = Mean SD = Standard deviation)

The results in table 15 above show that when we use the English and Chichewa versions irrespective of language, the mean scores for HIV negative respondents were consistently higher: HVLT English (*M* = 14.50, *SD* = 2.82); HVLT Chichewa immediate recall (*M* = 21.23, *SD* = 2.98); HVLT English delayed recall (*M* = 5.64, *SD* = 1.65); HVLT delayed recall Chichewa version (*M* = 9.64, *SD* = .902), Animal Naming English (*M* = 6.50, *SD* = 2.20); Animal Naming Chichewa (*M* = 9.50, *SD* = 1.92); Action Naming English (*M* = 4.55, *SD* = 2.02); Animal Naming Chichewa (*M* = 13.23, *SD* = 1.85); Beck Depression Inventory (*M* = 4.45, *SD* = 2.35) than the HIV positive individuals who obtained the following mean scores: HVLT English immediate recall (*M* = 9.18, *SD* = 2.21); HVLT Chichewa immediate recall (*M* = 12.89 *SD* = 2.30); HVLT English delayed recall (*M* = 2.86, *SD* = 1.27); HVLT delayed recall Chichewa version (*M* = 4.93, *SD* = .1.12), Animal Naming English (*M* = 3.50, *SD* = 1.92); Animal Naming Chichewa (*M* = 10.39, *SD* = 2.08); Action Naming English (*M* = 2.07, *SD* = 1.71); Action Naming Chichewa (*M* = 2.39, *SD* = 0.18), and Beck Depression Inventory (*M* = 8.57, *SD* = 1.35). However, the Beck Depression Inventory was administered only in Chichewa to find out the participant' depression levels between the two groups.

Table 16: HIV status and Neuropsychological Test Performance

Test item	***F***	Sig	Eta^2
HVLT-Eng * HIV status	(1, 48) = 55.156	<.001	.535
HVLTdr-Eng * HIV status	(1, 48) = 45.441	<.001	.486
HVLT-Chi * HIV status	(1, 48) = 257.252	<.001	**.843**
HVLTdr-Chi * HIV status	(1, 48) =125.029	<.001	**.723**
Animals Eng * HIV status	(1, 48) = 26.545	<.001	.356
Animals Chi* HIV status	(1, 48) = 252.589	<.001	**.840**
Actions Eng * HIV status	(1, 48) = 21.378	<.001	.308
Actions Chi * HIV status	(1, 48) = 126.970	<.001	**.726**
Beck D I * HIV status	(1, 48) = 60.999	<.001	.560

p < .001

To determine to what extent HIV status is a factor on the neuropsychological test performance on the four selected tests of the battery, an analysis of variance (ANOVA) was performed and results in table 16 indicate that there was a statistically significant effect of HIV status on the performance. The results were: HVLT-Eng *(F*(1,48) = 55.156, *p* < .001, *effect size* = .535); HVLTdr-Eng *(F*(1,48) = 45.441, *p* < .001, *effect size* =.486); HVLT-Chi (*F*(1,48) = 125.02, *p* <.001, *effect size* = **.843**); HVLTdr-Chi *(F*(1,48) = 257.252, *p* < .001, *effect size* = **.723**); Animals Eng (*F*(1,48) = 26.545, *p* < .001, *effect size* = .356); Animals Chi (*F*(1,48) = 252.589, *p* < .001, *effect size* = **.840**); Actions, Eng (*F*(1,48) = 21.37, *p* < .001, *effect size* = .308); Actions Chi (*F* (1,48) = 126.970, *p* < .001, *effect size* = .**726**) and Beck Depression Inventory scores were seen to be higher in HIV positive participants (*F* (1, 46) = 60.999, *p* < .001 with an *effect size* of .560).

From table 16 above, the Partial Eta Squared values show that the proportion of variance accounted for by HIV status was consistently higher on the Chichewa versions of the tests than on the English versions (see eta^2 values > 0.7).

Figure 4 - 11: Effects of HIV status on the Four Verbal Tests of the Neuropsychological Test Battery.

Fig. 4 - HIV status and HVLTir-Eng

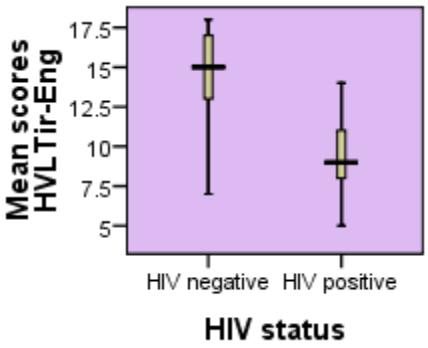


Fig. 5 - HIV status and HVLTdr-Eng

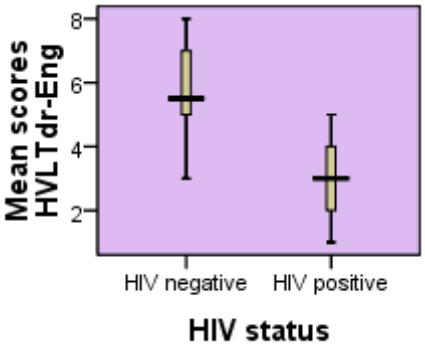


Fig. 6 - HIV status and HVLTir-Chi

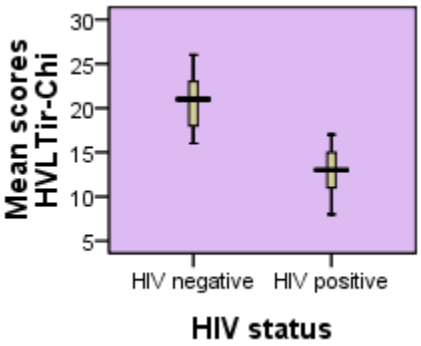


Fig. 7 - HIV status and HVLTdr-Chi

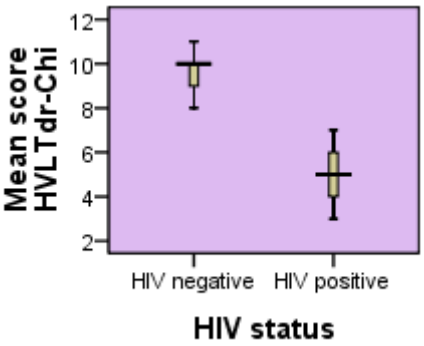


Fig. 8 HIV status and Animal Naming-Eng

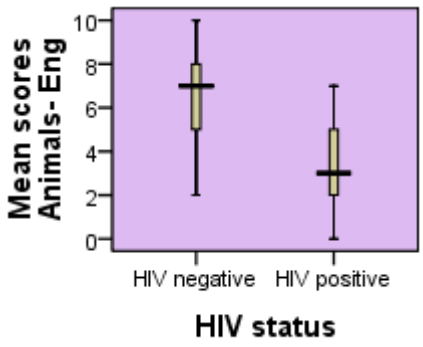


Fig. 9 HIV status and Animal Naming- Chi

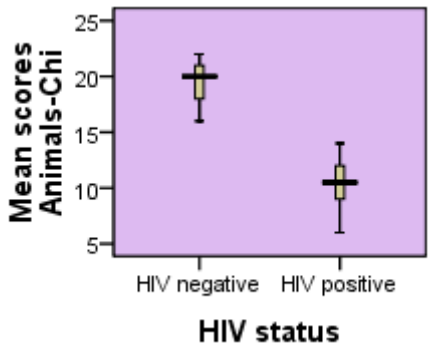


Fig. 10- HIV status and Action Naming Eng

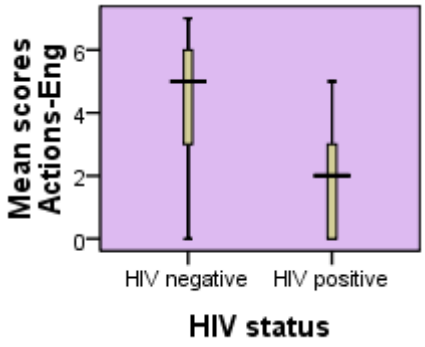
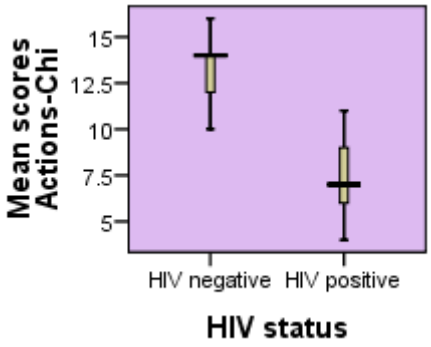


Fig. 11 - HIV status and Action Naming Chi



The results shown in the figures above indicate that HIV status had an effect on all the verbal tests of the Battery with HIV positive group performing poorer as hypothesised.

4.5 Theme 2: Linguistic medium and Neuropsychological Test Performance

This theme addressed the second research question. The question was 'What is the difference in mean scores between the English and Chichewa versions when individuals who are HIV negative and HIV positive are subjected to the three neuropsychological tests of the battery?' A Paired Samples t-test was conducted to determine the difference in mean scores between the English and the Chichewa versions. Firstly, Hopkins Verbal Learning Tests English and Chichewa versions for

immediate recall were paired up, followed by the Hopkins Verbal Learning Tests delayed recall in both versions. Animal naming English and Chichewa versions were also paired up. Lastly, action naming in both versions were also paired. Table10 below presents the mean scores and standard deviations of the two language versions.

Table 17: Mean difference between English and Chichewa Versions Paired-Sample t-test

Pairs	Test items	*Mean*	*SD*	*SD of difference*	*t*	*Sig (1 tailed)*
Pair 1	HVLTEng	11.52	3.649	3.110	-11.459	<.001
	HVLTChi	16.56	4.916			
Pair 2	HVLTdr Eng	4.08	1.998	1.496	-13.801	< .001
	HVLTdr Chi	7.00	2.571			
Pair 3	Animals Eng	4.82	2.521	3.676	-18.427	< .001
	Animals Chi	14.40	4.982			
Pair 4	Actions Eng	3.16	2.235	2.703	-17.789	< .001
	Actions Chi	9.96	3.434			

p < .05

A Paired Samples t-test analysis for each of the tests analysed as a function of Linguistic medium revealed a statistically significant difference in mean scores of all of the tests such that in all cases, the Chichewa version yielded higher mean scores than the English version: Hopkins Verbal Learning Test - English and Chichewa Version immediate recall (t = -11.459, p < .001); Hopkins Verbal Learning Test - delayed recall - English and Chichewa Versions (t = -13.801, p < .001); Animal naming English and Chichewa versions (t = -18.427, p < .001); Action naming English and Chichewa versions (t = -17.789, p < .001). The highest mean scores were observed in HVLT Chichewa version immediate recall (M = 16.56, SD = 4.916); Animal Naming Chichewa Version (M = 14.40, SD = 4.982); and Action Naming Chichewa version with (M = 9.96, SD = 3.434) in that order (See table 17 above).

4.6 Theme 3 Interactions among HIV status, linguistic medium and gender

4.6.1 Interactions among HIV status, linguistic medium and gender on the HVLT-English and Chichewa Versions– Immediate recall.

To check the assumption of homogeneity of variance the Levene's test for each of the repeated measures variables in the data editor was conducted. The results in the Levene's test indicated a non significant result showing that variances were homogeneous for all levels of the repeated measures variables.

i. **Tests of Subjects Effects: Hopkins verbal Learning Test-English and Chichewa versions: Immediate Recall**

Table 18 below shows that the main effect of gender on the Hopkins Verbal Learning Test for both English and Chichewa versions of the immediate recall was non-significant (F (1, 46) = .772, p =.384, with a small *effect size* of .016. However, there were highly significant main effects for linguistic medium and HIV status. Linguistic medium results were (F (1, 46) = 174.002, p = <.001, with a large effect size of .791 while HIV status results were (F (1, 46) = 99.388, p < .001, with a large *effect size* of .684. Results from the table indicate that the main effects of Linguistic medium and HIV status were large and highly significant.

Table 18: Tests of Subjects Effects: Hopkins verbal Learning Test-English and Chichewa versions: Immediate Recall

Source	***F***	***Sig***	***Eta*^{2}**
HIV status	(1, 46) = 99.388	**< .001**	.684
Lingmed	(1, 48) = 174.002	**< .001**	.791
Gender	(1, 46) = .772	.384	.016

*$p < .05$

ii: Tests of interaction effects: HVLT-English and Chichewa versions: Immediate recall

Table 19 below shows that in the three – way interaction, there was no significant interaction effect for the linguistic medium * HIV status * gender, (F (1, 46) = 1.506, p = .226), when Partial Eta was computed, it was found to be .032 and though this might have been due in part to low statistical power for detecting the interaction. Of the two-way interaction terms tested, (linguistic medium * gender interaction, linguistic medium * HIV status interaction and HIV status * gender), the linguistic medium*gender interaction was similarly not significant [(F (1, 46) = 2.367, p =.131. *effect size* = .049.. Equally, HIV status * gender interaction was found to be non significant (F (1, 46) = .797, p = .377, *effect size* = 0.17. However, Linguistic medium * HIV status interaction was found to be statistically significant (F (1, 46) = 16.750, p < .001). Partial Eta-squared for the interaction effect size was computed and was found to be .267, meaning that the linguistic medium * HIV status interaction explained approximately 27% of the variance in the dependent variable.

Table 19: Tests of interaction effects: HVLT-English and Chichewa versions: Immediate recall

Source	F	Sig	Eta^2
Hivstatus*gender	(1, 46) = .797	.377	.017
Lingmed*hivstatus	(1, 46) = 16.750	<.001	.267
Lingmed*gender	(1, 46) = 2.367	.131	.049
Lingmed*hivstatus*gender	(1, 46) = 1.506	.226	.032

p < .05

Figure 12: Interaction between HIV status and Linguistic medium: Hopkins Verbal Learning Test English and Chichewa Versions.

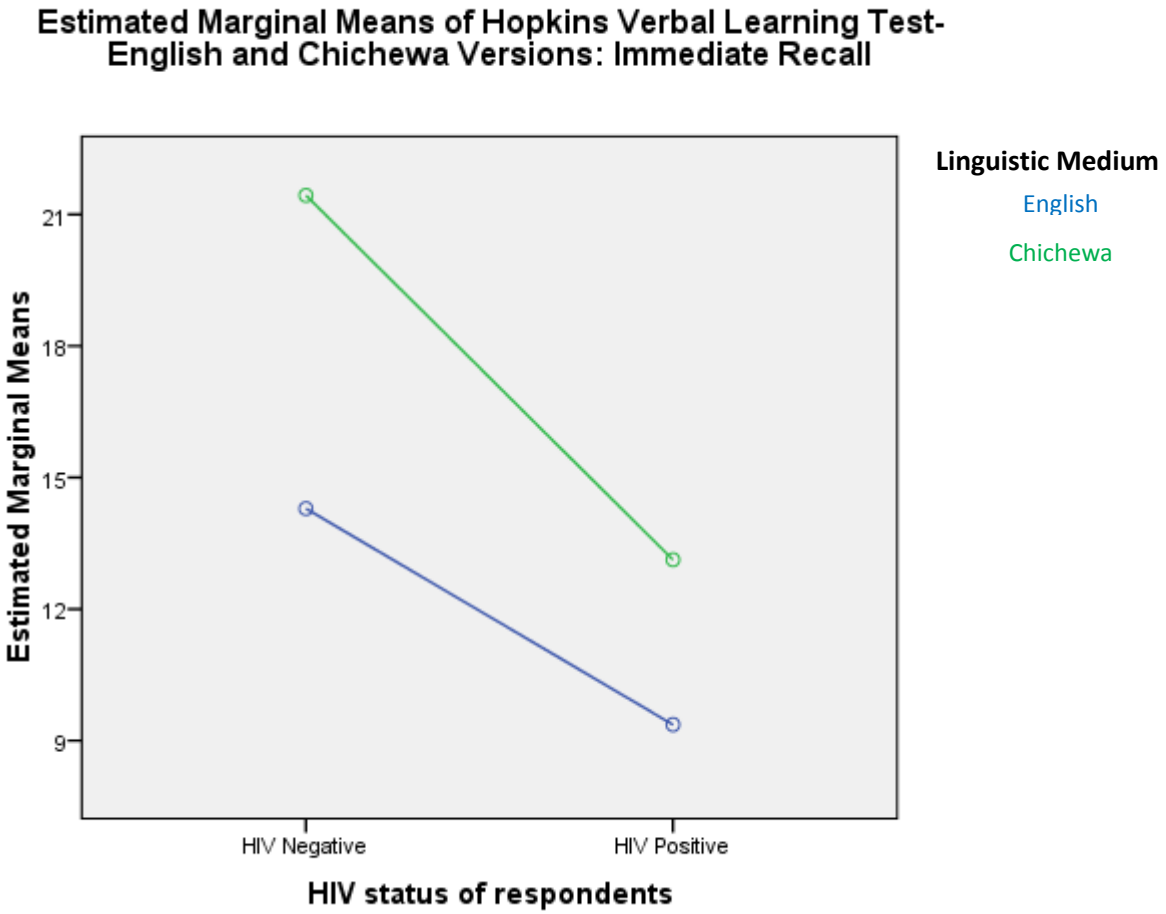


Figure 12 above reveals which version could be more effective in assessing patients with neuropsychological deficits.

This means that the HIV status has varying interactions with linguistic medium with HIV negative groups recording a wider gap in marginal means than their HIV positive counterparts on this test, who showed a narrow gap with a steeper gradient for the Chichewa version, indicating an effect of linguistic medium with a significant interaction of $p = < .001$ (see table 19 above for the p value). These results reveal that the Chichewa version can discriminate more sharply between HIV positive and negative groups than the English medium of testing.

4.6.2 Interactions among, HIV status, linguistic medium and gender on HVLT-English and Chichewa Versions– Delayed recall.

The assumption of homogeneity of variance was checked by the Levene's test for each of the repeated measures variables in the data editor. The test indicated a non significant result because all significance values were greater than alpha value of .05

i :Tests of Subjects Effects: HVLT: Delayed Recall

Table 20: Tests of Subjects Effects: HVLT- Delayed recall.

Source	***F***	***Sig***	***Eta*^{2}**
Hivstatus	(1, 46) = 110.351	<.001	.706
Lingmed	(1, 46) = 294.251	<.001	.865
Gender	(1, 46) = .125	.725	.003

p < .05

Table 20 above shows that the main effect of gender on the Hopkins Verbal Learning Test delayed recall was non-significant (F (1, 46) = .125, p = .725). When Partial Eta was computed for an effect size, it was found to be .003. On the other hand, there was a highly significant effect for HIV status (F (1, 46) = 110.351, p < .001, with an *effect size* of .706 while Linguistic medium was *(*F (1, 46) = 294.251, p < .001, with an effect size of .865. The table above shows that the effect sizes for both HIV status and linguistic medium were large and highly significant.

ii: Tests of interaction effects: Hopkins Verbal Learning Test-English and Chichewa versions: Delayed Recall.

Table 21: Tests of interaction effects: Hopkins Verbal Learning Test-English and Chichewa versions: Delayed Recall.

Source		*F*	*Sig*	*Eta*^{2}
Hivstatus*gender	1, 46) =	2.449	.124	.051
Lingmed*hivstatus	(1, 46) =	28.896	<.001	.386
Lingmed*gender	(1, 46) =	.363	.550	.008
Lingmed*hivstatus*gender	(1, 46) =	.000	.986	.000

p < .05

Table 21 above shows that, the three – way interaction, linguistic medium * HIV status * gender was found not to be statistically significant (F (1, 46) = .000, p = .986). *Partial Eta Squared* was found to be < .001. The two-way interaction terms tested, (linguistic medium * gender interaction, linguistic medium * HIV status interaction and HIV status * gender), HIV status * gender interaction was found to be non significant (F (1, 46) = 2.449, p = 124, and Partial Eta Squared for the *effect size* was found to be 51%. The linguistic medium *gender interaction was equally not significant (F (1, 46) = .363, p =.550). Its *Partial Eta Squared* value was .008. However, the linguistic medium * HIV status was found to be statistically significant (F (1, 46) = 28.896, p < .001) and when the *Partial Eta squared* was computed for the effect size, it was found to be .386.

Figure 13- Interaction between HIV status and Linguistic medium: Hopkins Verbal Learning Test-English and Chichewa Versions: Delayed Recall

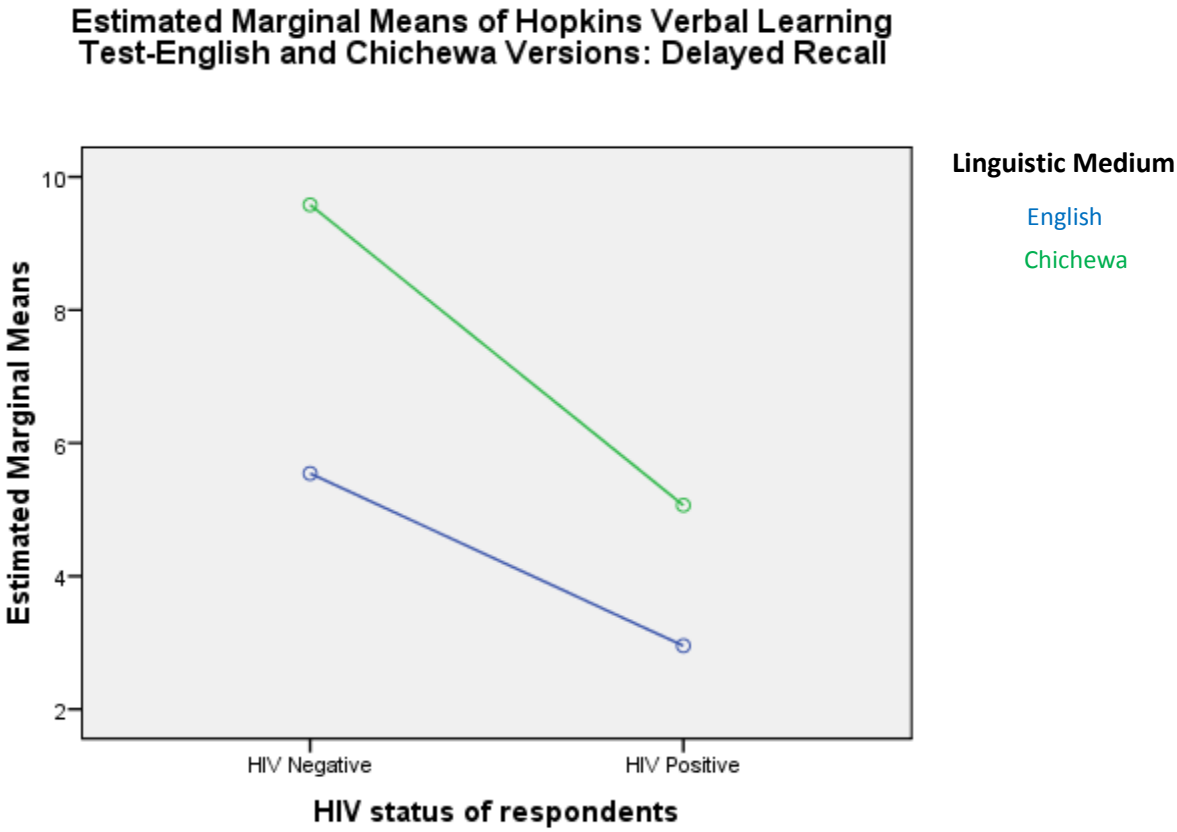


Figure 13 above indicates the simple main effect of linguistic medium. To determine which type of the version could be more effective in assessing patients with neuropsychological deficits, the two language versions were compared.

This means that the HIV status has varying interactions with linguistic medium with HIV negative groups recording a wider gap in marginal means (*Mc = 9.58 > Me* = 5.54 >, *d'* = .4.04), than their HIV positive counterparts on this test who showed a narrow gap with a steeper gradient for the Chichewa version (*Mc* 5.06 > 2.95, *d'* = 2.11). In the figure this interaction effect shows up as a difference in the gradient of the two lines, indicating a shallow gradient for the blue line of the English version, revealing that this version can not discriminate as sharply between HIV positive and negative groups as the Chichewa version.

4. 6. 3 Interactions among HIV status, linguistic medium and gender: Animal naming Tests - English and Chichewa

The homogeneity assumption of variance for each of the repeated measures variables in the data editor was conducted by using the Levene's test. The results were all showing non-significant for all levels of the repeated measures variables. All significance values were greater than .05.

i. Tests of Subjects Effects: Animals-English and Chichewa versions

Table 22: Tests of Subjects Effects: Animals-English and Chichewa versions

Source	*F*	*Sig*	Eta^2
Hivstatus	(1, 46) = 123.209	<.001	.706
Lingmed	(1, 46) = 977.958	<.001	.955
Gender	(1, 46) = 1.68	.200	.035

p < .05

The results in table 22 above indicate that gender did not have any significant effect on the performance (F (1, 46) = 1.688, p = .200) with Partial Eta Squared of .035. Results revealed that there was a highly significant effect of linguistic medium [(F (1, 46) = 977.958, p < .001); *Partial Eta Squared* = .955. In addition, there was a statistically significant effect for HIV status (F (1, 46) = 123.209, p < .001) with the effect size shown as Partial Eta Squared .728 (73%).

i. Tests of Interaction Effects: Animal Naming Test – English and Chichewa versions.

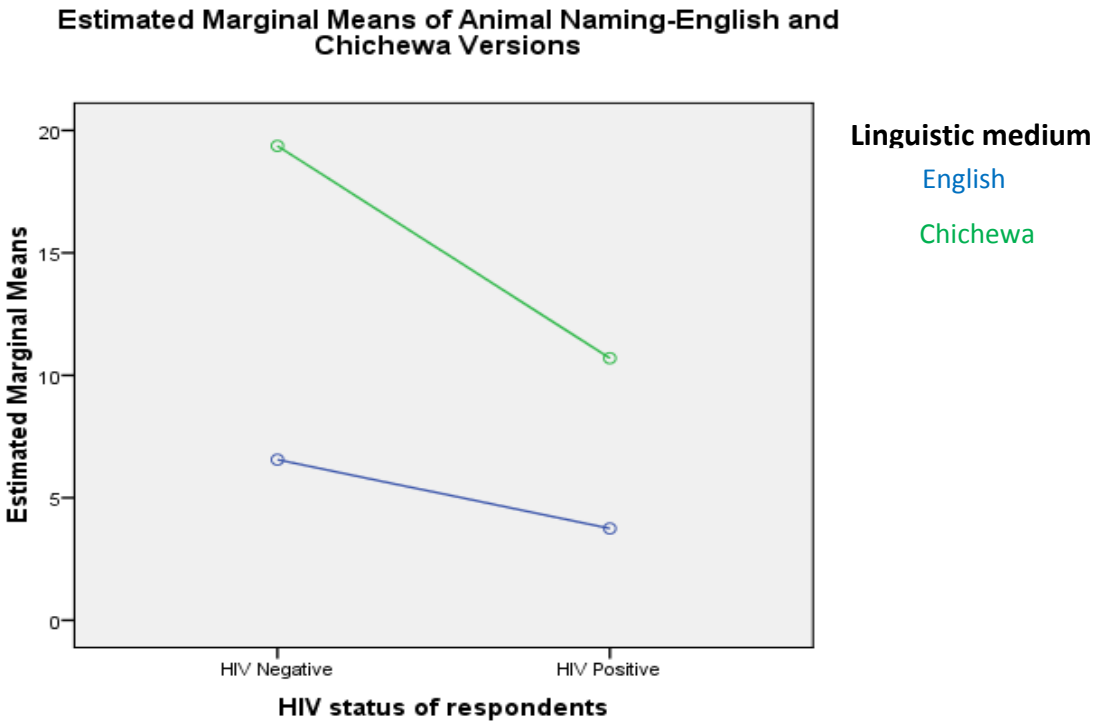
Table 23: Tests of within – Subjects Effects: Animals.

Source	*F*	*Sig*	*Eta*^{2}
Hivstatus*gender	(1, 46) = 2.905	.095	.059
Lingmed*hivstatus	(1, 46) = 85.988	<.001	.651
Lingmed*gender	(1, 46) = .330	.568	.007
Lingmed*hivstatus*gender	**(**1, 46) = 1.174	.284	.025

p<.05

Table 23 above indicate that the three – way interaction effect of linguistic medium * HIV status * gender was not statistically significant (F (1, 46) = 1.174, p = .284, effect size = .186). The two way simple main effects interactions for HIV status * gender and linguistic medium * gender were found not significant. The results for HIV status * gender were found not statistically significant (F (1, 46) = 2.905, p = .095, with a small *effect size* of .059. Linguistic medium * gender was equally found to be non significant (F (1, 46) = .330, p = .568, with a very small *effect size* of .007. However, the interaction between linguistic medium * HIV status was found to be statistically significant (F (1, 46) = 85.788, p < .001). When the *Partial Eta Squared* was computed, the *effect size* was found to be large (.651).

Figure 14: Interaction between HIV status and Linguistic Medium on Animal naming- English and Chichewa Versions



The main effect of linguistic medium was examined by comparing the mean scores for both versions as presented in Figure 14 above.

Averaging the means for the Chichewa version at HIV negative and HIV positive levels we would say that the mean score for the Chichewa version (*Mc* = 15.04), was higher than when we averaged the mean scores for English version at the HIV negative and HIV positive conditions (*Me* = 5.16), indicating the main effect of linguistic medium on animal naming with effect size (Eta^2 = .955, p < .001). The difference in mean scores between the Chichewa version and the English version within the HIV negative level was (*Mneg* = 19.37 > *Mneg* = 6.56 >, *d'* = .13.81) greater than the difference between the two versions at the HIV positive level (*Mpos* 10.70 > *Mpos* 3.75, *d'* = 6.95). The main effect of HIV status was determined by the difference between the scores of the HIV negative respondents which were higher in the two versions than of the infected group. However, the mean difference is greater

in the HIV negative group than the HIV positive group, which is why there is a statistically significant difference in means between the two versions ($p < .001$).

This means that the HIV status has varying interactions with linguistic medium with HIV negative groups recording a wider gap in marginal means than their HIV positive counterparts on this test, who also showed a wide gap. In the figure this significant interaction effect has resulted into a steeper slope of the green line for the Chichewa version, showing that this version can discriminate more sharply between HIV positive and negative groups than the English version.

4.6. 4 Interactions among HIV status, linguistic medium and gender: **Action Naming Tests – English and Chichewa versions**

Each of the repeated measures variables were tested for homogeneity assumption of variance by conducting the Levene's test. Results revealed that all levels of the repeated measures variables were not statistically significant because all significance values were greater than .05.

i. Tests of Subjects Effects: Action naming Tests- English and Chichewa versions

Table 24: Tests of Subjects Effects: Action naming Tests- English and Chichewa versions

Source	***F***	***Sig***	***Eta²***
Hivstatus	(1, 46) = 72.607	<.001	.612
Lingmed	(1, 46) = 448.654	<.001	907
Gender	(1, 46) = .349	.557	.008

p < .05

It is observed from table 24 above that gender had no main effect (F (1, 46) = .349, p = .557, with a small *effect size* of .008). But there was a main effect for linguistic medium (F (1, 46) = 448.654, $p < .001$) with a very large effect size of .907 (91%). Furthermore, there was a statistically significant effect of HIV status (F (1, 46) = 72.607, $p < .001$) with a large *effect size* of .612 (61%). These results indicate that

both linguistic medium and HIV status had highly significant effects on the test performance of Animal Naming.

ii. Tests of Interaction Effects: Action naming Tests – English and Chichewa versions

Table 25: Tests of Interaction Effects: Action naming Tests – English and Chichewa versions

Source	*F*	*Sig*	*Eta*^{2}
Hivstatus*gender	(1, 46) = 6.807	.012	.129
Lingmed*hivstatus	(1, 46) = 30.613	<.001	.400
Lingmed*gender	(1, 46) = .915	.344	.020
Lingmed*hivstatus*gender	(1, 46) = 1.060	.308	.023

p<.05

It is observed from table 25 above that the three - way interaction effects of linguistic medium * HIV status * gender was not statistically significant (F (1, 46) = .1.060, p = .308). Its simple main effect at *Partial Eta Squared* was found to be 2% When linguistic medium * gender interaction was computed, it was found not to be statistically significant (F (1, 46) = .915, p =.344) with a very small effect size of .02 (2%). The interaction between HIV status * gender was equally not significant (F (1, 46) = 6.807, p =.012 with a small *effect size* of .129 (13%). However, the interaction between linguistic medium * HIV status was found to be statistically significant (F (1, 46) = 30.615, p < .001). The computed *Partial Eta Squared* for the effect size was found to be .400 (40%).

Figure 15 - Interaction between HIV status and Gender on Action Naming-English and Chichewa Versions

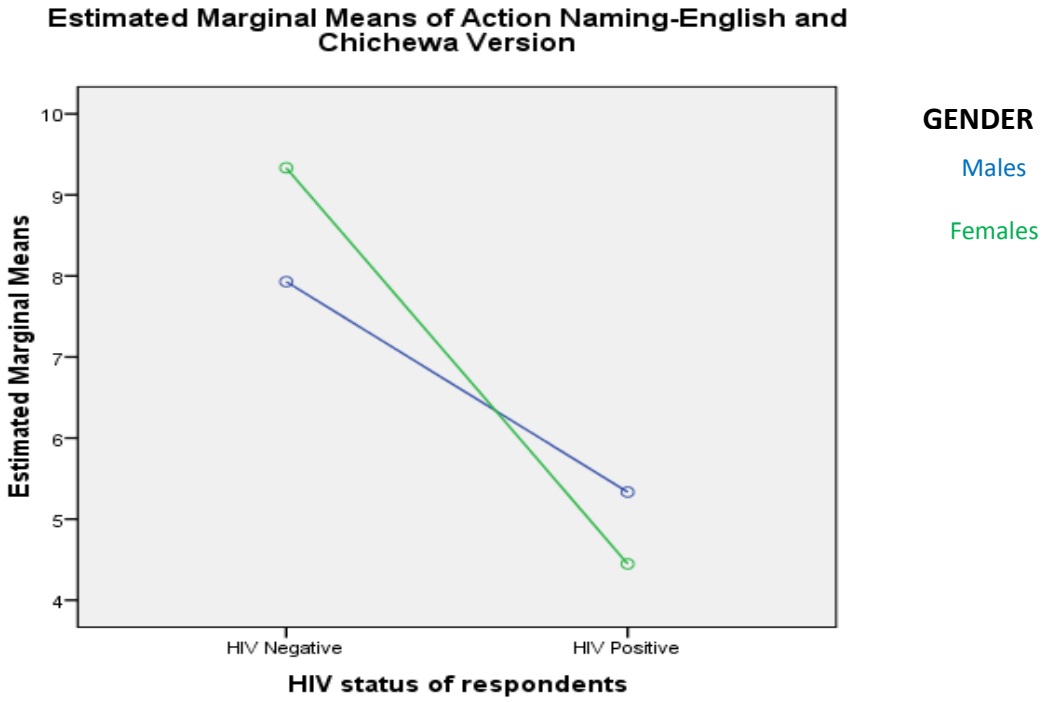


Figure 15 above shows a disordinal interaction effect, we can see that the mean scores for HIV negative females were higher than the HIV positive females (*Mfneg* = 9.33 > *Mfpos* = 4.45, *d'* = 4.88). The mean scores for HIV negative males were also seen to be higher than the mean scores for the HIV positive males (*Mmneg* = 7.93, *Mmpos* = 5.33, *d'* = 2.60). Also the average for the HIV negative score (*Mneg* = 8.63) was higher than the average score for HIV infected respondents (*Mpos* = 4.89).This reveals the main effect of HIV status on the Action Naming Test (Eta^2 = .612, p < .001)

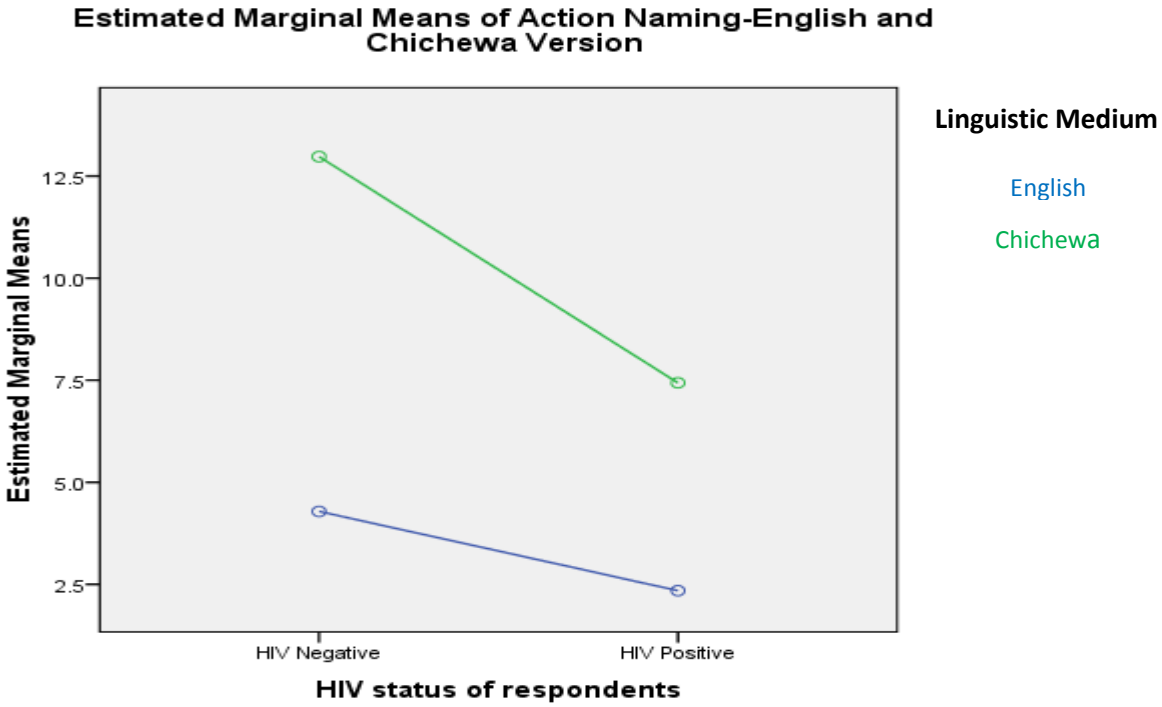
The scores for HIV negative females were higher than the scores for the HIV negative males (*Mfneg* = 9.33 >*Mmneg* = 7.93, *d'* = 1.40) while the HIV infected males had higher scores than the HIV infected female participants (*Mmpos* = 5.33 > *Mfpos* = 4.45, *d'* = 0.88). However, the average score for female participants was lower than the average score for the male participants (*Mf* = 6.89 >*Mm* = 6.63, *d'* = 0.26). The mean difference between HIV negative males and females is greater than the mean difference between HIV positive males and females,

In the Figure above, it shows that the HIV status has a varying interaction effect with gender, where the HIV negative groups have recorded a wide gap in marginal means (*Mfneg* = 9.33 > *Mmneg* = 7.93, *d'* = .40), HIV negative females performed better than their male counterparts on this test, whereas the reverse was true of the two HIV positive groups (*Mmpos* = 5.33 > *Mfpos* = 4.45, *d*' = .88), showing a narrow gap with a steeper slope for the females. The differences of the marginal means in the two instances, were statistically significant, which is why we have a statistically significant interaction of $p = .012$ (See table 21 above for the p value). We can say that there was a difference in performance between males and females on only the Action Naming Test.

Interactions among HIV status, linguistic medium and gender: Action Naming Tests-English and Chichewa Version.

Figure 16 below indicates that when the participants were tested in the Chichewa version irrespective of gender, their mean scores were higher than when they were tested in the English version. Due to the effect of HIV status, the mean scores for the Chichewa version of the HIV negative participants were much higher than for the HIV positive participants (*Mneg* = 12.98 >*Mpos* = 7.44, *d'* = 5.44). The English version results still indicated that the HIV negative group scored higher means than the HIV positive participants (*Mpos* = 4.29 >*Mpos* = 2.35, *d'* = 1.94).

Figure 16: Interaction between HIV status and Linguistic Medium on Action Naming Tests –English and Chichewa Versions



Averaging the means for the Chichewa version of the HIV negative and HIV positive levels, we would say that the mean score (*Mneg*= 10.21) is higher than when we average the mean scores for English version of the HIV negative and HIV positive conditions (*Mpos*= 3.32), showing the main effect of linguistic medium on the Action Naming Test with a large effect size (Eta^2 = .907, $p < .001$). The difference in mean scores between the Chichewa version and the English version within the HIV negative participants was (*Mcneg* = 12.98 > *Meneg* = 4.29, *d'* = 8.69) greater than the difference between the HIV positive respondents (*Mcpos* = 7.44 > *Mepos* = 2.35, *d'* = 5.09. resulting into HIV status having varying interactions with linguistic medium, with HIV negative groups recording a greater gap in marginal means than their HIV positive counterparts on this test. This significant interaction effect has resulted into a shallow gradient for the blue line of the English version, concluding that this version can not discriminate as sharply between HIV positive and negative groups as the Chichewa version.

CHAPTER FIVE: DISCUSSION OF FINDINGS

5.0 Introduction

This chapter discusses the findings presented in chapter four. The findings are organised on the basis of themes and research questions in order that the research outputs are thematically shown in relation to the problem the study had from the onset. The researcher begins first by presenting the meaning of the study before answers to the research questions.

5.1 The Meaning of the Study

A potentially important finding in the present study is after translation into Chichewa from English, this translated set of the neuro-cognitive battery detected cognitive dysfunction in HIV-infected respondents in the Eastern Province of Zambia. The meaning of this study outcome is that the earlier view held by Ardila et al (1995) arguing that the neurocognitive tool can only be used on literate respondents does not stand. There are other tests within the battery that probably are usable among participants who are considered to be 'illiterate' in a second language as long as there is translation of the tests with equivalence into what one could call a native language. The Chichewa version has established similar outcomes as the English version but has shown greater sensitivity than the English version. The findings further state that when neurocognitive tools are used in a native language, they are likely to yield more valid results as a reflection of actual abilities being assessed than a second language.

5.2 Sequencing and counterbalancing of Test administration

Due to an oversight, the counterbalancing of sequence in which the two language versions were administered was not systematically planned. However, a post hoc analysis revealed that roughly half of all participants received the two languages in each sequence. Thus, all effects of language can be considered independent of the sequence.

5.3 The answers to the research questions

It is paramount that at the end of an inquiry, answers to research questions or those using objectives, phenomena related to them are shown (Yin, 2008 ; Creswell, 2009).

The author has in this study opted to use the research questions model. The grounds are that research questions are the essence of most research conducted and act as the guiding plan for the investigation (Mertler and Vannatta, 2001; Creswell, 2009). In general, research questions are "specific questions that researchers seek to answer" (Creswell, 2005: 117). According to Maxwell (2005:69), "research questions state what you want to learn."

5.4 HIV status and Neuropsychological Test Performance

Regarding research question number one: What is the difference in performance between HIV negative and HIV positive individuals when subjected to the four verbal tests of the neuropsychological test battery using the English and Chichewa versions? HIV positive respondents scored significantly lower than HIV negative respondents in this sample of rural, low-literacy adults on all the Neuropsychological tests administered (See tables 9 and 10).

The extent, to which HIV status was a factor on the neuropsychological test performance on the four selected tests of the battery, was determined by performing an analysis of variance (ANOVA). The proportion of variance accounted for by HIV status was consistently higher on the Chichewa versions of the tests than on the English versions. These effect sizes were quite large and highly significant. The largest effect sizes were observed, on the Hopkins Verbal Learning Test Chichewa version followed by category (animal) Fluency Chichewa version, Action (verb) Fluency Chichewa version and Hopkins Verbal Learning Test Revised Chichewa version delayed recall. The results in our present study revealed that when we use the English and Chichewa versions irrespective of the HIV status, the mean scores for HIV negative respondents were consistently higher (See figures 4-11).

The results from the present study are similar to those reported in a recent pilot study that was conducted in Zambia by Hestad et al. (2012) on literate adults using only an English version. Their results indicated that the Zambian HIV-infected group had worse neuropsychological performance than the matched seronegative group, with an overall effect size that was medium to large. In the present study, though conducted in a rural area, HIV-positive participants performed poorly on the tests with small effect

sizes observed in Action Naming - English and Chichewa versions, Hopkins Verbal Learning Tests both immediate and delayed recall. Animal naming English version also had a small effect size. The results of our rural- low literate participants were also similar to those reported in Uganda by Robertson et al. (2007b) in which a study evaluating the neuropsychological test performance in a sample of HIV positive patients and HIV negative control participants revealed significant group differences on measures of verbal learning and memory tests.

The results in our present study could be seen that HIV-positive individuals had higher mean scores on the Beck Depression Scale, indicating more affective disturbances among HIV-positive people than in the HIV negative group. Despite the non validation of the Beck Depression Inventory in Zambia, it appeared to have worked well in our participants. Depression (in general, even without HIV) can also be related to immunological change (Hestad et al., 2009).

Given the study outcomes, and especially that our participants were not on antiretroviral therapy, we can say that low performance on the tests was as a result of the HIV infection. The results from the main core study which have been documented elsewhere revealed similar results. However, participants from the core study included those on ART which could have influenced the performance on the tests. Therefore, further studies that could exclude those on ART are needed.

Although our sample size was smaller and that gender distribution was not equal, than other studies done elsewhere, our study results are in consistence with a study that was conducted by Gupta et al. (2007) where they compared a sample of 119 adults in India infected with HIV-1 subtype C who were not on antiretroviral therapy, with normative data derived from an Indian sample of 540 healthy volunteers and with a matched cohort of 126 healthy, HIV-1-seronegative individuals. They found a high rate of mild to moderate cognitive deficits in the HIV patients but no evidence of true dementia. The results indicated that the neuropsychological profile was characterized by deficits in fluency, working memory, and learning and memory, once again similar to patterns that have been observed in the West. Furthermore, the findings by (Adelina et al., 2011) from the study conducted in Zambia revealed that HIV-positive

participants not on antiretroviral therapy had evidence of cognitive impairments compared with none among HIV-negative participants.

Similar results have also been reported in a pilot study from Botswana, in which 38% of the HIV-infected individuals revealed HIV Associated Neuropsychological Disorders. The difference in these studies could be cross cultural. The other difference arises because this study employed selected components of the Battery that was used in Zambia.

Although a study in South Africa by Joska (2010) noted that other factors such as age, gender and alcohol abuse, were associated with poor neuropsychological performance, our study results revealed that these factors did not have any effect on the neuropsychological performance.

5.5 Linguistic medium and neuropsychological test performance

Considering research question number two: What is the difference in mean scores between the English and Chichewa versions when individuals who are HIV negative and HIV positive are subjected to the four verbal tests of the neuropsychological test of the battery? The results of the mean Scores on the English medium version were consistently lower than scores on the familiar language (Chichewa version) across all tests and all groups of respondents in this sample of rural, low-literacy adults (see table 15).

For each of the tests a paired Samples t-test revealed a statistically significant difference between the two linguistic mediums, with participants scoring higher on the test when it was administered in their most familiar language (Chichewa) than when the same test was administered in the less familiar English language. The highest mean scores were observed in the Hopkins Verbal Learning Test - Chichewa version: immediate recall, Animal Naming Chichewa version also yielded higher means with most participants falling within more than four Standard Deviations above the mean. The mean scores for Action Naming Chichewa version were equally higher. Generally, we can say that all mean scores for the Chichewa version tests were significantly higher than the English version.

In our study, Animal Naming Test was a task where retrieval processing at a semantic level was required. Participants were asked to name as many animals as they could in 60 seconds. The number of correct responses was then calculated (Benton et al., 1994). Action fluency (Piatt et al., 1999) was another measure in which participants were asked retrieval processing to on a semantic level. Participants were expected to rapidly generate as many verbs (i.e., ‘‘things that people do’’) as possible in 60 s. They were to generate only single verbs (e.g., eat) and avoid repeating verbs that were generated earlier with a different ending (e.g eating, eaten). The number of correct responses was calculated. The Hopkins Verbal Learning Test is a test in which the tester reads a list of twelve items and the participant is asked to mention those items in any order followed by a delay after 25 minutes.

An examination of the two languages' effect on tests of the four verbal tests revealed a significant effect of linguistic medium on all of the tests administered with the Chichewa version yielding higher mean scores than the English version, with the highest differences observed in the Animal Naming Test; followed by Action Naming Test and the Hopkins Verbal Learning Test in that order. These findings have revealed that an individual is able to recall, name and learn things better in a familiar language than in unfamiliar language, an indication that more often than not, the neuropsychological deficits can be well identified by using the primary language of participants than in unfamiliar medium of testing.

5.6 Interactions among HIV status, Linguistic Medium and Gender on the Neuropsychological Test Performance

Relating to research question number four: What interaction if any occurs between the effects of HIV status, linguistic medium and gender on the performance of the four neuropsychological tests? The effects of HIV status and linguistic medium effect on neuropsychological test performance showed a significant interaction, with the difference between HIV positive and HIV negative groups being larger with the Chichewa version, indicating that this version can discriminate more sharply between HIV positive and negative individuals than the English version. There was no statistically significant interaction between the effects of linguistic medium and

gender, or between the effects of HIV status and gender in performance on any of the tests.

There were significant interaction effects in the study worth discussing. In the statistical analysis of scores on each of the four neuropsychological tests (Hopkins Verbal Learning Test- immediate and delayed recall, Animal Naming and Action Naming), the interactions among three independent variables were examined: HIV status, gender and linguistic medium.

When we examined the two-way interactions revealed in these factorial analyses of variance, we found that the effects of gender were for the most part orthogonal to those of HIV status and of linguistic medium (with no significant interaction between the pairs of independent variables), and the effects of linguistic medium were for the most part not orthogonal to those of HIV status. In all cases a significant two-way interaction was found between the effect of HIV status on test score and the effect of linguistic medium, with the gap between the scores of HIV positive and HIV negative participants being larger when the test was administered in Chichewa than when it was administered in English with Animal Naming recording a large effect size. The absence of significant interactions between gender and linguistic medium supports the interpretation that, in this sample of participants, HIV status affected neurocognitive performance negatively to a comparable degree for males and females, and that the beneficial effect of testing in the familiar language Chichewa was equally powerful for males and for females.

The means for the Chichewa version for the HIV negative group were much higher than at the HIV positive level. When the respondents were tested in the English version, still the HIV negative group obtained higher mean scores than the HIV positive participants. Averaging the means for Chichewa version at HIV negative and HIV positive levels, results revealed that the mean score for the Chichewa version was higher than when we averaged the mean scores for English version at the HIV negative and HIV positive conditions The difference in means between the Chichewa version and the English version within the HIV negative level was greater than the

difference between the two versions at the HIV positive level (See figures 12, 13 14 and 16).

This means that the HIV status has varying interactions with linguistic medium with HIV negative groups recording a wider gap in marginal means than their HIV positive counterparts on these tests resulting into a, narrow gap with a steeper gradient for the Chichewa version, indicating an effect of linguistic medium. These results revealed that the Chichewa version can discriminate more sharply between HIV positive and negative groups than the English medium of testing.

Despite the significant differences found between the seronegative and seropositive samples, there is no greater gap between genders in the group of participants infected with HIV virus. This leads us not to consider the possibility that gender along with all of the life circumstances that accompany it may be a factor which negatively affects vulnerability of neurocognitive functioning to HIV infection. Our current study is not in agreement with the partial confirmation of what Satz et al. in Pereda et al. (2000) claimed regarding a greater vulnerability to neuropsychological disorders in seropositive women than in seropositive men. The differences could be cross cultural and based on the tools used.

Although language impairments were not the primary focus of this study and particularly expressive language difficulties have been known to exhibit prominent cognitive disorders of HIV infected individuals (Wolters et al. 1997), it has long been held that HIV-infected adults demonstrate broadly unremarkable speech and language functioning. During the administration of the tool, the study exhibited remarkable auditory comprehension problems, speech and language dysfunctions in a few cases and mild difficulties in the more complex aspects of expression. This problem had gone unnoticed as our tool did not have any screening instrument for such problems. Drawing from this qualitative observation, it can be hypothesised that some of the cases could be linked to a CNS opportunistic infection, for example, the progressive multifocal leucoencephalopathy which produces a perisylvian lesion in the brain (see Woods et al., 2009).

Despite these difficulties, the researcher observed that indeed, verbal fluency impairment and auditory dysfunction could be the most frequently identified deficits in HIV infection. Unlike Rippeth et al. (2004) who estimated the prevalence of Verbal fluency deficits to occur in approximately 40% of the population, this study did not make any attempt to estimate the prevalence.

Though the study did not bring out the qualitative experience in language use characteristics, like the difficulties people with HIV encountered, the researcher has not found any large-scale studies examining the basic problems of speech and language in HIV infection and as such, readers ought to be cautious when drawing conclusions from these few cases. Despite a relative paucity of empirical evidence (see Reger et al. 2002; Henry and Crawford 2004; McCabe et al. 2007), the limited qualitative observations that were made indicate that testing patients should not only focus on the quantitative domains but qualitative domains as well.

Although Manly et.al. (1998) reported that the overall effect of literacy status remained significant after restricting the analyses to elders with no formal education, and even after controlling for the effects of language of test administration; our study did not replicate this effect. In the animal naming task, the participants were able to name as many different animals as possible in one minute that one new from their homes and the bush. They were also able to name things that people do every day in one minute. Can. Compared with several other criteria used in animals and action naming (Reis & Castro-Caldas, 1997; Ostrosky-Solís et al., 1998; Ostrosky-Solís et al., 1999), in our case, this appears to more properly reflect a shared cultural background because both literate and illiterate, populations do have a significant knowledge of animals (such as dogs, cats, lions) and actions that people do most of the time (for example, cook, drink, learn and fight). Based on this, we predicted that there would be a significant effect of linguistic medium especially a familiar language of testing, which was confirmed in that there were significant differences between the English and Chichewa version in naming of animals and actions.

To emphasise further our findings, differ from Ardila et al. (1989) that schooling has an effect on memory and language abilities. Their claims that without a careful

consideration of the educational variables, neuropsychology runs the risk of finding brain pathology where there are only educational differences. The claim that we draw from our present study is that illiterate people also have, in addition to basic localised literacy, the knowledge, acquired cognitive skills and strategies for efficient processing of information. This is in line with Lecours et al. (1987a, 1987b) who reported that "Writing has just some five to six thousand year history, and obviously pre-historical man was illiterate. Cultural knowledge and cognitive abilities mediated through written language represent a recent historical acquisition. The analysis of illiteracy can significantly increase the understanding about brain organization of cognition under normal and abnormal conditions".

5.7- Significance and Limitations of the study

There were limitations in this study and notable significant findings. To begin with, the researcher discusses the significance of the study.

5.7.1 Significance of the study

This study provides methodologically stringent evidence for translating the non-literate components of the neurocognitive battery and an update in Africa other than the Kanmogne Cameroonian study (2010) on the translation from an original language of the tool to a primary language of the respondents. This study other than the Kanmogne study is the first to the author's knowledge to have compared neurocognitive performance in two languages by describing the nature, extent, and analysis of performance of cognitive neuropsychology of HIV Associated Neurocognitive Disorders in the same people and proposes what could be considered as a culturally appropriate Zambia neuropsychological test battery in an indigenous language.

Although numerous review articles and meta-analyses have been published on the neurocognitive aspects of HIV (e.g., Grant and Atkinson, 1999 ; Reger et al. 2002; Grant et al., 2005), a unique aspect of this study is the focus on the cognitive neuropsychology of HIV Associated Neuropsychological Disorders based on the use of two linguistic mediums. By cognitive neuropsychology, we mean the use of

theoretical models from cognitive psychology and the cognitive neurosciences to test hypotheses related to performance.

This study has argued against the notion that the neurocognitive tool can only be used on literate respondents. Several studies that have been done to test HIV infected adults by using the Western standardized test batteries have excluded rural adults with less than five years of education. The study has generated a tool that is usable among participants who are considered to be 'illiterate' in a second language as long as there is translation of the tool with equivalence. This finding is important, since it shows that, in this low-education, rural sample of elderly respondents, and the underlying condition of HIV status could be more reliably detected using the Chichewa version of the test than using the English version.

5.7.2 Limitations of the study

The limitations of this study are related to the use of only 4 (2 fluency and 2 memory) measures of the battery. The four measures are rather brief. The standard battery incorporates more tests than the Chichewa version that we used. The use of the standard battery could have demonstrated even greater power to detect differences between our two study groups compared to the four testing modalities applied in this study, which focused on the four cognitive tests. However, there are other studies like Tross et al. (1988) and Van et al., (1989) that have employed fewer domains and have been found to be sensitive in detecting HIV-related neurocognitive changes. The Chichewa version however has no measures of reliability and therefore the results could be considered with some scepticism. While this may be the case, the tool has validity in the sense that it used a qualitative counterpart - dynamic equivalence in ensuring reliability. Dynamic equivalence reproduced "in the receptor language the closest natural equivalence of the source-language message.."(Nida and Taber, 1969: 12)

In addition, the results should be considered to be valid because not all relevant domains of functioning are characterized and could be used on the selected study sample since they did not require one to be literate (able to read and write). The researcher is suggesting future longitudinal studies that could extend these results on the full battery. The sample was restricted to respondents fluent in the Chichewa

medium and as such the study cannot be generalisable to non Chichewa speakers, this is because the research design was limited to one geographical region. Furthermore, the English language usage in their daily lives was not assessed. This made it difficulty for us to know how bilingual these respondents were.

5.8 Recommendations

Given these findings, this study recommends the use of the Hopkins Verbal Learning Test Revised Animal and Action Fluency from the Phonemic Fluency Test as selected parts of the main Neuropsychological Test Battery to be used as a tool with the intention of generating an extra-brief tool to assist HIV practitioners in referring HIV-positive persons at risk for impairment. This brief tool may be convenient to use as it takes only about one hour to be administered. The researcher believes that this study may provide a preliminary but robust solution to screening for neurocognitive disorders among low-literacy people who may be living with HIV.

The study recommends that future studies involve the development of tools in other Zambian languages and further a qualitative study to bring out lived experiences in the language and speech problems that people living with HIV have.

5.9 Conclusions

Nida's dynamic equivalence theory has contributed a remarkable insight into translating the neurocognitive tool and has helped to create an atmosphere of treating different languages and cultures from an entirely new perspective. Through seeking dynamic equivalence, the study has shown that the primary language is best suited to test neurocognitive performance and especially when one is using test components that do not require reading or writing. The study has shown what was unknown empirically in this part of the world on the basis of language use about HIV-associated neurocognitive functional disorders that remain highly prevalent and continue to represent a significant public health problem (Woods et al., 2009). This study calls, beyond the findings, for consideration by the project to treat people who are HIV positive and have HIV-associated neurocognitive disorders. This is because advances in the treatment of the human immunodeficiency virus (HIV) have dramatically improved survival rates over the past 13 years (Woods et al., 2009).

REFERENCES

Adelina, H., Mwanza, B., Elizabeth, J., Willen, C., Malama, K. O., Chiyenu, Mudenda, V. C., Wood, C (2011) HIV-1 effects on neuropsychological performance in a resource-limited country, Zambia. *AIDS and Behaviour*: *10.1007/s* 10461-011-9988-9

Akani, M., Serpell, R and Banda, M (2010) Cultural Influence on Neuropsychological Testing in Zambia: University Press, Lusaka, Zambia

Alirezaei, M., Watry, D.D., Flynn C.F., Kiosses, W.B., Masliah, E., Williams, B.R., Kaul, M., Lipton, S.A., Fox, H.S. (2007). Human immunodeficiency virus-1/surface glycoprotein 120 induces apoptosis through RNA-activated protein kinase signaling in neurons. *Journal of Neurosciences; 27(41):*11047-11055.

Anderson, N.H. (2001) Empirical Direction in Design and Analysis. Mahwah, NJ: Lawrence Erlbaum Associates

Antinori, A., Arendt, G., Becker, J.T., Brew, B.J., Byrd, D.A., Cherner, M., Clifford, D.B., Cinque, P., Epstein, L.G., Good, K., et al. (2007). Updated research nosology for HIV-associated neurocognitive disorders**.** *Neurology 69(18):*1789-1799.

Ardila, A. (1995). Directions of research in cross-cultural neuropsychology. *Journal of Clinical and Experimental Neuropsychology*, *17*, 143–150.

Ardila, A., Rosselli, M., & Rosas, P. (1989). Neuropsychological assessment in illiterates: Visuospatial and memory abilities. *Brain and Cognition, 11,* 147–166.

Arruda, J. E., Stern, R. A., Somerville, J. A., Cohen, R., Stein, M., and Martin, E. M. (1997). Neurobiohavioral functioning in asymptomatic HIV-1 infected individuals. *Journal of the International Neuropsychological Society, vol. 3, article 14,*160-181

Beck AT, Steer, R.A., Brown, G.K. (1996). *Beck Depression Inventory* (2nd ed). San Antonio, TX: Pearson psych Corp.

Benedict, R.H. (1977). *Brief Visuospatial Memory Test-Revised:* Psychological Assessment; Resources Inc Lutz FL.

Benedict, R.H., and Brandt, J. (2001). *Hopkins Verbal Learning Test-Revised, Professional manual:* Psychological Assessment Resources Inc Lutz FL

Benton, A. L. (1994). *Test de Retención Visual de Benton,* TEA, Madrid.

Berger, J.R., Avison, M.J. (2004). The Blood Brain Barrier in HIV Infection. *Frontiers in Bioscience 9:* 2680–2685, doi:10.2741/1427, PMID 15358591

Bialystok, E., Craik, F.I.M., & Luk, G. (2008). Lexical access in bilinguals: Effects of vocabulary size and executive control. *Journal of Neurolinguistics, 21(6),* 522–538. doi:Doi 10.1016/ J.Jneuroling.2007.07.001.

Bialystok, E., Craik, F.I.M., Green, D.W., & Gollan, T.H. (2009). Bilingual minds. *Psychological Science in the Public Interest, 10(3),* 89–129.

CDC: Guidelines for national HIV case surveillance including monitoring for HIV infection and AIDS**.** *MMWR* 1999, 48(RR-13):1-27.

Clifford, D. B., Mitike, M.T., Mekonnen, Y., Zhang, J., Zenebe, G., Melaku, Z., Cohen, R. A., Harezlak, J. (1981). Effects of nadir CD4 count and duration of human immunodeficiency virus infection on brain volumes in highly active antiretroviral therapy era. *Journal of Neurovirology 16 (1), 25–32,* doi:10.3109/13550280903552420, PMC 2995252, PMID 20113183.

Creswell, J.W. (2009). *Research Design: Qualitative, Quantitative, and Mixed Methods Approaches.* 3rd Edition. Los Angeles: Sage Publications, Inc.

Cysique, L. A., Jin H., Franklin, D. R., Jr.Morgan, E. E., Shi, C., Yu X., et al. (2007b). Neurobehavioral effects of HIV-1 infection in china and the United States: a pilot study. *Journal of the International Neuropsychological Society, 13(5),* 781–790. [PMC free article] [PubMed].

Cysique, L. A., Maruff, P., Brew, B. J. (2004). Prevalence and pattern of neuropsychological impairment in human immunodeficiency virus-infected/acquired immunodeficiency syndrome (HIV/AIDS) patients across pre-and post-highly active antiretroviral therapy eras: A combined study of two cohorts. *Journal of Neurovirology 10 (6):* 350–357, doi:10.1080/13550280490521078, PMID 15765806

DeFilippis, N.A. (2002). *Category Test: Computer Version Research Edition.* Psychological Assessment Resources Inc Lutz FL.

D'Elia, L.F., Satz, P., Uchiyama, C.L., White, T. (1996). *Colors Trails Test:* Psychological Assessment Resources Inc Lutz FL.

Diehr, M.C., Heaton, R.K, Miller, W., Grant, I. (1998). The Paced Auditory Serial Addition Task (PASAT): norms for age education, and ethnicity**.** *Assessment, 5(4):*375-387.

Ellis, L., & Masliah. (2007). HIV and antiretroviral therapy in the brain: Neuronal injury and repair. National Review of Neurosciences; *8:*33-44.

Esplen, E. (2007). Women and girls living with HIV/AIDS: Overview and annotated bibliography report prepared at the request of Irish Aid by BRIDGE in collaboration with the International Community of Women Living with HIV and AIDS (ICW). No. BRIDGE (developmentVgender): Bibliography 18.

Everall, I, Vaida, F, Khanlou, N. et al. (2009). Cliniconeuropathologic correlates of human immunodeficiency virus in the era of antiretroviral therapy. *Journal of Neuroviralogy; 15(5–6):*360–70.

Folstein, M. F., Folstein, S. E. & McHugh, P. R. (1975). Mini Mental State: A practical method for grading the cognitive state of patients for clinician. *Journal of Psychiatric Research, 12*: frontal hypothesis: task alternation in verbal fluency.

Gollan, T.H., Montoya, R.I., Fennema-Notestine, C., &Morris, S.K. (2005) Bilingualism affects picture naming but not picture classification. *Memory and Cognition, 33(7),* 1220–1234.

Grant, I. & Atkinson, J. H. (1999). Neuropsychiatric aspects of HIV infection and AIDS. In B. J. Sadock & V. A. Sadock (Eds.), *Kaplan and Sadock's comprehensive textbook of psychiatry vii* (pp. 308–335*).*

Grant, I., Sacktor, N. & McArthur, J. C. (2005). HIV neurocognitive disorders in H. E. Gendelman, I. Grant, I. Everall, S. A. Lipton, & Swindells S (Eds.). *The neurology of AIDS:* (2nd ed., pp. 359– 373).

Gronwall, D.M. (1977). Paced auditory serial-addition task: a measure of recovery from concussion**.** *Percept Motor Skills, 44(2):*367-373.

Gupta, J. D., Satishchandra, P., Gopukumar, K., Wilkie, F., Waldrop-Valverde, D., Ellis, R et al. (2007). Neuropsychological deficits in human immunodeficiency virus type 1 clade C seropositive adults from South India. *Journal of Neurovirology 13:*195-202.

Heaton, R. K., Cysique, L. A., Jin, H., Shi, C., Yu X., Letendre, S., Franklin, D. R., Jr. Ake., Vigil, C. O., Atkinson, J.H (2008). Neurobehavioral effects of human immunodeficiency virus infection among former plasma donors in rural China**.** *Journal of Neurovirology 17:* 1-14.

Heaton, R. K., Franklin, D. R., Ellis, R. J., McCutchan, J.A., Letendre, S.L., Leblanc, S., Corkran, S. H., Duarte, N. A. et al. (2010). HIV-associated neurocognitive disorders before and during the era of combination antiretroviral therapy: differences in rates, nature, and predictors. *Journal of Neurovirology 17* (1): 3–16, doi:10.1007/s13365-010-0006-1, PMC 3032197, PMID 21174240

Heaton, R. K., Grant, I., Butters, N., White, D. A., Kirson, D., Atkinson, J. H., McCutchan, J. A., Taylor, M. J., Kelly, M. D., Ellis, R. J. (1995). The HNRC 500--neuropsychology of HIV infection at different disease stage: HIV Neurobehavioral Research Center**.** *Journal of the International Neuropsychological Society 1(3):*231-251.

Heaton, R. K., Ryan, L. & Grant. I. (2009). Demographic influences and use of demographically corrected norms in neuropsychological assessment**,** in Neuropsychological Assessment of Neuropsychiatric and Neuromedical Disorders Third edition. Edited by: Grant I, Adams K. M. New York: Oxford University Press; 127-155.

Heaton, R., Franklin, D., Clifford, D., Woods, S., Rivera, M. M. (2009). HIV-associated neurocognitive impairment remains prevalent in the era of combination art:

The charter study. Paper presented at the 16th Conference on Retroviruses and Opportunistic Infections, Montreal.

Heaton, R.K., Ryan, L., & Grant, I. (2009). Demographic influences and use of demographically corrected norms in neuropsychological assessment. *Neuropsychological Assessment of Neuropsychiatric and Neuromedical Disorders, 3,* 127–155.

Hemelaar, J., Gouws, E., Ghys, P. D., & Osmanov, S. (2006). Global and regional distribution of HIV-1 genetic subtypes and recombinants in 2004. *Aids, 20(16*), W13–W23. [PubMed]

Henry, J. D., & Crawford, J. R. (2004). A meta-analytic review of verbal fluency performance following focal cortical lesions. *Neuropsychology, 18,* 284–295.

Hestad, K., McArthur, J. H., Dal Pan, G. J., Selnes, O. A., Nance- Sproson, T. E., Aylward, E., et al. (1993). Regional brain atrophy in HIV-1 infection: association with specific neuropsychological test performance. *Acta Neurologica Scandinavica, 88,* 112–118.

Hestad, K., McArthur, J. H., Dal Pan, G. J., Selnes, OA., Nance-Sproson, T.E., Aylward, T. E, Mathews, V. P., McArthur, J. C. (1992). *Regional atrophy in HIV-1 infection: Association with specific neuropsychological test performance. Neuroscience of HIV infection, basic and clinical frontiers:* Amsterdam, the Netherlands, July, 14-17

Joska, J. A, Westgarth-Taylor, J., Myer, L et al. (2010). Characterization of HIV-associated neurocognitive disorders among individuals starting antiretroviral therapy in South Africa. *AID Behavioural*; 14:371-378.

Kamat, R., Manisha, G., Tamar, H., Gollan, R. M., Florin V., Heaton, K. R., Scott ., Donald, F., Terry A., Grant, I., Sanjay, M., Thomas, D., and Marcotte. (2012). HIV Neurobehavioral Research Program (HNRP) Group. Effects of Marathi-Hindi Bilingualism on Neuropsychological Performance. *Journal of the International \neuropsychological Society; 18(2):* 305–313.

Kanmogne, G. D., Kuate, C. T., Cysique, L. A., Fonsa, J.Y., Eta, S., Doh, R., Njamnshi, D. M., Nchindap, E., Franklin, Jr, D. R., Ellis, R. J., McCutchan, J. A., Binam, F., Mbanya, D., Heaton, R. K., Njamnshi, A. K. (2010). HIV associated neurocognitive disorders in sub-Saharan Africa: a pilot study in Cameroon. *BMC Neurology,* 10:60.

Kempler, D., Teng, E. L., Dick, M., Taussig, I. M. & Davis, D. S. (1998). The effects of age, education, and ethnicity on verbal fluency. *Journal of the International Neuropsychological Society, 4,* 531–538.

Klove, H. (1963). *Clinical neuropsychology:* The medical clinics of North America, *In FM Foster* New York Saunders.

Kongs, S.K., Thompson, L. L., Iverson, G.L., Heaton, R. K (2000). *Wisconsin Card Sorting Test-64:* Card Version Lutz FL.

Lawler, K, Mosepele, M, Ratcliffe, S, et al. (2010). Neurocognitive impairment among HIV-positive individuals in Botswana: a pilot study. Journal for the international AID society; 13:15.

Lecours, R. L., Mehler, J., Parente, M. A., et al. (1987a). Illiteracy and brain damage 1: aphasia testing in culturally contrasted populations (control subjects). *Neuropsychologia, 25,* 231-245

Lecours, R. L., Mehler, J., Parente, M. A., et al. (1987b). Illiteracy and brain damage 2: Manifestations of unilateral neglect in testing "auditory comprehension" with iconographic material. *Brain and Cognition, 6,* 243-265.

Lezak, M. D., Howeison, D. B., and Loring, D. W. (2004). Neuropsychological Assessment (4th Ed.) New York: Oxford University Press.

Lopez, O. L., Wess, J., Sanchez, J., Dew, M. A. and Becker, J. T. (1999). Neurological characteristics of HIV-infected men and women seeking primary medical care, *European Journal of Neurology, vol. 6, no. 2,* pp. 205–209.

Manly, J. J., Miller, S. W, Heaton, R. K., Byrd, D., Reilly, J., Velasquez, R. J., Saccuzzo, D. P., Grant, I. (1998). The effect of African-American acculturation on neuropsychological test performance in normal and HIV-positive individuals: The HIV Neurobehavioral Research Center (HNRC) Group**.** *Journal of the International Neuropsychologicalo Society; 4(3)*:291-302.

Masliah, E., DeTeresa, R. M., Mallory, M. E, Hansen, L. A. (2000). Changes in pathological findings at autopsy in AIDS cases for the last 15 years**:** *AIDS, 14(1):*69-74.

Maxwell, J. A. (2005). *Qualitative Research Design: An Interactive Approach*. *Applied social research methods series: v. 41*. Thousand Oaks, CA: Sage Publications.

Mertler, C. A., & Vannatta, R. A. (2001). *Advanced and multivariate statistical methods: Practical application and interpretation.* Los Angeles, CA: Pyrczak, Publishing.

Miller, E. (1984). Verbal fluency as a function of a measure of verbal intelligence and inrelation to different types of cerebral pathology: *British Journal of Clinical Psychology, 8:* 385-394.

Nida, E. A. and Charles, R.Taber. (1969). *The Theory and Practice of Translation*. Leiden: EJ.Brill.

Ogden, J. A., Cooper, E. and Dudly, M. (2003) Adapting Neuropsychological Assessments for Minority Groups: A Study Comparing White and Maori New Zealanders. *Brain Impairment*, 4 (2), 122-134.

Ostrosky, F., Ardila, A., Rosselli, M. Lo' pez-Arango, G., & Uriel-Mendoza, V. (!998). Neuropsychological test performance in illiterates. *Archives of Clinical Neuropsychology, 13*, 645-660.

Ostrosky-Solís, F., Ardila, A., & Rosselli, M. (1999). NEUROPSI: A brief neuropsychological test battery in Spanish with norms by age and educational level. *Journal of the International Neuropsychological Society, 5*, 413–433.

Ostrosky-Solís, F., Ardila, A., Rosselli, M., Lopez-Arango, G. & Uriel-Mendonza, V. (1998). Neuropsychological test performance in illiterate subjects. *Archives of Clinical Neuropsychology, 13*(7), 645–660.

Piatt, A. L., Fields, J. A., Paolo, A. M, & Tröster, A. I. (2004). Action verbal fluency normative data for the elderly: *Brain and Language, 89,* 580–583.
Ratcliff, G., Ganguli, M., Chandra, V., Sharma, S., Belle, S., Seaberg, E. & Pandav, R (1998). Effects of literacy and education on measures of word fluency. *Brain and Language, 61*, 115–122.

Reger, M., Welsh, R., Razani, J., Martin, D. J., & Boone, K. B. (2002). A meta analysis of the neuropsychological sequelae of HIV infection: *Journal of the International Neuropsychological Society, 8*, 410–424.

Reis, A., & Castro-Caldas, A. (1997). Illiteracy: A bias for cognitive development. *Journal of the International Neuropsychological Society, 3*, 444–450.

Rippeth, J. D., Heaton, R. K., Carey, C. L., Marcotte, T. D., Moore, D. J., Gonzalez, R., et al. (2004). Methamphetamine dependence increases risk of neuropsychological impairment in HIV infected persons. *Journal of the International Neuropsychological Society, 10*, 1–14.

Rivera Mindt, M., Arentoft, A., Kubo Germano, K., Dı´Aquila, E., Scheiner, D., Pizzirusso, M.,yGollan, T.H. (2008). Neuropsychological, cognitive, and theoretical considerations for evaluation of bilingual individuals. *Neuropsychology Review, 18(3)*, 255–268.

Robertson, K. R., Nakasujja, N., Wong, M., Musisi, S., Katabira, E., Parsons, T. D., Ronald, A, and Sacktor, N. (2007). Pattern of neuropsychological performance among HIV positive patients in Uganda. *BioMedical Central Research Award Neurovirology:* 7:8.

Robertson, K., Jiang, H., Tripathy, S., Santos, B., and Silva, M., Montano S. et al. (2009). Improved neuropsychological function during HAART in diverse resource-limited settings: AIDS clinical trials group study A5199, the international

neurological study. Paper presented at the 16 th Conference on Retroviruses and Opportunistic Infections, Montreal.

Rosselli, M., Ardila, A., Salvatierra, J., Marquez, M., Matos, L. & Weekes, V. A. (2002). A cross-linguistic comparison of verbal fluency tests. *International Journal of Neuroscience, 112,* 759–776.

Sacktor, N. (2012). Frequency of and risk factors for HIV dementia in an HIV clinic in sub-Saharan Africa**:** *Neurology, 68(5):*350-355.

Sacktor, N., Skolasky, R., Selnes, O. A., Watters, M., Poff, P., Shiramizu, B., Shikuma, C., Valcour, V. (2007). Neuropsychological test profile differences between young and old human immunodeficiency virus-positive individuals. *Journal of Neurology 13(3):*203-209.

Tombaugh, T. N., Kozak, J. & Rees, L. (1999). Normative data stratified by age and education for two measures of verbal fluency: FAS and animal naming. *Archives of Clinical Neuropsychology, 14,* 167–177.

UNAIDS: Executive Summary: 2008 Report on the global AIDS Epidemic**.** *UNAIDS/WHO* 2008.

Wechsler, D. (1997). *Wechsler Adult Intelligence Scale* - Third edition (WAIS-III)**.** *Pearson Psych Corp San Antonio TX*.

Wolters, P. L., Brouwers, P., Civitello, L., & Moss, H. A. (1997). Receptive and expressive language function of children with symptomatic HIV infection and relationship with disease parameters: a longitudinal 24-month follow-up study. *AIDS, 11,* 1135–1144.

Wood, S. M. (2009). The impact of AIDS diagnoses on long-term neurocognitive and psychiatric outcomes of surviving adolescents with perinatally acquired HIV-AIDS. *Journal of the International Neuropsychological Society; 23*:1859-1865

Woods, S. P., Moore, D. J., Weber, E., and Grant, I. (2009). Cognitive Neuropsychology of HIV-Associated Neurocognitive Disorders. *Neuropsychologicai Review* 19*:*152–168.

Woods, S. P., Scott, J. C., Sires, D. A., Grant, I., Heaton, R. K. & Troster, A. I. (2005). Action (verb) fluency: test-retest reliability normative standards and construct validity. *Journal of the International Neuropsychological Society, 11(4*):408-415

Zhou, K.Z., and Nakamoto, K. (2007). How do enhanced and unique features affect new product preference? The moderating role of product familiarity. *Journal of Academy of International Business conferences Journal, 40(2):* 339-352

APPENDICES

Appendix A- Age Range and Neuropsychological Test Performance

Table 10: Age Range and Neuropsychological Test Performance

Test item	*F*	*Sig*	*Eta*^{2}
HVLT-Eng * age range	.479	.751	.041
HVLTdr-Eng * age range	.494	.740	.042
HVLT-Chi * age range	1.160	.341	.093
HVLTdr-Chi * age range	1.196	.326	.096
Animals Eng * age range	.865	.492	.071
Animals Chi* age range	1.708	.165	.132
Actions Eng * age range	.366	.832	.031
Actions Chi * age range	1.240	.308	.099

*$p < .05$

Appendix B – Marital status and Neuropsychological Test Performance

Table 13: Marital status and Neuropsychological Test Performance

Test item	***F***	***Sig***	***Eta*^{2}**
HVLT-Eng * Marital status	1.094	.371	.o89
HVLTdr-Eng * Marital status	1.322	.276	.105
HVLT-Chi * Marital status	1.675	.172	.130
HVLTdr-Chi * Marital status	1.434	.238	.113
Animals Eng * Marital status	2.057	.102	.155
Animals Chi* Marital status	1.922	.123	.146
Actions Eng * Marital status	1.062	.386	.086
Actions Chi * Marital status	1.433	.238	.113

p < .05

Appendix C- Period of Residence and Neuropsychological Test Performance

Table 14: Period of Residence and Neuropsychological Test Performance

Test item	*F*	*Sig*	Eta^2
HVLT-Eng * Period of residence	.641	.593	.040
HVLTdr-Eng * Period of residence	.901	.448	.056
HVLT-Chi * Period of residence	.071	.975	.005
HVLTdr-Chi * Period of residence	.063	.979	.004
Animals Eng * Period of residence	.461	.711	.029
Animals Chi* Period of residence	.045	.982	.003
Actions Eng * Period of residence	.766	.519	.048
Actions Chi * Period of residence	.217	.884	.014

p < .05

Appendix D - Information Sheet English version

University of Zambia

Department of Psychiatry

PLEASE READ THIS DOCUMENT CAREFULLY. SIGN YOUR NAME BELOW ONLY IF YOU AGREE TO PARTICIPATE AND YOU FULLY UNDERSTAND YOUR RIGHTS. YOUR SIGNATURE IS REQUIRED FOR PARTICIPATION. FOR THIS PROJECT, YOU MUST BE BETWEEN 20 AND 65 YEARS OF AGE TO PARTICIPATE. IF YOU DESIRE A COPY OF THIS CONSENT FORM, YOU MAY REQUEST ONE AND WE WILL PROVIDE IT.

Introduction:

This study is entitled: **Effects of HIV and linguistic medium on the test performance of rural adults with less than five years of education: implications for neuropsychological test development in Zambia.** This research is directed by Masters Students in Clinical Neuropsychology at the University of Zambia, sponsored by NOMA Project. This document defines the terms and conditions for consenting to participate in this study. A total number of 50 participants will be recruited for the study.

Description of the Study:

You are being invited to take part in the study of **Effects of HIV and linguistic medium on the test performance of rural adults with less than five years of education: implications for neuropsychological test development in Zambia.** You will be required to undergo medical screening and laboratory/blood tests done by qualified medical personnel. Thereafter, you will be required to complete questionnaires and take a group of tests to assess brain functioning using the Neuropsychological test battery.

Confidentiality

All the information you will give shall be confidential and shall be kept under key and lock. The findings in the research shall be presented in aggregate form with no identifying information to ensure confidentiality.

Risks and Benefits:

- You may experience minimal pain during drawing of blood. A cold compress will be used to reduce pain.
- You may experience fatigue due to the length of time required for the testing process. To reduce on this you are free to ask for a short break whenever you require it.
- We cannot guarantee that you will receive any direct benefits from this study though you will have an opportunity to contribute to neuropsychological assessments that will help Zambians in general by participating in this study.

Time Involvement and reimbursement

The whole process will take approximately 2 hours and 30 minutes to 3hours to complete. Reimbursements of K30, 000 as transport refund and K20, 000 for your refreshments.

Participation Rights:

- Participation in this study is purely voluntary so that if you decide to withdraw at any point, there will be no consequences to you.
- All personal identifying information will be kept confidential and the data sheets will be kept in secured lockers in accordance with the standards of the University of Zambia Biomedical Ethics Committee. If the results of this study are required for publication as we hope, your identity will still be kept private.

Contacts

If you have any further questions about this research please contact:

The Principal Investigator	Biomedical Research Ethics
Lazarous Ndhlovu	Committee
The University of Zambia	The University of Zambia
School of Medicine	School of Medicine
Department of Psychiatry	Ridgeway Campus
Ridgeway Campus	P.O. Box 50110
P.O. Box 50110	**Lusaka**
Lusaka	Telephone: +260-211- 256067
Cell No: 0974478725	Fax: + 260-211-250753

E-mail: lazziendhlovu@yahoo.com E-mail: unzarec@zamtel.zm or unzarec@unza.zm

Appendix E -Consent Form: English Version

I……. (Name) have read and understood the terms and conditions of this study and I hereby agree to participate in the above-described research study. I understand that my participation is voluntary and that I may withdraw at any time without penalty. As the participant in this project, my signature under here testifies that I understand the consent process and management of confidentiality as indicated above. I also understand that I can withdraw at any time.

Signature of research participant: …….Date…….....

Thumb print of research participant.....

Name of witness: …….....

Signature of witness.....Date.....

Thumb print of witness.....

Name of researcher: …….....…….....

Signature of researcher.....Date.....

Thumb print of witness.....

Appendex F-Ndondomeko ya fomu (Information sheet Chichewa version)

Conde werengani fomu iyi mwatsatanetsane. Fomuyi ili ndi zidziwitso kapena kuti malongosoledwe ofunika pakutengako mbali mu maphunzilowa akafufuzidwe kapena kuti `research study' mu cingelezi. Pokhala ngati oyembekezeledwa kutengako mbali mu maphunzirowa akafufuzidwe (research), mull nalo danga lotenga nthawi pakupanga ciganizo cotengako mbali ndiponso mupemphedwa kuti mukambirane nao a banja lanu ndiponso a dotolo anu. Ngati muli ndi funso liri lonse pa ma phunzirowa akafui-'uzidwe (research) kapena pa fomu iyi, Conde, khalani omasuka pakundifunsa mafunso. Ngati mwatsimikiza kuti mudzatengako mbali mu maphunzirowa, mudzapemphedwa kusaina cifomu cosonyeza kuti mwabvomekeza ndi mtima wanu wonse kutengako mbali. Limodzi lama fomu omwe mudzasaina lidzapatsidwa kwa inu kuti mudzisungire nokha.

Mutu wama phunzirowa akafufuzidwe: *Chilankhulo comwe tingagwiritse nchito pakufufuza za Mabvuto omwe kalombo ka HIV kamabweretsa m'bongo wa anthu osaphunzira omwe analekeza sukulu mugeredi* la cinai ndi aja omwe sanapondemo mkalasi ndipo ali ndi zaka zakubadwa pakati pa makumi anai (40 years) ndi makumi asanu ndi limodzi ndi mphambu sisanu (65 years).

Colinga ca kafufuzidwe kapena kuti `purpose of the study' mu cingelezi: Colinga ndi kufuna kudziwa ngati zilankhulo zathu zikhoza kugwritsidwa chito m'malo mwa zilankhulo zina kotero kuti ngakhale anthu osaphunzira azithandizika kuzipatala.

Kodi ndi anthu angati amene adzatengako mbali mu ma phunzirowa akafufuzidwe kapena kuti 'research study' mucingerezi?
Adzakhala anthu makumi asanu otengako mbali.

Kalambulabwalo (Introduction)

Dzina langa ndine..... Ndipo ndacokera ku sukulu lalikulu lamuno mu Zambia lochedwa Univesiti. Colinga ceni-ceni ndikufuna kufufuza zinthu zomwe sizinafufuzidwepo pakati pathu. Ndi kufuna kudziwa pa zaubwino wakugwiritsa nchito cilankhulo cathu ca Chichewa/Chinyanja pakufuna kudziwa za mmene muthu aganizira ngati ali ndi kacilombo ka HIV. Ndipo kuti zonsezi zitheke, ndikupemphani kuti mutengeko mbali mu maphuzirowa akafufuzidwe kapena kuti `research' mucingelezi. Maphunzirowa akafufudzidwe ndi njira imodzi yomwe tingadziwitsitse pa cinthu comwe tingafune kudziwitsitsitsa. Conco muli kupemphedwa kutengako mbali mumaphunzirowa akafufuzidwe cifukwa cakuti simunapite kutali ndi maphuniro anu ndipons mulikhale ndi zaka zosacepekera makumi anai (40 years) ndiponso zosapitirira makumi asanu ndilimodzi ndi mphambu zisanu (65 years).

Ngati mwatsimikiza kuti mudzatengako mbali, ndidzapempha kuti mucite zotsatilazi:-

- Kuyankhe mafunso omwe ali pa ma fomu ena ambiri ofufuza za umoyo wanu ndi zina zambiri.
- Mudzapimidwa magazi kuona ngat muli ndi kacilombo ka HIV.

Kodi ndi zalandilitsidwa pakutengako mbali mu sitadi kapena kuti mumaphunzirowa akafufuzidwe? Ai, Kutengako mbali ndi kodzipereka cabe ndipo sikudzakhala malipilo ena alionse. Koma iwo adzamaliza zonse, tidzawabwezera ndalama zomwe akwerera galimoto, Njinga kapena Ngolo pobwera kun zokwanila K30,000. Tidzawabwezeranso ndalama zomwe asewenzetsa kugula zakudya patsiku la lero zokwanila K20,000.

Cisinsi: Malongosoledwe onse ndi zotulukamo zake zidzasungidwa mosamalika ndiponso mwa cisinsi. Ngati mayankho onse agwirisidwa nchito, zipepara zomwe zichula anthu zidzatengedwa ndikuyikidwa mu fayelo, Ndiponso zonse tafotokozelana zidzasungidwa ndi ku khomeledwa mu ofesi ku University of Zambia.

Kudzipeleka mukutengako mbali ndi kulekeza kutengako mbali: Mungasankhe kutengako mbali kapena kulekera panjira pa mayeso opanda mulandu wina uliwonse kapenanso kulipilitsidwa kali konse. Ndiponso otengako mbali ali obvomelezedwa kukana kuyankha funso lina lililronse ngati afuna kapena cinthu cina cocita pakucita mayeso. Ngati mungafune kutenga kapena kubwezeredwa zomwe munafotokozela opima mkupita kwa nthawi muli ololedwa pakudziwitsa oyanganira maphunziro kapena kuti `the principal investigator of the study' mucingerezi.

Zobvuta ndi phindu: Palibe zomwe zingapatsidwe za phindu kwa otengako mbali. Phindu lomwe liyembekezeka liri la tonse, maka-maka pa kuyelekeza momwe mndodomeko zazilankhulo zoyenera ku gwiritsa nchito maka-maka kwa aja amene sanapite ku sukulu, kotero kuti ngati ndikotheka Boma lisinthe kafunsidwe ka mafunso kucoka mchingerezi ndikusewenzetsa zilankhulo zathu zacikuda.

Ma keyala akugwilitsa ntchito ngati muli ndi mafunso kapena zonena zili zonse: Ngati mull ndimafunso kapena zokamba zilizonse conde dziwitsani oyanganira pa zonse kapena kuti ‘the principal investigator of the study’ ku pyolela mu keyala ili pansipa. Ndiponso ngati mufuna kulankhula ndi wina aliyese amene salikutengako mbali mumaphunzirowa akafufuzidwe kapena kuti 'research study' mucingelezi pazaufulu wanu pakukhala ngati wotengako mbali mu maphunzirowa akafufuzidwe `research,' conde dziwitsani kapena lembelani bungwe lomwe limayanganira pa malamulo omwe afunikira kutsatidwa mumaphunzilo a mtundu uyu, bungweli lichedwa ‘Biomedical Research Ethics Committee’ muchingerezi. Keyala yake ndi iyi ili kudzanja lamanja munsimu.

The Principal Investigator
Lazarous Ndhlovu
The University of Zambia
School of Medicine
Department of Psychiatry
Ridgeway Campus
P.O. Box 50110
Lusaka
Cell No: 0974478725

Biomedical Research Ethics
Committee
The University of Zambia
School of Medicine
Ridgeway Campus
P.O. Box 50110
Lusaka
Telephone: +260-211- 256067
Fax: + 260-211-250753

E-mail: lazziendhlovu@yahoo.com E-mail: unzarec@zamtel.zm or unzarec@unza.zm

Monga zilili mu fomu ya otengako mbali:

1. Taonani kuti mwawerenga ma fomu kapena mapepala omwe ali ndizidziwitso kapena kuti malongosoledwe onse ndiponse ndikukhutira mwamvetsetsa zidziwitso zolembedwazo.
2. Kutengako mbali mu maphunzirowa ndikodzipeleka cabe, mwacitsanzo ngati simufuna inu eni ake, simukakamizidwa ai.
3. Ngati mwakana kutengako mbali, simungayimbidwe mulandu oliwonse kapena kulipiritsidwa kanthu kena kalikonse.
4. Ngati mwafuna kutengako rnbali mulinso omasuka kuleka nthawi ina iliyonse popanda kulipilitsidwa kapena kuyimbidwa mlandu uliwonse, kapenanso kufunsidwa cifukwa comwe mwalekera.
5. Ngati pali mafunso ena ndinu omasuka kufunsa pazimene simunamvestetse. Ndiponso, ngati pali cina comwe simuli omasuka bwino kuti tikambirane, conde ndifotokozera zonse zili kumtima kwanu.
6. Malongosoledwe amayankho amafunso onse adzasungidwa mwacisinsi
7. Ngati mwasankha kutengako mbali sainani munsimu ndisanapitilize ndi mafunso ena.……

Appendix G - CHICHEWA CONSENT

KUBVOMERA MODZIPELEKA (VOLUNTARY CONSENT)

Ndawerenga (andifotokozera) ndondomeko ndi zidziwitso zonse za maphunzirowa akafufuzidwe kapena kuti `research' mcingelezi monga ngati mornwe zalembedwela mufomu ya otengako mbali. Indedi, mpata ndinali nao wofunsa mafunso ndipo mafunso onse ayankhidwa mofikapo.

Tsopano ndibvomera modzipeleka kutengako mbali mumaphunzirowa pakudziwa kuti ndilinalo danga lakuleka kuyankha mafunso kapena kutengako mbali mumafunsowa akufunsidwa muma phunzirowa akafufuzidwe kapena kuti 'research study' mucingelezi.

Sigineca ili musimu isonyeza kuti ndabvomera kutengako mbali mumaphunzirowa akafufuzidwe

Dzina la otengako mbali (kulemba cimoozi-cimodzi).....

Sigineca kapena cidindo ca cala (fingerprint) ya/ca otengako mbali:

Tsiku lomwe analoledwa kapena kubvomereza (consent date)..... .....

Dzina la wocitira umboni (kulemba cimoozi-cimodzi): ....

Sigineca kapena cidindo ca cala (fingerprint) ya/ca ocitira umboni:

Tsiku lomwe anacitira umboni (witness date).....

Dzina la ocititsa maphunziro akafufuzidwe (Printed).....

Sigineca ya ocititsa maphunziro: .....

Tsiku lomwe mafunso anfunsidwa kwa wotengako mbali (date).....

Appendix H- English Questionnaire

THE UNIVERSITY OF ZAMBIA

SCHOOL OF MEDICINE

DEPARTMENT OF PSYCHIATRY

P. O. Box 32379, Lusaka, Zambia

CLINICAL NEUROPSYCHOLOGY

DATA COLLECTION QUESTIONNAIRE

FOR OFFICIAL USE ONLY

Date:……

Clinic/Centre:……

Examiner:……

Subject Study Number:……

INSTRUCTIONS

A. Please give/tick [√] the appropriate answer to the question.

B. All the information you will provide will be used for the purpose of this study only, therefore, provide genuine information and ensure that all questions are carefully answered.

AGE AND GENDER

Q1What is your age?

A. 40-45 [ ]

B. 46-50 [ ]

C. 51-55 [ ]

D. 56-60 [ ]

E. 61-65 [ ]

Q2What is your gender?

A. Female [ ]

B. Male [ ]

MARITAL STATUS

Q3 What is your marital status?

A. Single [ ]

B. Married [ ]

C. Widowed [ ]

D. Divorced [ ]

E. Separated [ ]

EDUCATION

Q4. What is your highest grade did you attained

A. Never been to school [ ]

B. Went up to grade 1 [ ]

C. Went up to grade 2 [ ]

D. Went up to grade 3 [ ]

E. Went up to grade 4 [ ]

PERIOD OF RESIDENCE

Q5 How long have you lived in this locality?

A. Brief period (< 4 year) [ ]

B. Short period (5-14 years) [ ]

C. Moderate period (15-24 years) [ ]

D. Longest period (24-65 years) [ ]

Appendix I-CHICHEWA QUESTIONNAIRE

MAFUNSO A MCHICHEWA

ZAKA ZA KUBADWA

Q1 Muli ndi zaka zakubadwa zingati?

A. 40 – 45 [ ]

B. 46 – 50 [ ]

C. 51 – 55 [ ]

D. 56 – 60 [ ]

E. 61 – 65 [ ]

MWAMUNA PENA MKAZI

Q.2 Ndinu mwamuna kapena mkazi

A. Mkazi [ ]

B**.** Mwamuna [ ]

ZA UKWATI

Q 3 Kodi

A. Ndinu osakwatira? [ ]

B. Ndinu okwatira? [ ]

C. Ndinu ofedwa? [ ]

D. Munalekana? [ ]

E. Munapatukana cabe [ ]

ZA MAPHUNZIRO

Q4. Kodi munalekeza geredi bwanji ku sukulu?

A. Sindinapondemo mwendo mkalasi [ ]

B. Ndinalekeza mgeredi loyamba [ ]

C. Ndinalekeza mgeredi laciwiri [ ]

D. Ndinalekeza mgeredi lacitatu [ ]

E. Ndinalekeza mgeredi lacinai [ ]

NCHITO NDI KAPEZEDWE KA NDALAMA

Q5. Kodi pakalipano mukucita ciani?

A. Sindilikugwira nchito iliyonse [ ]

B. Ndine kadzipalire [ ]

C. Ndiri pa nchito [ ]

D. Ndinaleka nchito [ ]

Q6. Ngati muli pa nchito, chulani nchito yomwe mugwira

A. Ya ulimi [ ]

B. Ya umtekenya/udilaiva [ ]

C. Ya umalonda [ ]

D. Ya umisili wokhoma/womanga [ ]

E. Ya zogulitsa-gulitsa [ ]

Q8. Mwakhala kuno zaka zingati?

A. Kuchokera pamene ndinabadwaL [ ]

B. Kwa zaka zosapitilira khumi (teni) [ ]

C. Pakati pa zaka teni ndi twente [ ]

D. Zaka zopitirira twente [ ]

CILANKHULO CANU

Q9. Kodi mumakamba cilankhulo bwanji?

A. Chizungu [ ]

B. Chichewa/Chinyanja [ ]

C. Chitumbuka [ ]

D. Chingoni [ ]

E. Chilankhulo cina (nenani)..... [ ]

Appendix J- Hopkins Verbal Learning Test- Revised: English Version

Trial 1*: Instructions to the participant:*

"I am going to read a list of words to you. Listen carefully, because when I'm through I'd like you to tell me as many as you can remember. You can tell them to me in any order. Are you ready" Read list at rate of one word every two seconds. If participant does not spontaneously begin repor1ing words after the last word is read, say: **"Ok. Now tell me as many of those words as you can remember."**
You can gently prompt by asking if they can recall any other words by saying: **"Can you tell me anymore?"**

Trial 2: *After participant has indicated that they can recall no more words, say:* **"Now we are going to try it again. I am going to read the same list of words to you Listen carefully and tell me as many of the words as you can remember, in any order including the words you told me the first time."** Read list at rate of one word every two seconds.

Trial 3: *After participant has indicated that they can recall no more words, say:* **"I am going to read the list one more time. As before, I'd like you to tell me as many of the words as you can remember, in any order, including the words you've already told me."** After participant has indicated that they can recall no more words record the clock time on the Time Trial 3 Completed line. Delay should be done 20-30 minutes after this time.

Delay: After 20 minute delay ask participant: **"Do you remember that list of words you tried to learn before? Tell me as many of those words as you can remember."**

Recognition: Immediately following the Delay trial say: **"Now I am going to read a longer list of words to you. Some of them are words from the original list and some are not. After I read each word, I'd like you to say "Yes" if it was on the original list or "No" if it was not."**

Appendix K - Category Fluency Test: Animal Naming-English Version

Animals

Instructions to the participant:

“Now we are going to do something a little different. This time I want you to tell me all of the animal names that you can think of. It doesn't matter what letter they start with. Just tell me all of the animal names that you can think of.”

Begin timing. Stop the respondent after 60 seconds

Appendix L - Category Fluency Test: Action Naming-English Version

"I'd like you to tell me as many different things as you can think of that people do. I don't wasn't you to use the same word with different endings, like eat, eating, eaten. Also just give me single words such as eat rather than a sentence. Can you give me an example of something that people do?"

Limit participant to one response and record the example on the periphery of the form.

If the response is unacceptable (any verb response is acceptable), then ask the subject to provide another example of an action word. If the response is acceptable:

"That is the idea. Now in one minute tell me as many different things as you can think of that people do." Begin timing. Stop after 60 seconds

Appendix M- Hopkins Verbal Learning Test- Revised:Chichewa Version

Kuyetsedwa koyamba:

"Ndidzakuwerengerani gulu la mau ndipo mumvetsetse bwino kwambiri cifukwa ndikamaliza kuwerenga ndidzakufunsani kuti mundiuze mau amene mudzakhoza kukumbukira. Munene mauwa mumndanda uliwonse momwe munga kumbukire mosatsatira mmene ndawerengera ine. Ndinu okonzeka?" *Werengani gulu la mauwa modekha bwino mosapitilira kuthamanga kwa manunsu awiri liu limodzi ndithu.*

Ngati iye sanena kanthu mutamaliza kuwerenga liu lomalizira, nenani kuti, **"cabwino, tsopano nenani mau onse omwe mungakumbukire."**

Atamaliza, mutha kuwafunsa ngati pali mau ena omwe akhoza kukumbuka kuti anene.

"Kodi mukhoza kunena mau ena?"

Kuyetsedwa kwaciwiri: Ngat woyetsedwayo atsimikizira kuti palibe liu lomwe anga kumbukire, nenani kuti, **"Tsopano tidzayesanso" Ndidzawerenganso gulu la mau aja kwainu ndipo mumvetsetse bwino cifukwa muyenera ku ndiuza mau omwe mudzakumbulira kuphatikiza mau aja munanena poyamba mumndandanda uliwonse.**

Werengani gulu la mauwa modekha bwino mosapitilira kuthamanga kwa manunsu awiri pa liu limodzi ndithu.

Kuyetsedwa kwacitatu:

Woyetsedwayo atanena kuti palibe mau ena omwe angakumbukire, nenani kuti, **" Tsopano ndidzawerenganso mndandanda wamauwa monga poyamba paja ndipoa ndipo mumvetsete bwino cifukwa muyenera ku ndiuza mau omwe mudzakumbukira kuphatikiza mau aja munanena poyamba mumndandanda uliwonse munga kumbukire.** *Ngait woyetsedwayo atsimikizira kuti palibe liu lomwe angakumbukire, lembani nthawi yomwe mwatenga pakoloko yanu pakamzere ka kuyetsedwa kwa citatu.*

Yembekezani kwa mphindi makumi awiri pena atatu musanawayesenso: Patapita mphindi zimenezi, muwafunse motere: **"Kodi mukumbukira mndandanda wa mau aja munanena poyamba? Ndiuzeninso mau aja omwe munanena poyamba paja ngati mungakumbukire bwino."**

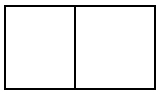
Recognition /Cikumbumtima: Atamaliza kuchula mau apamwambapa, munene kuti: **"Tsopano ndidzawerenga gulu la mau ambiri. Ena mwa mau awa apezeka mgulu la mau aja apoyamba ndipo ena mwa mauo ndi acilendo omwe sapezeka mgulu lija loyamba. Ngati liu lowerengedwalo lipezeka mgulu loyamba munene 'inde' Kapena 'iyai' ngati silipezekamo."**

Nthawi yonse yo yesedwa ke tatu:_____Nthawi yomwe analekelapo atayamba patapita mphind khumi_____Mphindi Zocedwapo (makumi awiri)_____

Kuyesedwa koyanba mpaka kacitatu

Mau	Kuyesa 1	Kuyesa 2	Kuyesa 3	Kuyesa 4	Kumbutso patapita nthawi
Mkango					
nthoci					
Ngolo					
Nyumba					
Galu					
Masuku					
Njinga					
Khola					
Fisi					
Makole					

Mthuthuthu					
Cinkhwema					

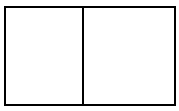


Trial 1 Total

Trial 2 Total

Trial 3 Total

Delay Total



True positive

False negative

TRIAL RECOGNITION (CHIKUMBUMTIMA)

ZOCITA	INDE/IYAI
1. Galu	INDE IYAI
2. Dzenje	INDE IYAI
3. Nyumba	INDE IYAI
4. Nthoci	INDE IYAI
5. Khasu	INDE IYAI
6. Wilibala	INDE IYAI
1. Ngolo	INDE IYAI
2. Masuku	INDE IYAI
3. Cona	INDE IYAI
4. Mthuthuthu	INDE IYAI
5. Mkango	INDE IYAI
6. Mandimu	INDE IYAI
7. Njinga	INDE IYAI
8. Nsapato	INDE IYAI
9. Funga	INDE IYAI
10. Fulu	INDE IYAI
11. Cinkhwema	INDE IYAI
12. Makole	INDE IYAI

13. Mpunga	INDE	IYAI
14. Fisi	INDE	IYAI
15. Khola	INDE	IYAI
16. Njuci	INDE	IYAI
17. Ndege	INDE	IYAI

Appendix N-Category Fluency Test (Gulu la maina anyama)

Maina a nyama

Malangizo kuotengako mbali

“Tsopano tidzacita cinthu cina cosiyana ndi zimene tinali kucita. Pa nthawi ino ndifuna kuti muchule maina a nyama iliyonse yomwe inu mungaganize. Musabvutike ndi coyambilira ca dzina la nyamayo ayi, koma inu muchule cabe nyama zones zimene inu mudziwa.”

Yambani Kuona nthawi pakoloko

Muleketseni munthuyo pakapita mphindi makumu asanu ndi limodzi.

Appendix O-Actions/ Zomwe anthu amacita

“Tsopano ndifuna kuti mundiuze zinthu zosiyana-siyana zomwe anthu amacita. Sindifuna kuti mugwiritse nchito liu limodzi lofanana monga ‘phika, phikitsa, phikirana’ kapena ‘ kuphika, kuphikirana, kuphikilira; koma liu limodzi cabe. Kodi mungathe kundipatsa citsanzo ca zomwe anthu amacita?

Munthuyo akupatseni citsanzo cimodzi cabe ndipo atatero, mulembe citsanzoco pambali pa tsamba la fomu yanu.

Ngati simunakhutire ndi yankho yoperekedwa, lolani kuti munthuyo akupatseni liu lina. Ndipo ngati wakhoza, nenani,

“Inde ndi zomwe zifunika. Tsopano mumphindi imodzi cabe, nenani zinthu zosiyana-siyana zomwe anthu amacita.”

Yambani kuona nthawi pakoloko: Aleke patapita mphindi makumu asanu ndi limodzi.

Appendix P-English oral questions for exclusion

1. Good morning
2. How are you
3. What is your name
4. Where were you born
5. What is the name of your father
6. What is the name of your mother
7. Where are you going?
8. How old are you?
9. Are you married
10. What is the name of your wife?

Total	Exclusion	Inclusion
10	> 5	< 5

Appendix Q-ZAT – READING RECOGNITION TEST

1

Eat	Four
Good	She

2

Old	His
Fly	Round

3

Five	Green
Sing	Around

4

Warm	Fall
Start	Drink

5

Outside	Fishing
Town	Smile

6

Wagon	Houses
Meaning	Families

7

Question	Change
Joined	Brook

8

Instead	Blaze
Signs	Colt

9

Pleasant	Dangerous
Ledge	Escape

10

Northern	Towel
Kneel	Height

11

Exercise	Observe
Ruin	License

12

Uniforms	Pigeon
Moisture	Artificial

13

Issues	Quench
Hustle	Thigh

14

Guardian	Vein
Civilisation	Anchor

15

Composition	Elegant
Sympathy	Authorities

16

Utensil	Geometry
Condemn	Unparalleled

17

Reign	Adjourned
Limousine	Manoeuvres

18

Heroine	Statistics
Phenomenal	Vicinity

19

Judicial	Medieval
Rheumatism	Silhouette

20

Diminutive	Celestial
Navigable	Ecstasy

Appendix R - Approval from Biomedical Research Ethics Committee

THE UNIVERSITY OF ZAMBIA

BIOMEDICAL RESEARCH ETHICS COMMITTEE

Telephone: 260-1-256067
Telegrams: UNZA, LUSAKA
Telex: UNZALU ZA 44370
Fax: + 260-1-250753
E-mail: unzarec@unza.zm
Assurance No. FWA00000338
IRB00001131 of IORG0000774

Ridgeway Campus
P.O. Box 50110
Lusaka, Zambia

25th September, 2012.

Your Ref: 007-05-12.

Mr. Lazarous Ndhlovu,
School of Medicine,
Department of Psychiatry,
PO Box 50110,
Lusaka.

Dear Mr. Ndhlovu,

RE: RE-SUBMITTED RESEARCH PROPOSAL: **"EFFECTS OF HIV AND LINGUISTIC MEDIUM ON THE TEST PERFORMANCE OF RURAL ADULTS WITH LESS THAN FIVE YEARS OF EDUCATION: IMPLICATIONS FOR NEUROPSYCHOLOGICAL TEST DEVELOPMENT IN ZAMBIA"**

The above mentioned research proposal was re-submitted to the Biomedical Research Ethics Committee with recommended changes on 13th July, 2012. The proposal is approved.

CONDITIONS:

- This approval is based strictly on your submitted proposal. Should there be need for you to modify or change the study design or methodology, you will need to seek clearance from the Research Ethics Committee.
- If you have need for further clarification please consult this office. Please note that it is mandatory that you submit a detailed progress report of your study to this Committee every six months and a final copy of your report at the end of the study.
- Any serious adverse events must be reported at once to this Committee.
- Please note that when your approval expires you may need to request for renewal. The request should be accompanied by a Progress Report (Progress Report Forms can be obtained from the Secretariat).
- **Ensure that a final copy of the results is submitted to this Committee.**

Yours sincerely,

Dr. J.C Munthali
CHAIRPERSON

Date of approval: 25 September, 2012 **Date of expiry**: 24 September, 2013

Appendix S– Letter of clearance to conduct Research in Chipata Rural Health Centres

SCHOOL OF MEDICINE
Department of Paediatrics and Child Health
P.O BOX 50110 LUSAKA
TEL/E-mail Address: Prof. MPS Ngoma, +260 977 310638 (profmngoma09gmail.com)

23rd October, 2012

Dr. Davy Simumba
Chipata District Officer
170 Ufulu Road Res
Chipata

Dear Dr. Simumba

RE: NOMA STUDENTS

Thank you for your verbal clearance, as discussed the following students will be coming to Chipata District for their Research:

1. Ndhlovu Lazarous, Computer Number 530506701, Cell 0974478725
   E-Mail lazziendhlovu@yahoo.com

Title of the Research: **Effects Of HIV And Linguistic Medium On The Neuropsychological Test Performance Of Rural Zambian Adults With Less Than Five Years Of Education.**

2. Kayungwa Foster, Computer Number 530506689, Cell 0966752734
   E-Mail kosterkayungwa@yahoo.co.uk

Title of the Research: **Performance Of HIV Infected Adults With Low Level Education On The Neuropsychological Test Battery: The Case Of The Motor Domain.**

All the eight Lusaka students have been cleared by the District Health Management Team. For any information you can contact the Lusaka Research and Ethics on 0211-256067 or Mariah on 0955-175067.

Your facilitation of this is highly appreciated.

REPUBLIC OF ZAMBIA
PAEDIATRIC DEPARTMENT
HEAD OF DEPT.'S OFFICE
OCT 25 2012
UNIVERSITY TEACHING HOSPITAL
BOARD OF MANAGEMENT
P.O. BOX RW 1, LUSAKA.

Yours faithfully

MPS Ngoma

Prof MPS Ngoma
Associate Professor
Paediatrics and Child Health

Cc: Dr. Kennedy Malama- Chipata **Provincial District Officer**
Cc: **File**

Appendix T – Letter of permission to conduct Research in Health Centres

P.O. Box 50827
Lusaka
Tel: +260-211-235554
Fax: +260-211-250429

In reply please quote

No.....

Republic of Zambia

MINISTRY OF HEALTH
LUSAKA DISTRICT HEALTH MANAGEMENT TEAM

Thursday, July 19, 2012.

Professor MPS Ngoma
Associates Professor
Paeadiatrics and Child Health
University Teaching Hospital
LUSAKA.

Dear Dr. Ngoma,

RE: PERSMISSION TO CONDUCT RESEARCH AT LUSAKA DISTRICT CLINICS: MASTERS IN CLINICAL NEUROPSYCHOLOGY.

The District Health Office is in receipt of your letter dated 16th July, 2012 on the above subject.

Approval has been granted for the ten named students to conduct research in the Lusaka District Clinics.

However, the research should only commence upon production of a copy of UNZA REC approval.

You will also be required to furnish the DHO with a summary of your research findings at the completion of the study.

Yours sincerely,

DR. M. M. CHIKO
ACTING PRINCIPAL CLINICAL CARE OFFICER
For/ACTING DISTRICT MEDICAL OFFICER.

c.c.: Health Centre in-charges.

Appendix U – Zambia Neurobehavioural Test Battery