NEUROCOGNITIVE DEFICITS AND PSYCHOSOCIAL ADJUSTMENT AMONG HIV POSITIVE AND HIV NEGATIVE CHILDREN AGED 7 to 12 YEARS IN GABORONE, BOTSWANA: A COMPARATIVE STUDY

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A dissertation in partial fulfilment for the degree of Masters of Science in Clinical Psychology

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DECLARATION

This proposal/thesis is my original work and has not been presented for a degree in any other University

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CERTIFICATE OF APPROVAL

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DEDICATION

This study is dedicated to all the individuals who helped me to successfully complete this study by equipping with the skills and knowledge (Dr Manasi and Dr Mathai), the psychiatry department lecturers and staff. The study is also dedicated to all those who offered me with love and support (my family, colleagues and friends). Special thanks to Rachel Maina and Philip Ayieko for their guidance. I also dedicate this study to the Government of Botswana and the Botswana High Commission (Kenya) for making everything easier and possible for me.

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LIST OF ACRONYMS

AIDS	Acquired Immune Deficiency Syndrome
HIV	Human Immunodeficiency Virus
KABC-II	Kaufman's Battery Assessment for Children-Second Edition
SDQ	Strengths and Difficulties Questionnaire
WHO	World Health Organization

OPERATIONAL DEFINITIONS

KABC-II A measure of processing and cognitive abilities of children and adolescents

Neurocognitive functioning This refers to the KABC-II neurocognitive domains of learning ability, sequential processing, visual processing, short term and long term memory storage and retrieval, planning, conceptual thinking and pattern reasoning.

Neurocognitive deficits This refers to the impairment in the neurocognitive domains of learning ability, sequential processing, visual processing, short term and long term memory storage and retrieval, planning, conceptual thinking and pattern reasoning.

Psychosocial adjustment Factors that are measured by the SDQ (see SDQ definition below)

Psychosocial This refers to one's psychological development interaction with the social environment

SDQ It refers to the Strengths and Difficulties Questionnaire that will assess the psychological adjustments in children. Measures emotional symptoms, conduct problems, hyperactivity/ inattention, peer relationship problems and pro-social behaviour.

ABSTRACT

Background: Approximately 200 million children born in low and middle-income countries do not reach their full cognitive potential (Grantham-McGregor et al., 2007). Busman, et al., (2013) reported that children with HIV may suffer from disruption in attention, concentration, and severe social withdrawal. Loughan and Perna (2012) stated that poor children were twice as likely to have repeated a grade, to have been expelled or suspended from school and more likely to be diagnosed with developmental delay. Again, children of mothers with low level or no education are three times more likely to be prone to neurocognitive deficits than those of mothers with high level of education (Boyede, Lesi, Ezeaka & Umeh, 2013).

Aim: The purpose of this study was to assess the prevalence of neurocognitive deficits among HIV positive and HIV negative children aged 7 to 12 years in Gaborone, Botswana to understand overlaps and differences in neurocognitive functioning.

Method: The researcher assessed the relationship between neurocognitive deficits and psychological adjustment using the Kaufman Assessment Battery for Children (KABC-II), second edition and Strengths and Difficulties Questionnaire (SDQ)-parent and teacher administered, respectively. The study was conducted at Baylor Children's Clinic and Ben Thema primary school, at Gaborone, Botswana. The Luria's model was used to assess outcomes on KABC-II.

Results: A total of 35 HIV positive and 62 HIV presumed negative children were recruited. The neurocognitive scaled scores for HIV positive children were significantly lower than those of HIV presumed negative children in three subdomains: sequential processing (mean score = 93 versus 101); learning (mean score = 77 versus 87) and planning (mean score = 74

versus 81). Overall, the Mental Processing Index (MPI) was significantly lower in the HIV positive children (mean = 78) compared to the HIV presumed negative children (mean = 87).

HIV positive children reported higher mean scores on three of the five SDQ scales and also on the total difficulty score. HIV positive children scored higher on emotional symptoms (3±2 versus 2±2), conduct problems (3±2 versus 1±2) and peer problems (4±2 versus 2±1), compared to HIV presumed negative children. On average the total difficulties score in HIV positive children was 14 ± 5 compared to in 9 ± 5 of the HIV presumed negative children. Children who scored high on SDQ (scores 17+) were not significantly more likely to perform lower on KABC-II (MPI) after adjusting for HIV status ($p=0.37$).

Conclusion: HIV positive children had a higher prevalence of neurocognitive deficits than the HIV presumed negative children. Again, the HIV positive children had significant difficulties in emotional, peer and conduct functioning than the HIV presumed negative children. There was no association between neurocognitive deficits and psychosocial adjustment among HIV positive and HIV presumed negative children aged 7 to 12 years in Gaborone, Botswana.

CHAPTER 1: INTRODUCTION

1.1: Introduction

Neurocognition represents a wide range of executive brain functions including attention, memory, learning, thinking and perception (Fraser, 2014). Neurocognitive deficits refer to reductions or impairments of cognitive functioning including attention span, memory, verbal skills and executive functions and visuospatial skills (Zillmer, Spiers & Culbertson, 2008). Brain development is faster in the earlier years of life compared to the rest of the body, which may make the brain more vulnerable to cognitive and neurodevelopmental defects (Benton, 2010).

It has been reported that cognitive development in pre-schoolers is predictive of later school achievement including the 7-12 year olds (Engle, 2010). Zillmer, Spiers and Culbertson (2008) stated that between the ages of 7 and 9, the frontal lobes which control higher cognitive functions including planning, coordination, sequencing and self regulation appears to grow in children.

It is known worldwide that one of the major biological contributors of neurocognitive deficits is HIV (World Health Organisation, 2013). Around 25 000 children (under 14 years) in Botswana are infected by HIV. Interestingly, cognitive impairment, including slowed processing and deficient memory and attention; motor symptoms, such as a loss of fine motor control and behavioral changes, such as apathy or lethargy has been observed among HIV positive individuals (Zillmer, Spiers & Culbertson, 2008)

Grant (2008) has also highlighted that learning of new information, information processing speed, and/or attention, and different levels of interference in daily functioning is seen in HIV positive individuals. Furthermore, as HIV disease progresses, motor functioning, executive skills, and speed of information processing demonstrated the greatest decline

(Macllawaine, 2014). Therefore, the primary aim of this study was to find out the prevalence of neurocognitive deficits among the HIV negative and HIV positive children aged 7 to 12 years in Botswana.

1.2 Background

Approximately 200 million children born in low and middle-income countries do not reach their full cognitive potential (Grantham-McGregor, Cheung, Cueto, Glewwe, Ritcher & Strupp, 2007). According to Boivin (2002), the key risk factors that contribute to the neurocognitive deficits among children in low and middle income countries has been linked to both biological and psychosocial factors.

It is of significant importance to note that children in low and middle income countries face psychosocial risk factors which may contribute to the development of neurocognitive deficits (Fraser, 2014). These psychosocial factors include among others child education, maternal education, maternal depression, maternal sensitivity, nutrition as well as low cognitive stimulation (Mitchell, 2015).

In some of the studies done in Africa which looked at cognitive functioning in children with some of the above risk factors highlighted some deficits in attention, language, memory, visuospatial skills and executive functions (Boivin, 2002). Furthermore, as reported by Grantham-McGregor et al. (2007) the Sub-Saharan Africa has been reported to have the highest number of children at risk of neurocognitive deficits, with 61 percent of the children less than 5 years being stunted, living in poverty and in addition to all that, the burden of HIV/AIDS

Since the beginning of the HIV epidemic, almost seventy-eight million people have been infected and close to 39 million people having died of AIDS. At the end of the year 2013, it was reported that between 33.2 and 37.2 million people across the globe were living with HIV. HIV has hit Africa, especially the Sub Saharan Africa quite severely, with almost 1 in every 20 adults

living with HIV. The Sub Saharan Africa constitutes almost 71% of the people living with HIV worldwide (World Health Organisation, 2013).

HIV has been one of the major public health concerns in Botswana. It was estimated that 319, 750 out of a population of 2 million were living with HIV in 2013. Of the total population living with HIV, children aged 5 to 9 years have a prevalence rate of 6 percent, whereas those aged 10 to 14 years have a prevalence rate of 3.9 percent (National AIDS Coordinating Agency, 2014).

1.3 Problem Statement

Approximately 25 000 children (under 14 years) in Botswana are infected by HIV. Despite the overwhelming burden of HIV as well as neurocognitive deficits among children in Sub-Saharan Africa (World Health Organisation, 2013), there exists no data detailing the prevalence of these in Botswana. Furthermore, there exists no data surrounding psychological adjustment of the children and its relationship to neurocognitive deficits. Without such data appropriate interventions to improve the cognitive functioning of children with HIV to enable them to achieve their potential and therefore to grow into resourceful independent adults cannot be integrated into care. This study aims at providing data on the prevalence of neurocognitive deficits among HIV positive and HIV negative children as well as their psychosocial functioning in Botswana.

1.4 Research Question

What is the prevalence of neurocognitive deficits as well as the relationship between neurocognitive deficits and psychosocial adjustment among HIV positive children and how does this compare to HIV presumed negative children aged 7 to 12 years in Gaborone, Botswana?

1.5 General Objective

To assess the prevalence of neurocognitive deficits in relation to the psychosocial adjustment of children aged 7 to 12 years using the KABC-II and SDQ.

1.6 Specific Objectives

1. To assess the neurocognitive deficits in the HIV positive and HIV presumed negative children using the KABC-II.
2. To assess the psychosocial adjustment among the HIV positive and HIV presumed negative children using the SDQ tool.
3. To evaluate the relationship between neurocognitive deficits and psychosocial adjustment among HIV positive and HIV presumed negative children aged 7 to 12 years.

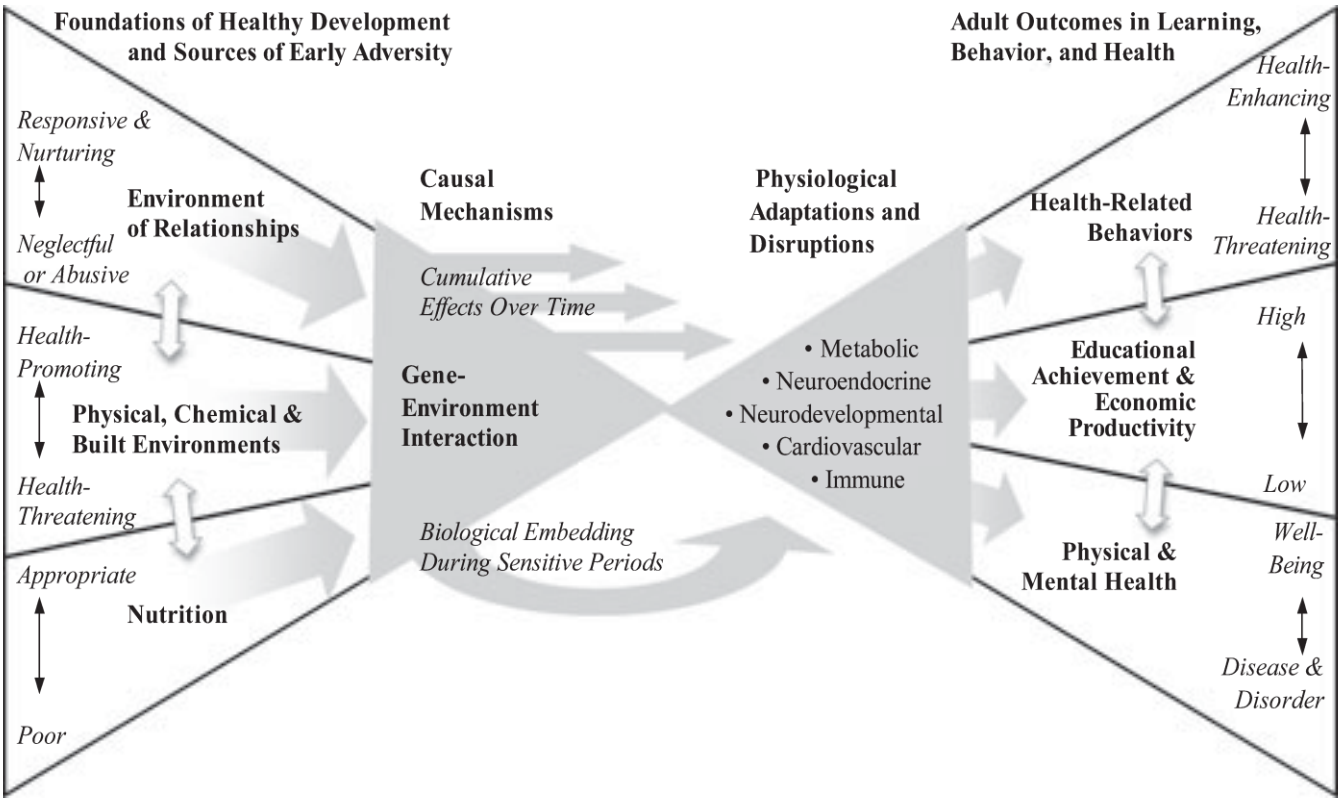
1.7 Significance and Justification of Study

Neurocognitive functioning in HIV positive children has been studied in the sub-Saharan Africa, including in South Africa (Fraser, 2014; Macllawaine, 2014). However, there are no studies that traced the relationship between neurocognitive functioning and psychological adjustments in Sub-Saharan Africa-Botswana included. Other studies were done using the SDQ, testing psychological adjustment of HIV negative children in school settings in South Africa (Mitchell, 2015); to test for effects of caregiver support (Casale, Clover, Phil, Cranshaws, Kuo et. al., 2015) and to investigate mental health outcomes for urban children (Cluver & Gardner, 2006). Nevertheless, these studies were not focused on exploring the relationship of the SDQ thus the psychosocial adjustment and neurocognitive deficits as measured by the KABC-II.

This study therefore aims at filling in the existing gap in literature on the prevalence of neurocognitive deficits among children aged 7 to 12 years in Gaborone, Botswana. Hopefully, the findings from this study will help inform health and education policy and advice on

intervention, rehabilitation and management programs aimed at promoting neurocognitive functioning and psychosocial adjustment of the 7 to 12 year old children in Botswana.

1.8 Theoretical Framework



Note: Model adapted from: Shonkoff, J. P. (2010).

The biodevelopmental framework above was developed by Shonkoff (2010). The model highlights the relationship between health, learning and behaviour. In this study, this model is used to explain the influences of health, learning and behavior on neurocognitive functioning of children.

The basic elements of the biodevelopmental framework presented above incorporate three sets of target domains: (a) interactions among foundations of healthy development and

sources of early adversity, (b) measures of physiological adaptation and disruption, and (c) both positive and negative outcomes in learning, behaviour, and health (Shonkoff, 2010).

The first target area is the environment of relationships in which a child develops. This area explores attention given to the child including nurturing, responsive caregiving to neglectful or abusive interactions. Both the family and nonfamily members act as important sources of stable and growth-promoting relationships as well as protectors against significant threats to healthy development. In order to understand the importance and relevance of the family in influencing neurocognitive development, including potential neurocognitive deficits of the child, this study incorporates questions surrounding education and income of the family.

As stated by Shonkoff (2010) the second target area is the physical, chemical, and built environments in which the child and family live. The second set of domains in the proposed framework includes a variety of physiological responses that mediates biological variables (Shonkoff, 2010). This study explores HIV infection as a potential risk factor in the prevalence of neurocognitive deficits among children.

According to Shonkoff (2010) the third set of target domains includes adult outcomes in educational achievement and economic productivity (high vs. low). Children with mothers who had low level or no education were found to be three times more likely to be prone to neurocognitive deficits than those of mothers with high level of education (Boyede, Lesi, Ezeaka & Umeh, 2013). In this study the mother's educational level is explored in the socio-demographic questionnaire.

In this study, Luria's neuropsychological theory of processing is used to interpret the children's scores. Therefore, the focus of the results will be more on mental processing and less emphasis will be placed on the acquired knowledge. In the end the global score called the Mental

Processing Index (MPI) will be produced. MPI refers to the general ability to think abstractly, solve problems, identify patterns and understand relationships (King, 2012).

The Luria model produces four index scores and does not include a measure of general knowledge (Mitchell, 2015). The four index scores that will be included for the 7 to 12 years age group in this study will be: sequential processing scale, simultaneous processing scale, learning ability as well as planning ability. According to this model acquired knowledge is considered to "lie outside" the realm of mental processing. The general belief is that general knowledge has more to do with life experiences than it does with cognitive ability (King, 2012). The Luria model includes eight to ten subsets, depending on the age of the child. These subsets are atlantis, story completion, number recall, rover, atlantis delayed, rebus, triangles, word order and rebus delayed.

CHAPTER 2: LITERATURE REVIEW

2.1 Neurodevelopmental Milestones of Children

Neurocognitive functions are important in a diverse range of ways. It has been argued that neurocognitive functioning allows for the initial acquisitions of competencies for everyday life. Again, it has been reported that cognitive development in pre-schoolers is predictive of later school achievement including the 7 to 12 year olds (Engle, 2010). Zillmer, Spiers and Culbertson (2008) argued that between the ages 7 and 9 years, there is growth in the development of the frontal lobes in children which control higher cognitive functions including planning, coordination, sequencing and self regulation.

Children therefore require fully effective neurocognition as it is in their childhood years that they develop a wide range of skills including motor, sensory, verbal, visuospatial, attention, reasoning and executive functioning skills to become competent in adulthood (Zillmer, Spiers & Culbertson, 2008).

After these everyday functions are acquired, they become automated in the child hence the child becomes independent in neurocognitive functioning (Tucker-Drob, 2011). However, any impairment or disturbance of neurodevelopment in a child could lead to potential neurocognitive deficit that will make the child to perform everyday functions at a lower neurodevelopmental milestone expectation. Among children aged 7-12 years, there exist several different neurodevelopmental milestones which are highlighted in the paragraph below.

Between the ages of the 7 and 10, children develop gross motor skills that allow them to have balance in sporting and other physical activities, including control of speed when running (King, 2012). At the ages 10 to 12 years, children develop strength for games with increased skill and stamina such as in tennis sports. With regard to fine motor skills, children aged between 7

and 10 years are able to write in script as well as play a musical instrument. On the other hand, children aged between 10 and 12 years are manually dexterous and they write well.

With regards to their cognitive development, children between the ages 7 and 10 years begin to understand logical reasoning; they are able to write relatively fast for a good length of time (King, 2012). Children aged between 10 and 12 years are able to understand the relational terms such as weight and size. They are also able to consider all aspects of situations and may understand abstract concepts. Again they tend to enjoy discussions and debates (King, 2012).

Looking at the linguistic development of children aged between 7 and 10, they are able to express themselves clearly and fluently, they can reason and participate in discussions and they can also read a wide range of books by themselves. At the ages between 10 and 12 years, children are able to perform verbal formal reasoning and can discuss a wide range of topics with knowledge and understanding (King, 2012).

2.2 Risk Factors of Neurocognitive Development

Grandjean and Landrigan (2006) highlighted some important factors which interact to determine the outcome of the neurodevelopmental process in the child. The socio-cultural factors that can impair neurocognitive development include nutrition, prenatal care, education, access to healthcare, maternal IQ, ethnicity, gender, culture, support networks and quality of child rearing.

Over years, it has been reported that over 780 million of children living in low as well as middle countries do not fulfil their cognitive potential (Mitchell, 2015). Walker, Wachs, Gardener et al. (2007) reported that stunting, inadequate cognitive stimulation, iodine deficiency and iron deficiency anaemia as the four main risk factors for the neurocognitive deficits. Other reported factors that contribute to neurocognitive deficits include infectious diseases such as HIV (Zillmer, Spiers & Culbertson, 2008).

It has also been reported that early interventions could assist in reducing the effects of the risk factors on predisposed children's cognitive efficiency and development (Bland, Coovadia, Coutsodis, Rollins, & Newell, 2010).

However, as stated by Holding and Kitsao-Wekulo (2004) it is important to validate or develop appropriate test to accurately determine the prevalence of neurocognitive deficits among African children and ensure that the test are measuring what they have been purposed to measure. Using or developing appropriate tests may assist in convincing relevant authorities to carry out interventions as well as to effectively monitor the effects of these interventions (Bangirana, Idro, John & Boivin, 2006).

2.3 Risk Factors associated to Neurocognitive Impairment

A substantial amount of evidence has suggested that various risk factors play important role in neurocognitive outcomes of children. These factors include nutritional resources, physical development, duration of schooling, parental education, parental occupation, family income, quality of the home environment indicators including parental interaction, provision of stimulation as well as early education affect cognition in children as highlighted by Bangirana et al. (2009).

According to Bangirana et al. (2009) the above psychosocial factors differ in how they influence neurocognition. Stated simply, there are those psychosocial factors which are indirectly experienced (distal variable) such as maternal education and those that are directly experienced by the child (proximal variables) such as nutrition and parental interaction.

2.3.1 Low Educational Background of Caregiver

Education has been reported to increase an individual's sense of personal control and self esteem and these factors have been shown to influence better health behaviour (Macllawaine, 2014). More or higher education has been linked to acquiring better jobs, higher income, higher socio-economic status, better health care access and housing as well as better lifestyle, nutrition and physical activity (Florence et al., 2008).

Children of mothers with low level or no education increase the negative impact associated with HIV. These are three times more likely to be prone to neurocognitive deficits than those of mothers with high level of education (Boyede, Lesi, Ezeaka & Umeh, 2013). The reason is that educated mothers provide cognitive stimulating experiences which have contributing effect on the cognitive development of the child.

2.3.2 Low Economic Status

Loughan and Perna (2012) stated that poor children were twice as likely to have repeated a grade, to have been expelled or suspended from school, or to have dropped out of high school. Poor children were also 1.4 times as likely to be identified as having a learning disability in elementary or high school than the non-poor children.

Data was collected on 65 children educated in the public school system, who were from low socioeconomic households (Loughan & Perna, 2012). As Loughan and Perna stated, children facing the challenges of poverty and neglect highlighted below average scores across measures of intellect, academic ability, memory and executive functioning and had a higher incidence of all diagnoses investigated, with 100 percent of this sample being subsequently diagnosed with an emotional or behavioural disorder.

The children with a history of poverty and neglect were more likely to be diagnosed with developmental delay (60 percent compared to 10 to 20 percent), Attention Deficit-Hyperactivity Disorder (ADHD) thus (80 percent compared to 3 to 7 percent), and Learning Disability (LD) was at 8 percent compared to 5 percent. Furthermore, 100 percent of this sample had emotional/behavioural disorders, compared to 46 percent of the general population. Again, 56 percent of the children had IQ scores which were below average. Thirty-three to 52 percent of the sample had below average academic ability, 36 to 55 percent demonstrated below average memory testing whereas 36 to 47 percent had below average executive functioning (Loughan & Perna, 2012).

2.3.3 Poor Home Environment

A large number of studies on neurocognitive functioning of children with poor home environments or those who have been neglected suggest possible sequelae, including compromised psychosocial functioning and psychopathology, brain dysfunction and cognitive deficits including impaired executive functioning, attention, processing speed, language, memory and social skills (De Bellis, 2005; Macllawaine, 2014).

2.3.4 Psychological Problems in the Child's Environment

A wide range of psychosocial factors may contribute to children experiencing psychological problems and toxic stress. A study by Laughton, Cornell, Boivin and Van Rie (2013) posited that there is a positive relationship between psychological problem and neurocognitive functioning. To add on to the above statement, Salama et al. (2013) found that depressive symptoms, conduct disorder problems were directly associated with poor coping skills and poor neuropsychological functioning. Additionally, as asserted by Busman, et al.,

(2013), children with HIV may also suffer from disruption in attention and concentration, and severe social withdrawal.

To assess childhood psychological problems in schools settings, the SDQ has been used in South Africa (Mitchell, 2015). In this study, a total of 1, 025 children were assessed. Teachers identified high levels of behavioural and emotional problems (41%). Children reported lower but substantial rates of anxiety/depression (14%). Again, children reported significant post-traumatic stress symptoms (24%). Lastly, almost a quarter felt unsafe in school. Risk factors included being a second-generation former refugee. Protective factors highlighted maternal factors including being more educated and in stable partnership (Mitchell, 2015).

Another study that made use of the SDQ questionnaire was done, still in South Africa. Casale, Clover, Phil, Cranshaws, Kuo et. al (2015) conducted a research that was aimed as assessing the direct and indirect effects of caregiver support in adolescent psychological outcomes. This study was conducted among 2477 adolescent – caregiver dyads at KwaZulu Natal. Adolescent children who were female or orphaned reported more emotional problems whereas adolescents with older caregivers had fewer conduct problems. Additionally, lower household socioeconomic status was associated with more adolescent peer problems and less pro-social behaviour.

Still in South Africa, Cluver and Gardner (2006) aimed to investigate mental health outcomes for urban children aged 6 to 19 living in deprived settlements in Cape Town. 30 orphaned children and 30 matched controls were compared using SDQ on emotional and behavioural problems, peer and attention difficulties, and pro-social behaviour. Both groups scored highly for peer problems, emotional problems and total scores. However, orphans were more likely to view themselves as having no good friends ($p = 0.002$), to have marked

concentration difficulties (p = 0.03), and to report frequent somatic symptoms (p = 0.05), but were less likely to display anger through loss of temper (p = 0.03) (Cluver & Gardener, 2006).

2.4 Hypothesis

1. Children who are HIV positive are more likely to score lower in the KABC-II than children who are HIV negative.

2. Children who have a high total difficulties score SDQ are more likely to perform low on the KABC-II. (SDQ High score =17+).

3. Children who have higher pro-social behaviour scores in the SDQ are more likely to perform higher in the KABC-II.

CHAPTER 3: METHODOLOGY

3.1 Study Design

This is a comparative study, among Batswana children aged between 7 to 12 years. The HIV presumed negative children were selected from a local primary school called Ben Thema primary school. It should be noted that the children from Ben Thema primary school are identified as HIV presumed as the only source of information that was used to validate their HIV status was the parent/caregiver, no HIV test was done to ascertain these children's HIV status.

The researcher recruited a sample of children living with HIV at a local Baylor Children's Clinic. Both the school and the children's clinic are based in one location, Gaborone. For a complete session of one child involving all the 3 tools (KABC-II, SDQ and socio-demographic questionnaire), the assessment process took approximately 1 hour 15 minutes in total, taking into account, 15 minutes breaks in between and other participant factors like psychological state and age. However, most children took between 30 minutes and 75 minutes to complete the KABC-II assessment. It took parents and teachers 15 minutes to complete the SDQ and another 15 minutes for parents to complete the socio-demographic questionnaire.

Inclusion and exclusion criteria

HIV positive children-Baylor Children's Clinic

- Children aged 7 to 12 years (Which was confirmed at the Baylor Children's Clinic registration file).
- The children had to be attending Baylor children's clinic (which was confirmed at the Baylor Children's Clinic registration file).
- The children had to be HIV positive (which was confirmed at the Baylor Children's Clinic registration file).

Exclusion criteria

- Children who are not HIV positive (as confirmed by Baylor Children's Clinic) but attending clinic for other chronic condition not known or known to the parent/child.
- Children who had any obvious mental retardation including any significant psychiatric and neurological illness (as confirmed by the clinic records) were excluded from the study.
- Children whose parents/guardian did not agree to give consent or if the child did not give assent were excluded from the study.

Comparative group: Children from Ben Thema primary school

- Children aged 7 to 12 years (which was confirmed in the Ben Thema registration file).
- Attending Ben Thema primary school (which was confirmed by the Ben Thema registration file).
- The children had to be presumed to be HIV negative based on the report from the consenting parent/caregiver.

Exclusion Criteria

- Children who are known to be HIV positive (as confirmed by the parent/guardian) or attending clinic for any chronic condition were also excluded.
- Children who have any obvious mental retardation including any significant psychiatric and neurological illness (as confirmed by the school records) were excluded from the study.
- Children whose parents/guardian did not give consent or if the child did not give assent were excluded from the study**.**

In order to ensure that the children who expressed interest in the study do not feel discriminated or marginalized (by not fitting in the inclusion and exclusion criteria above), all children who expressed interest in the study were assessed. However, in the analysis, the assessment scores of such children were not included.

3.2 Study Setting

The study was conducted at Ben Thema primary school in Gaborone, Botswana. Ben Thema is a local, public school located in Gaborone, Botswana. Children are admitted into this school for primary education from standard 1 until standard 7. School operates from 7:30am until 4:30pm on weekdays only. Baylor Children's Clinic which is another study area is located in Gaborone, Botswana. This is an outpatient clinic that serves all local children and adolescents who have been infected with HIV in Gaborone. The clinic runs from Monday to Saturday.

3.3 Participants

Participants in this study were mainly HIV presumed negative children aged 7 to 12 years studying at Ben Thema primary school as well as HIV positive children aged 7 to 12 year old attending the Baylor children's clinic. Other participants in this study were parents/caregivers of the children at Baylor Children's Clinic and the parents/caregivers and teachers of the children at Ben Thema primary school. There was a total of 97 primary participants; 62 (HIV presumed negative children) and 35 (HIV positive children).

3.4 Sample Size Determination

HIV positive children and HIV presumed negative children were considered as comparative groups – and matched on the background characteristics (gender and age). The sample size for was calculated using a formula cited in Sheetz (2014):

$$n = \frac{2\,\delta^2\left(z_{\frac{\alpha}{2}} + z_\beta\right)^2}{(\mu_1 - \mu_2)^2}$$

Where;

n – is the sample size in each arm

$\mu_1 - \mu_2$ – Clinically meaningful effect size of neurocognitive deficits between HIV positive and HIV negative children.

δ – is the standard deviation of the anticipated effect size.

$z_{\frac{\alpha}{2}}$ - corresponds to two tailed significance level (1.96 for $\alpha = 5\%$)

z_β – corresponds to power of 80%.

In this study, an effect size of 1.0 derived using pro-social subscale[1] of SDQ in Cluver (2012) between HIV negative and positive orphaned children, and pooled standard deviation of 2.05 in the difference of mean scores in pro-social measurements, together with a significance level of 5% and a power of 80% are used. These result in a total sample size of:

$$\frac{2(2)\ (12.84)^2(1.96\ +\ 0.84)^2}{(6.2)^2} = 132\ (66\ in\ each\ arm)$$

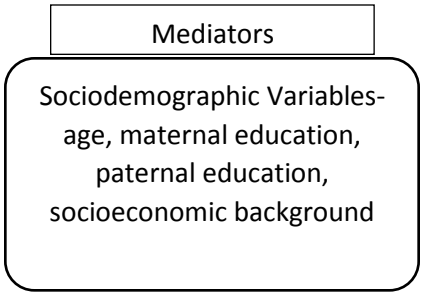
This subscale was selected as it resulted in the largest standardised mean difference among the five SDQ subscales.

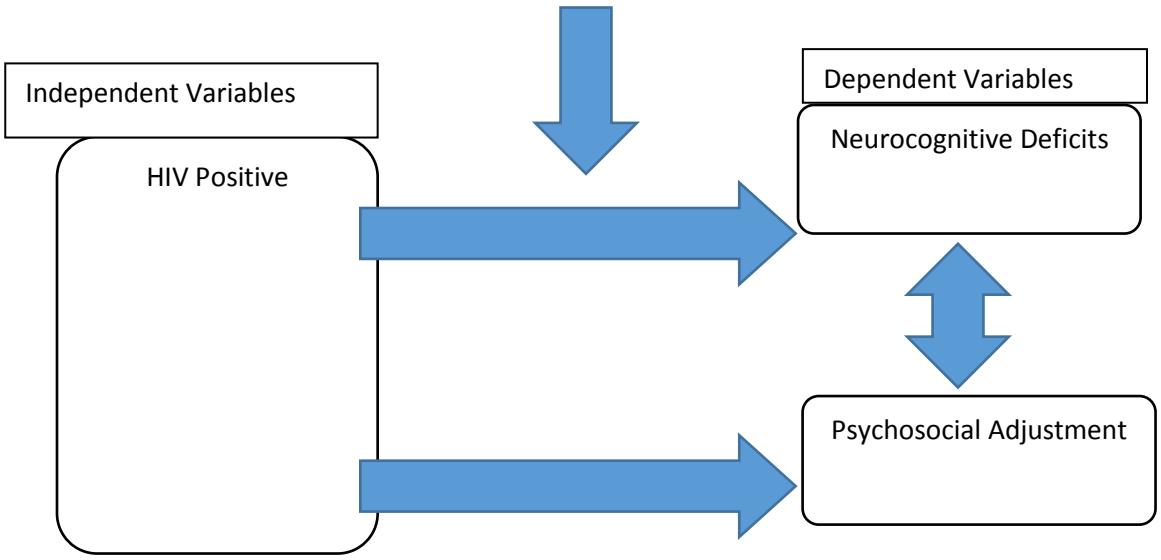
3.5 Variables: Dependent, Independent and Mediators

The independent variable in this study is being HIV positive. The dependent variables are the neurocognitive deficits as measured by the KABC-II and the psychosocial adjustment measured using the SDQ. The socio-demographic data are the mediators in this variables interaction. In this study, neurocognitive deficits and psychosocial adjustment of children were hypothesized to depend on the HIV status of the children.

Neurocognitive domains measured in children include *learning ability, short term and long term memory, storage and retrieval as well as planning (fluid reasoning)* using KABC-II battery. Psychosocial adjustment includes *emotional symptoms, conduct problems, hyperactivity / inattention, peer relationship problems and pro-social behaviour* measured using the SDQ. The mediators are the socio-demographic variables which include *age, gender, home environment, school environment, paternal and maternal education.*

Flow Chart A: The interaction of study variables





3.6 Sampling Method

The type of sampling technique that the researcher used is stratified sampling. As stated by Newman (2000), stratified sampling allows each member of the targeted population subset or strata an equal probability of being selected for the study. From the institution's database children aged 7 to 12 years were divided according to gender, assigned numbers 1 - 4 then each even numbered participant recruited into the study. The two groups of HIV positive children and HIV presumed negative children were considered as comparative groups.

3.7 Piloting

A pretest of the KABC-II and SDQ was carried out in order to identify elements that may not be well understood by respondents and problems that may be encountered during the main study. The piloting was carried out among randomly selected 20 children at both Ben Thema primary schools as well as at Baylor Children's Clinic. The pilot process aided in identifying the misunderstood content in both the KABC-II and SDQ to the Botswana children population. With

results from the pretest, statistical analysis was done to highlight items that may be biased. This analysis was of use in improving the content validity of the KABC-II and SDQ tools. Additionally, two raters reviewed the results of the pretest in order to improve interrater validity as well as minimize response bias of the participants.

3.8 Recruitment Process and Consenting Procedures

Children who attend Ben Thema primary school who fitted the inclusion criteria were recruited via a stratified mode. In Ben Thema primary school, the children were narrowed down to the age group 7- 12 years old from the institution's registration file. The children were assigned numbers 1 - 4 then each even numbered child was recruited into the study.

Recruitment of participants was done on a daily basis by the researcher. There was no research team as only the researcher was responsible for all the administrations. The researcher cross checked the contact number of the parent or caregiver responsible for the child in the school records. Following that, the researcher contacted the confirmed parent/caregiver, introduced herself and provided the parent/caregiver with a description of the research. The information on the inclusion and exclusion criteria including the HIV status of the child was captured. The parent/guardian was also asked about the status of the child.

If the child did not fit the inclusion criteria, they were excused from participating in the study and if the child fitted the inclusion criteria, the parent/guardian was invited to consent to the study in writing. This was followed by an invitation to allow the child to assent to participate in the study. Both the child and the parent were informed that they were not forced to participate and there were no penalties attached to refusing participation with the researcher and the school.

If the parent or guardian provided consent for the child's participation they were given a consent document to read in their preferred language of choice (*see appendices b and d*),

thereafter if they had no questions or after their questions were answered to their satisfaction they were given two copies of informed consent form to sign in the language of their choice, the other copy was given to the participant to keep. All parental consents were in written form only.

For children who did not know how to sign, they wrote an X, in the space where they were supposed to sign (*see appendices c and e*). At Ben Thema primary school, after consent forms and assent forms were signed, the researcher administered a socio-demographic questionnaire to the parent, which took approximately 15 minutes to complete followed by a KABC-II tool to the child which took approximately 75 minutes. The child was given up to a total of 15 minutes breaks in between so as to minimise fatigue.

Upon completion of the KABC-II, the participant was given yoghurt or a packet of chips. Following the administration of the KABC-II to the child, the researcher administered the SDQ to the teacher and this took approximately 15 minutes to complete the administration. The whole process of administering the 3 tools took approximately 2 hours, with up to 15 minutes breaks in between.

For the HIV positive children attending Baylor Children's Clinic who fit the inclusion criteria, the researcher cross checked the contact number of the parent or caregiver responsible for the child in the clinic records. Following this, the researcher privately and confidentially called the confirmed parent/caregiver. The researcher introduced herself and provided the parent/caregiver with a description of the research followed by an invitation to allow the child to participate in the study. Both the child and the parent/caregiver were informed that they were not forced to participate and there were no penalties attached to refusing participation with the researcher and the clinic.

If the parent or guardian provided consent for the child's participation they were given a consent document to read in their preferred language of choice (*see appendices b and d*), thereafter if they had no questions or after their questions were answered to their satisfaction they were given two copies of informed consent form to sign in the language of their choice, the other copy was given to the participant to keep.

After consent forms were signed, the child was informed in detail about the study and was asked to voluntarily participate in the study. An overview of the study was given and the child was told what their involvement would entail. They were assured that all information obtained during the study will be treated as confidential. The child was read the assent form and asked to sign.

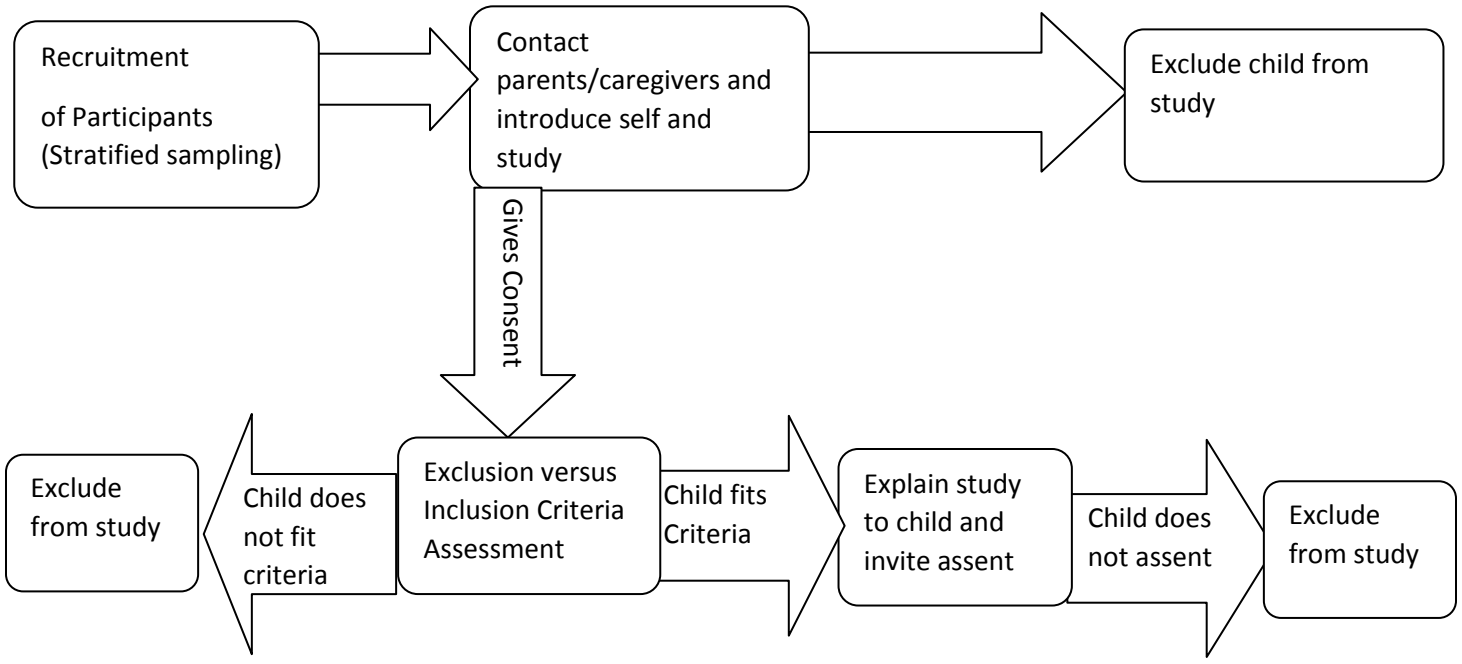
For children who did not know how to sign, they wrote an X, in the space where they were supposed to sign (*see appendices c and e*). The total length of the tool administration was approximately between 30 minutes and 75 minutes. Details pertaining to health status, home environment and school environment were taken before the administration of the tools via a socio-demographic questionnaire which took approximately 15 minutes to complete and was administered to the caregiver by the researcher at Baylor Children's Clinic.

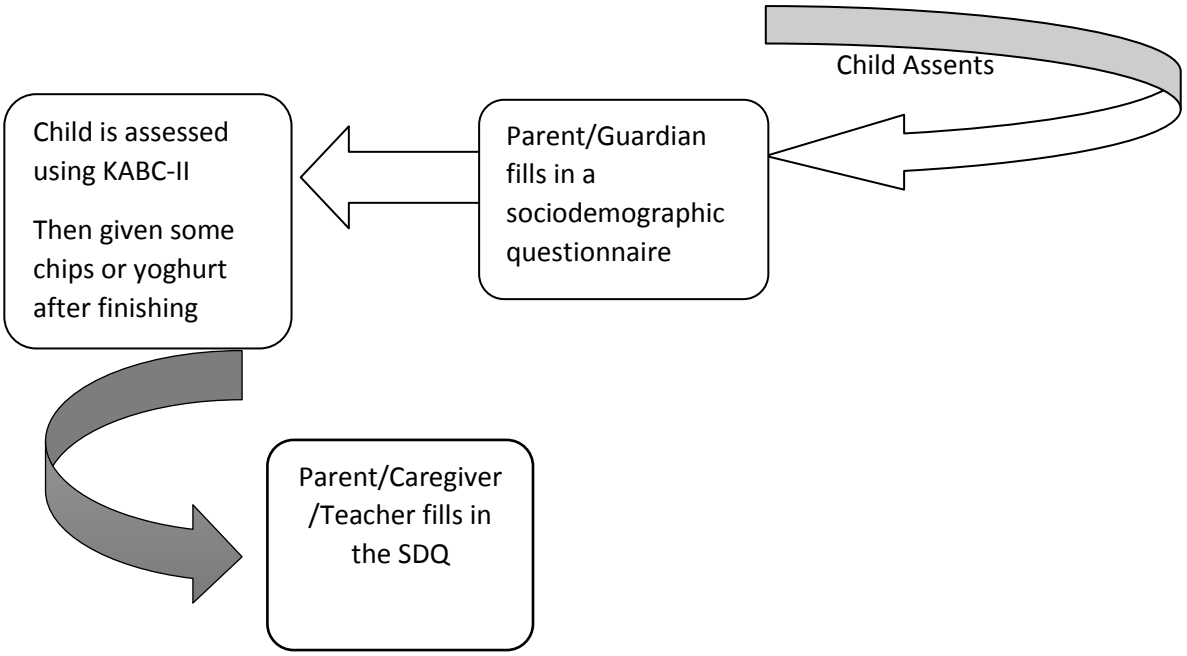
Following the parent/caregiver answering the sociodemographic questionnaire, the KABC-II tool was administered to the child, still at Baylor Children's Clinic. The KABC-II administration took approximately 75 minutes for the child to complete. The child was given a total of up to 15 minutes breaks in between so as to minimise fatigue.

Upon completion of the KABC-II, the participant was given yoghurt or a packet of chips. Following the administration of the KABC-II to the child, the researcher administered the SDQ to the parent and this took approximately 15 minutes to complete the administration. The

whole process of administering the 3 tools took approximately 2 hours, with a total of up to 15 minutes breaks in between.

Flow chart 2: Recruitment process and consenting procedure





3.9 Data Collection Instruments

Data collection and instruments included three tools: A socio-demographic questionnaire for caregivers, KABC-II and the SDQ (*see appendices f and g*).

3.9.1 Socio-demographic Questionnaire for Caregivers

A socio-demographic questionnaire was created and included demographic information on age, gender, school environment, home environment, socioeconomic status, paternal and maternal education (*see appendix f*). The sociodemographic questionnaires were filled in by parents/caregivers with the researcher administering it. The administration period took approximately 15 minutes.

3.9.2 Strengths and Difficulties Questionnaire (SDQ)

The ***Strengths and Difficulties Questionnaire*** (***SDQ***) is a mental health screening tool for use with children and adolescents (*see appendix g*). It is a brief screening questionnaire on the psychosocial adjustment of 2-17 year olds. It exists in several versions to meet the needs of researchers, clinicians and educationalists. Each version could be answered by either a parent/caregiver or a teacher. At Baylor Children's Clinic, parent/caregiver answered the SDQ as they were readily available since they had accompanied the child to the clinic. At Ben Thema primary school, the teacher answered the SDQ as they were readily available and in class with the child.

The ***SDQ*** asked about 25 attributes, some positive and others negative. According to Cluver and Gardner (2006), these 25 items are divided between 5 scales: emotional symptoms (5 items), conduct problems (5 items), hyperactivity/inattention (5 items), peer relationship problems (5 items), pro-social behaviour (5 items).

This instrument was chosen as it has been used among some vulnerable children population including the orphaned as well as the poor children in Southern Africa, specifically South Africa. It has evidenced good reliability and predictive validity among the children populations studied (Cluver & Gardner, 2006).

3.9.3 Kaufmann Assessment Battery for Children –Second Edition (KABC-II)

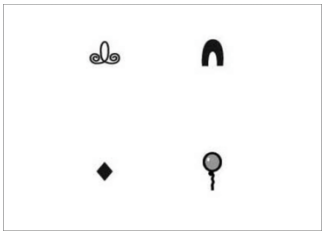
In assessing the neurocognitive deficits among children in this study, the Kaufman Assessment Battery for Children-Second Edition (KABC-II) was used. As stated by Kaufman and Kaufman (2004) the KABC-II is a standardized test that assesses intelligence and achievement in children aged three years to eighteen years. KABC-II was chosen for this study

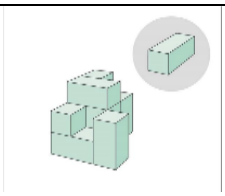
because it has been adapted and validated in a wide range of settings including in Kenya, Congo, Malawi and Uganda (Bagenda et al., 2004; Bangirana et al., 2009).

This battery test has been used in low middle income countries such as South Africa and Malawi and it has proven to be a culturally fair test (Mitchell, 2015). According to Bangirana et al. (2009) the KABC-II has demonstrated good construct and predictive validity. The KABC-II consists of 18 subsets of two types which are the core and the supplementary subtests. In this study only the core subtypes which included; atlantis, story completion, number recall, rover, atlantis delayed, rebus, word order and rebus delayed were assessed. Depending on the model of interpretation choice and the age of the child, the subsets are grouped into 4 or 5 scales. This study followed the Luria's model which is made up of four scales which are sequential processing scale, simultaneous processing scale, learning ability and planning ability (McKown, 2010).

Table 1: KABC-II Core Battery Index Scales-Ages 7-18

Index Scale	7-18

Learning	Atlantis The assessor teaches the child nonsense names for pictures of fish, shells and plants. The child then has to point to the correct picture, when the assessor read out the nonsense name. Rebus The assessor helps the child to learn pictures with their labels. The assessor then introduces pictures alone and asks the child to label each picture. 
Simultaneous	Rover The child moves a toy dog to a bone on a grid that contains several obstacles trying to find the quickest path to the bone. Block Counting The child has to say the number of blocks they have counted, as in the picture below.

	
Sequential	Word Order The assessor reads the names of common objects, the child then touches a series of silhouettes of these objects in the same order they were read out in. Number Recall The assessor reads a string of numbers to the child. The child repeats the sting of numbers in the same order as they have been read out in.
Planning	Pattern Reasoning The child is shown a series of stimulus that form a logical linear pattern with one stimulus missing. The chid selects the missing stimulus from several options.

	Story Completion The child is shown a row of pieces that tell a story. Some pictures are missing. The child selects several pictures needed to complete the story from a selection. The child places the pictures in the correct location to complete the story.

The KABC-II administration was done by the researcher. The administration period for the KABC-II lasted between 30 minutes and 75 minutes, with a total of up to 15 minutes breaks in between to minimize fatigue.

3.10 Data Storage Protection

All research materials including informed consent and assent forms, SDQ, researcher designed socio-demographic questionnaires and KABC-II answer sheet and results were kept safe by locking them in a safe box. Soft copies in the computer devices were password protected.

3.11 Data Analysis

The statistical analyses regarding neurocognitive functioning were obtained by using the computer program Statistical Package for Social Sciences (SPSS) 20.0. The data was entered into the SPSS 20.0. Measures of central tendency and measures of dispersion were used to analyse the data and present prevalence of neurocognitive deficits. A p value of < 0.05 was used as statistically significant. The researcher tested for the normality of the distribution and based on that ran bivariate analyses using Standard Deviation and Confidence Intervals. Since it was expected that the effect of age will make a difference in the analyses, between the groups, age

was tested as a covariate. An independent samples t-test was used to measure the differences in cognitive functioning between HIV positive children and HIV presumed negative children.

Relative Risk Ratio was used to compare the difference between SDQ total difficulties score with Mental Processing Index of the KABC-II scores. The outcome variable of KABC-II scores were dichotomised to lower extreme, below average, average, above average and upper extreme. Multi-variable regression was performed to determine the sociodemographic risk factors and psychological adjustment related risk factors that impact neurocognitive outcomes in the HIV positive and HIV presumed negative children. The analysed data was presented in summarized regression tables, and the profiles of the HIV positive and HIV presumed negative children were compared on graphs.

3.12 Ethical Procedures

The researcher submitted the research proposal to the relevant Institutional Review Boards in Kenya and Botswana. Additionally, permission to conduct the study was obtained from both study sites in Ben Thema primary school and Baylor children's clinic. Authorities in the study sites were informed of the study and its purpose. The interviews were carried out in private, in a specified room within the research site with only the child and researcher present and the teacher or caregiver where needed.

At Baylor children's clinic, participants found to be distressed received free psychological support with the assistance of clinical or counselling psychologists who are in attendance at the clinic. Whereas at Ben Thema primary school, distressed participants were attended to by the guidance and counselling teacher.

3.12.1Institutional Review Bodies

This research proposal was submitted to the Department of Psychiatry, University of Nairobi to seek ethical clearance from the Kenyatta National hospital / University of Nairobi Research and ethics Committee. Additionally, the proposal was submitted to the Ministry of Health and Ministry of Education, Botswana ethics board for ethics clearance to conduct the study in Botswana.

3.12.2 Recruitment and Consenting Process

Participation into this study was on voluntary basis. There was no form of penalty against those who do not wish to consent or assent to participate. The interested participants were given a detailed explanation of what the study entails and what their role was in this study. Those who wanted to participate were given consent and assent forms to sign in preferred choice of language (*see appendices b, c, d and e*).

3.12.3 Confidentiality

Participants were assured that the data would be kept confidential and will only be used for research purposes (*see appendices b, c, d and e*). The research study maintained the anonymity of the participants. There were no personal identifiers and this ensured that no participant can be traced.

3.12.4 Compensation for participants

The children who participated in this study were provided with light refreshments in the form of yoghurt or a packet of chips.

3.12.5 Study risks

Since the SDQ are psychosocial interviews which explored personal, social and psychological life, a few of the participants in this study were left distressed by such questions. To try and compensate for the distress, the researcher made appropriate referrals and arrangements for the child and parent/guardian to get counselling from the guidance and counselling teacher in the school or a counselling or clinical psychologist at the children's clinic. Lastly, if the participants performed badly on KABC-II, the school was alerted for further assessment and proper referrals to aid the participant.

3.12.6 Dissemination of Results

The results of the study were shared with University of Nairobi, KNH-mental health department and department of psychiatry; school of medicine, Ministry of Health and Education as well as Ministry of Youth, Sports and Culture in Botswana. Other influential departments, schools, health care, organisations and parties will also be presented with the results upon necessity, interest or request.

3.13 Research Work Plan

The table below depicts the research time frame:

Table 2: Research Time-Frame

Activity	Time Frame
Development of proposal and defence presentation	August-October 2016
Proposal submission for ethical approval	December 2016
Data collection	March 2017
Data analysis	June 2017

Report writing	August 2017
Results presentation	August 2017
Submission of report	September 2017

CHAPTER 4: RESULTS

A total of 35 HIV positive children and 62 HIV presumed negative children were recruited in the study. The mean age of HIV positive children was 9.5 years (±2.1) compared to 9.7 years (± 1.9) among the HIV presumed negative children. At Baylor Children's Clinic, a total of 91 children were eligible for the study, as they were HIV positive and were aged between 7 and 12 years. From this total, 49 children were not recruited because: 38 children could not be reached as they were not booked for appointment at the Clinic during the data collection period and some parents of 11 children did not consent. Three children who wanted to participate but did not meet the inclusion criteria were assessed but the data was not analysed.

At Ben Thema primary school, 80 children met the inclusion criteria, however, 9 parents did not consent for their children to be part of the study. Another 7 children who wanted to participate but did not meet inclusion criteria were assessed but their results were not included in the data analysis as they were below 7 years (3 children) and above 12 years (4 children). An additional 2 children were excluded from the data analysis as they were reported to be HIV positive by their parents. In this study males accounted for 48.6% and 46.8% of HIV positive children and HIV presumed negative children, respectively ($p = 0.877$).

The mother of the participating child was the primary caregiver among 60% of the HIV positive children and 67.7% of the HIV presumed negative children. Relatives were more likely to be primary care givers among HIV positive children (25.7%) compared to HIV presumed negative children (1.6%), RR 2.7; 95% CI 1.8-4.06). HIV positive children were more likely to report that the mother was alive (93.5% versus 85.7%), although this difference was not significant. Most fathers of both the HIV positive children (71.4%) and HIV presumed negative children (91.9%) were alive.

Table 1: Demographics of child and caregiver characteristics in both HIV positive and HIV presumed negative participants

	HIV positive	**HIV negative**	**RR (95% CI)**	**P**
Age				
6-8 years	14(40.0)	20(32.3)	1.0	
9-11 years	13(37.1)	28(45.2)	0.77(0.42-1.41)	0.398
12-13 years	8(22.9)	14(22.6)	0.88(0.44-1.76)	0.723
Sex				
Male	17(48.6)	29(46.8)	1.0	
Female	17(48.6)	31(50.0)	0.96(0.56-1.64)	0.877
Primary caregiver				
Mother	21(60.0)	42(67.7)	1.0	
Other nuclear family (father/ sibling)	4(11.4)	15(24.2)	0.63(0.25-1.62)	0.34
Relative	9(25.7)	1(1.6)	2.70(1.80-4.06)	<0.001
Child's mother alive				
Yes	30(85.7)	58(93.5)	1	
No	5(14.3)	4(6.5)	1.63(0.85-3.14)	0.145
Father's child alive				
Yes	25(71.4)	57(91.9)	1	
No	5(14.3)	5(8.1)	1.64(0.81-3.32)	0.169

At least one half of mothers of both HIV positive children (68.6%) and HIV presumed negative children (54.8%) were single (Table 2). Mothers of the HIV presumed negative children were more likely to have attained higher education (45.2% had tertiary level education) compared to those of the HIV positive children (11.4% had tertiary education), $P < 0.001$. Similarly, for paternal education, the fathers of the HIV presumed negative children were more likely to report tertiary level education compared to those of the HIV positive children (58.1% versus 22.9%, RR 0.34; 0.15-0.76, $p = 0.008$). Maternal and paternal marital status did not show significant differences between HIV positive children and HIV presumed negative children (Table 2).

Table 2: Parental marital status, and education level according to HIV status of participating children

	HIV positive	**HIV negative**	**RR (95% CI)**	**P**
Maternal marital status				
Single	24(68.6)	34(54.8)	1	
Married	4(11.4)	22(35.5)	0.37(0.14-0.97)	0.043
Widowed	0(0.0)	2(3.2)	NA	NA
Separated	2(5.7)	1(1.6)	1.61(0.68-3.81)	0.278
Cohabiting	0(0.0)	2(3.2)	-	-
Paternal marital status				
Single	20(57.1)	26(41.9)	1	
Married	7(20.0)	28(45.2)	0.46(0.22-0.97)	0.041
Separated	1(2.9)	1(1.6)	1.15(0.27-4.82)	0.848

Cohabiting	0(0.0)	4(6.5)	-	-
Maternal education level				
Primary education and below	6(17.1)	1(1.6)	1	
Didn't complete secondary school	12(34.3)	4(6.5)	0.87(0.58-1.33)	0.53
Completed secondary but didn't attend post-secondary training	11(31.4)	29(46.8)	0.32(0.18-0.58)	<0.001
Tertiary training	4(11.4)	28(45.2)	0.15(0.06-0.38)	<0.001
Paternal education level				
Primary education and below	7(20.0)	6(9.7)	1	
Didn't complete secondary school	8(22.9)	4(6.5)	1.24(0.65-2.36)	0.517
Completed secondary but didn't attend post-secondary training	8(22.9)	16(25.8)	0.62(0.29-1.33)	0.217
Tertiary training	8(22.9)	36(58.1)	0.34(0.15-0.76)	0.008

The HIV positive children had poorer school performance compared to the HIV presumed negative children (Table 3). Out of the 62 HIV presumed negative children, only 9.7% had ever repeated school grade compared to 57.1% of the HIV positive children (RR = 0.28; 95% CI 0.17-0.46, $p < 0.001$). Participants' school attendance was not significantly associated with HIV status. Most children in both groups rarely failed to attend school (74.3% and 80.6%, $p = 0.058$) and for those who failed to attend school the most common cause of non-attendance was illness (54.8% of HIV presumed negative children) or other illness (34.3%) or other reasons (57.1%) in HIV positive children.

Table 3: School attendance and performance of HIV positive and HIV presumed negative children

	HIV positive	**HIV negative**	**RR (95% CI)**	**P**
Child ever repeated school grade				
Yes	20(57.1)	6(9.7)	1	
No	15(42.9)	55(88.7)	0.28(0.17-0.46)	<0.001
Don't know	0(0.0)	1(1.6)	-	-
Child's school attendance				
Never attended	5(14.3)	3(4.8)	1	
Often fails to attend	2(5.7)	4(6.5)	0.53(0.15-1.88)	0.328
Occasionally fails to attend	2(5.7)	5(8.1)	0.46(0.13-1.67)	0.236
Rarely fails to attend	26(74.3)	50(80.6)	0.55(0.29-1.02)	0.058
Challenges for school attendance				
Financial problems (lack food/ transportation)	3(8.6)	10(16.1)	1	
Illness/ sickness	12(34.3)	34(54.8)	1.13(0.37-3.43)	0.829
Other reasons	20(57.1)	18(29.0)	2.28(0.80-6.47)	0.121

KABC-II scores

The neurocognitive scaled scores for HIV positive children were significantly lower than those of HIV presumed negative children in three subdomains: sequential processing (mean score = 93 versus 101); learning (mean score = 77 versus 87) and planning (mean score = 74 versus 81), Figure 1. There were however no differences in simultaneous processing between

the HIV positive children and the HIV presumed negative children (p = 0.45). Overall, the MPI was significantly lower in the HIV positive children (mean = 78) compared to the HIV presumed negative children (mean = 87).

Figure 1: Global neurocognitive scaled scores in HIV positive children and HIV presumed negative children

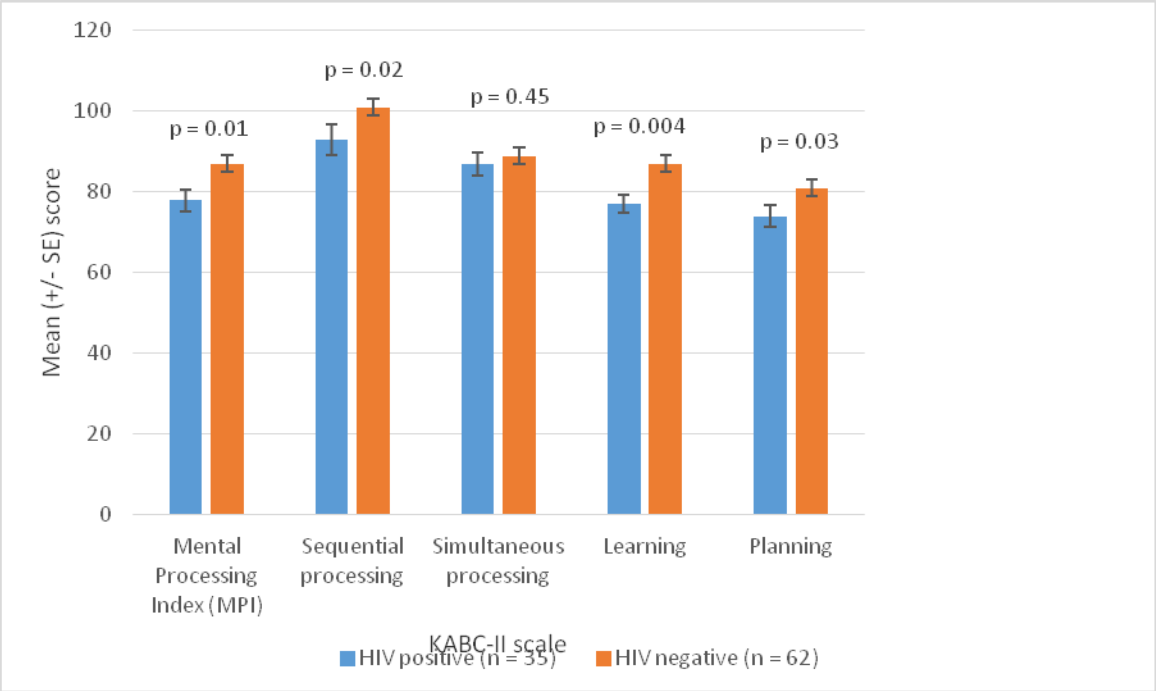


Table 4 below shows that HIV positive children had lower scores than HIV presumed negative children in six out of the 10 KABC-II subtests: Atlantis (p = 0.017), storytelling (p = 0.001), number recall (p = 0.005), Atlantis delayed (p < 0.001), word order (p < 0.001) and Rebus delayed (p = 0.017). There were no differences in the scores of HIV positive children and HIV negative children for Gestalt closure (p = 0.118), Rover (p = 0.206), Rebus (p = 0.935) and block counting (p = 0.71).

Table 4: Summary of KABC subtest scaled scores in HIV positive children and HIV presumed negative children

	HIV-positive children N= 35 Mean (± SD)	**HIV-negative Children N= 62 Mean (± SD)**	**P value**
Atlantis	6 (±3)	8 (±4)	0.017
Story Completion	4 (±3)	6 (±3)	0.001
Number Recall	9 (±3)	11 (±3)	0.005
Gestalt Closure	8 (±3)	9 (±4)	0.118
Rover	8 (±2)	9 (±2)	0.206
Atlantis Delayed	5 (±2)	7 (±3)	<0.001
Rebus	8 (±3)	8 (±2)	0.935
Block Counting	8 (±4)	9 (±3)	0.071
Word Order	6 (±2)	9 (±3)	<0.001
Rebus Delayed	6 (±3)	8 (±4)	0.017

Ever repeated grade school and KABC-II scores

The KABC-II learning subtest was associated with ever having repeated a grade in school. Children who had repeated a grade in school had a mean scaled learning score of 75.3 compared to a score of 86.6 for the children who had never repeated a grade ($p = 0.007$), (Table 8). The remaining subtests (sequential, $p = 0.274$; simultaneous, $p = 0.461$; planning, $p = 0.072$) and the overall MPI ($p = 0.139$) did not show associations with ever repeating a grade (Table 5).

Table 5: KABC- II scaled scores and school performance based on repeating an academic grade

	Sequential processing	**Learning**	**Simultaneous processing**	**Planning**	**MPI**
	Mean (± SD)	Mean (± SD)	Mean (± SD)	Mean (± SD)	Mean (± SD)
Ever repeated school grade					
Yes	93.3(±18)	75.3(±13)	85.2(±15)	72.4(±14)	78.3(±17)
No	99.7(±17)	86.6(±16)	89.7(±17)	80.8(±16)	85.8(±16)
P value	0.274	0.007	0.461	0.072	0.139

Maternal level of education and KABC-II scores

Maternal level of education was associated with subtests for sequential processing ($p = 0.022$) and learning ($p = 0.023$), but not simultaneous processing ($p = 0.651$), planning ($p = 0.073$) or MPI ($p = 0.193$). Children of mothers who had completed secondary education or had attended tertiary training had higher sequential processing and learning score (Table 6).

Table 6: KABC- II scaled scores and participants' maternal level of education

	Sequential processing	**Learning**	**Simultaneous processing**	**Planning**	**MPI**
	Mean (± SD)	Mean (± SD)	Mean (± SD)	Mean (± SD)	Mean (± SD)
Maternal education					
Primary education and below	91.1(±24)	74.9(±18)	84.6(±21)	71.7(±14)	75.7(±21)
Didn't complete secondary school	89.7(±18)	74.4(±13)	89.5(±17)	72.4(±16)	80.5(±19)
Completed secondary but didn't attend post-secondary training	97.5(±17)	86.8(±15)	86.9(±16)	78.3(±14)	83.1(±14)
Tertiary training	104.8(±14)	85.8(±17)	91.1(±16)	83.6(±17)	88.3(±17)
P value	0.022	0.023	0.651	0.073	0.193

Extreme KABC-II scores

Table 7 and 8 compare extreme KABC-II scores in HIV positive children and HIV presumed negative children. Of the four subtests only sequential processing was associated with HIV status ($p < 0.001$). This was evident at <-1SD (Table 7), however, this association

disappears at extreme scores of <-2SD (Table 8). Specifically, 17.1% HIV positive children had sequential processing scores ≤ 69 representing below average neurocognitive performance (Table 8). The overall MPI score ≤ 69 was not significantly associated with HIV status (p = 0.064), but 45.7% HIV positive children compared to 27.4% HIV presumed negative children had below average MPI score.

Table 7: KABC (<-1 SD) performance according to HIV status

	HIV positive	**HIV negative**	**RR (95% CI)**	**P**
Sequential processing				
Below average (< -1 SD)	6(17.1)	1(1.6)	1	
Average and above (> -1 SD)	29(82.9)	61(98.4)	0.38(0.25-0.58)	<0.001
Simultaneous processing				
Below average (< -1 SD)	10(28.6)	12(19.4)	1	
Average and above (> -1 SD)	25(71.4)	50(80.6)	0.73(0.42-1.29)	0.279
Learning				
Below average (< -1 SD)	14(40.0)	15(24.2)	1	
Average and above (> -1 SD)	21(60.0)	47(75.8)	0.64(0.38-1.08)	0.093
Planning				
Below average (< -1 SD)	17(48.6)	23(37.1)	1	
Average and above (> -1 SD)	18(51.4)	39(62.9)	0.74(0.44-1.26)	0.27
MPI				
Below average (< -1 SD)	16(45.7)	17(27.4)	1	
Average and above (> -1 SD)	19(54.3)	45(72.6)	0.61(0.36-1.03)	0.064

None of the KABC-II subtests had a significant association between lower extreme scores (<-2SD) and HIV status (Table 8). The overall MPI was however associated with lower extreme scores of <-1SD (Table 7). Among the HIV positive children, 13 (37.1%) had lower extreme scores compared to 12 (19.4%) of the HIV presumed negative children (p = 0.043).

Table 8: KABC (<-2 SD) performance according to HIV status.

	HIV positive	**HIV negative**	**RR (95% CI)**	**P**
Sequential				
Lower extreme (< -2 SD)	2(5.7)	1(1.6)	1	
Above lower extreme (> -2 SD)	33(94.3)	61(98.4)	0.53(0.22-1.23)	0.139
Simultaneous				
Lower extreme (< -2 SD)	6(17.1)	7(11.3)	1	
Above lower extreme (> -2 SD)	29(82.9)	55(88.7)	0.75(0.39-1.45)	0.389
Learning				
Lower extreme (< -2 SD)	11(31.4)	13(21.0)	1	
Above lower extreme (> -2 SD)	24(68.6)	49(79.0)	0.72(0.41-1.24)	0.234
Planning				
Lower extreme (< -2 SD)	14(40.0)	17(27.4)	1	
Above lower extreme (> -2 SD)	21(60.0)	45(72.6)	0.70(0.42-1.19)	0.193
MPI				
Lower extreme (< -2 SD)	13(37.1)	12(19.4)	1	
Above lower extreme (> -2 SD)	22(62.9)	50(80.6)	0.59(0.35-0.98)	0.043

SDQ scores

HIV positive children reported higher mean scores on three of the five SDQ scales and also on the total difficulty score (Figure 2). HIV positive children scored higher on emotional symptoms (3±2 versus 2±2), conduct problems (3±2 versus 1±2) and peer problems (4±2 versus 2±1), compared to the HIV presumed negative children. On average the total difficulties score in HIV positive children was 14 ± 5 compared to in 9 ± 5 in the HIV presumed negative children.

Figure 2: Mean SDQ scales and total score (± standard error) according to HIV status

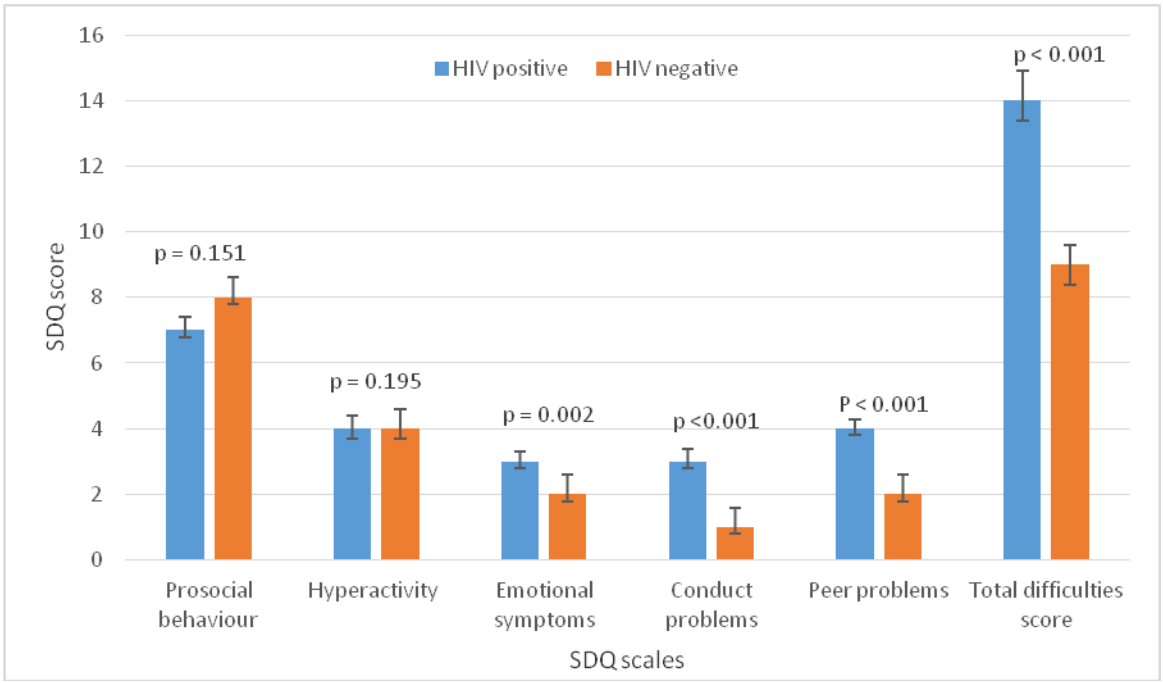


Table 9 below shows that based on the SDQ cut-off values 10 (29%) of HIV positive children had abnormal total difficulties score compared to 4 (6%) of the HIV presumed negative children. The SDQ scales in which abnormal scores were more prevalent in the HIV positive children in comparison to the HIV presumed negative children were: emotional symptoms (23% versus 5%), conduct problems (31% versus 5%) and peer problems (46% versus 5%).

Table 9: SDQ scales scores and total difficulties score in HIV positive children and HIV presumed negative children

	HIV positive (n = 35)			**HIV negative (n = 62)**		
	Normal n (%)	Borderline n (%)	Abnormal n (%)	Normal n (%)	Borderline n (%)	Abnormal n (%)
SDQ scale						
Prosocial behaviour	26(74)	5(14)	4(11)	53(85)	7(11)	2(3)
Hyperactivity	26(74)	6(17)	3(9)	53(85)	4(6)	5(8)
Emotional symptoms	19(54)	8(23)	8(23)	58(94)	1(2)	3(5)
Conduct problems	15(43)	9(26)	11(31)	50(81)	9(15)	3(5)
Peer problems	14(40)	5(14)	16(46)	54(87)	5(8)	3(5)
Total difficulties score	16(46)	9(26)	10(29)	51(82)	7(11)	4(6)

Table 10 shows that the risk associated with borderline (RR 2.36; 95% CI 1.28-4.34) and abnormal (RR 2.99; 1.74-5.15) total difficulties score in HIV positive children was between two and three fold higher than that of the HIV presumed negative children. Borderline and abnormal scores were also more common in HIV positive compared to HIV presumed negative children for three SDQ scales (emotional symptoms, conduct and peer problems).

Table 10: Relative risks (95% CI) for borderline and abnormal scores in SDQ scales in HIV positive and HIV presumed negative children

	HIV positive	**HIV negative**	**RR (95% CI)**	**P**
Prosocial behaviour scale				
Normal	26(74.3)	53(85.5)	1.0	
Borderline	5(14.3)	7(11.3)	1.27(0.60-2.66)	0.534
Abnormal	4(11.4)	2(3.2)	2.03(1.06-3.88)	0.034
Hyperactivity scale				
Normal	26(74.3)	53(85.5)	1.0	
Borderline	6(17.1)	4(6.5)	1.82(1.00-3.32)	0.049
Abnormal	3(8.6)	5(8.1)	1.14(0.44-2.96)	0.788
Emotional symptoms scale				
Normal	19(54.3)	58(93.5)	1.0	
Borderline	8(22.9)	1(1.6)	3.60(2.28-5.68)	<0.001
Abnormal	8(22.9)	3(4.8)	2.95(1.73-5.03)	<0.001
Conduct problems scale				
Normal	15(42.9)	50(80.6)	1.0	
Borderline	9(25.7)	9(14.5)	2.17(1.14-4.13)	0.019
Abnormal	11(31.4)	3(4.8)	3.40(2.02-5.75)	<0.001
Peer problems scale				
Normal	14(40.0)	54(87.1)	1.0	
Borderline	5(14.3)	5(8.1)	2.43(1.11-5.30)	0.026

Abnormal	16(45.7)	3(4.8)	4.09(2.46-6.80)	<0.001
Total difficulties score				
Normal	16(45.7)	51(82.3)	1.0	
Borderline	9(25.7)	7(11.3)	2.36(1.28-4.34)	0.006
Abnormal	10(28.6)	4(6.5)	2.99(1.74-5.15)	<0.001

HIV status and adjusted KABC scores, SDQ scores and significant participants' characteristics

Children who scored high on SDQ (scores 17+) were not significantly more likely to perform lower on KABC-II (MPI) after adjusting for HIV status (p=0.37). Therefore, in this study, there was no association between neurocognitive deficits and psychosocial adjustment among HIV positive and HIV presumed negative children aged 7 to 12 years in Gaborone, Botswana.

Table 11: Multivariable regression model of factors independently associated with HIV status

	RR	**P value**	**95% CI**	
Never repeated school grade	0.47	0.007	0.27	0.81
Maternal education				
Didn't complete secondary school	0.96	0.893	0.55	1.68
Completed secondary but didn't attend post-secondary training	0.60	0.123	0.32	1.15
Tertiary training	0.31	0.02	0.12	0.84
KABC-II MPI	0.99	0.37	0.98	1.01

Total difficulties score	1.06	0.003	1.02	1.10

In this study the first hypothesis was that children who are HIV positive are more likely to score lower in the KABC-II than children who are HIV negative. Based on the results above, this hypothesis was rejected. The results from this study indicated that the overall MPI score ≤ 69 was not significantly associated with HIV status ($p = 0.064$). However, 45.7% of the HIV positive children compared to 27.4% HIV presumed negative children had below average MPI score.

The second hypothesis was that children who have a high total difficulties score in the SDQ are more likely to perform lower on the KABC-II. As indicated in the results above, children with higher total difficulties score were more likely to be HIV positive. And generally speaking, HIV positive children scored poorly on the KABC-II than the HIV presumed negative children. Therefore, this hypothesis was accepted as HIV positive children who generally scored lower on the KABC-II presented with higher total difficulties score ($p=0.003$).

The third hypothesis was that children who have higher abnormal pro-social behaviour scores in the SDQ are more likely to perform lower in the KABC-II. The HIV positive children were more likely to have higher abnormal pro-social behaviour scores than the HIV presumed negative children in this study, and this was statistically significant ($p=0.034$). Therefore, this hypothesis was accepted.

CHAPTER 5: DISCUSSION

This research study looked at the prevalence of neurocognitive deficits and their association to psychosocial adjustment among HIV positive and HIV presumed negative children aged 7 to 12 years at Gaborone, Botswana. Botswana is a middle-income country that has been largely affected by HIV/AIDS, as it stands as the third country with the highest prevalence of HIV in the world (UNAIDS, 2017). Children in Botswana who are less than 14 years old make up to 25 000 HIV positive cases (WHO, 2013).

According to Boivin (2002), the key risk factors that contribute to the neurocognitive deficits among children in low and middle income countries has been linked to both biological and psychosocial factors. These factors include among others diet, living arrangements and body mass index of children, which were not captured in this current research. In this study, some of the captured psychosocial factors included the maternal and paternal education. It was found that maternal education was an important factor in predicting the neurocognitive functioning of children. Mothers of the HIV presumed negative children were more likely to have attained higher education (45.2% had tertiary education) compared to those of the HIV positive children (11.4% had tertiary education), $P < 0.001$. Similarly, the fathers of HIV negative children were more likely to report tertiary level education compared to fathers of the HIV positive children (58.1% versus 22.9%, RR 0.34; 0.15-0.76, $p = 0.008$).

Currently, there is no data that points out specifically to the education levels of HIV positive men and women in Botswana. However, UNAIDS (2017) stated that 56 percent of the HIV positive population comprises of women. Additionally, the Women's NGO Coalition (2006) stated that in Botswana, women have a higher level of literacy (79%) compared to men 75% and they account for 52.7% of total enrolment at the local University of Botswana, which is

a tertiary university. Perhaps these numbers are more applicable to the largest part, the majority of the HIV negative men and women.

Other studies have however, reported that children of mothers who had low level or no education were three times more likely to have neurocognitive deficits than those of mothers with high level of education (Boyede, Lesi, Ezeaka & Umeh, 2013; Grandjean & Landrigan (2006).

Additionally, as Shonkoff (2010) stated in the third set of target domains in his bio-developmental model, which argues that adult outcomes in educational achievement (high vs. low) has detrimental influences in the bio-development of the child. Low educational background of the mothers and fathers of the HIV positive children predicts increased neurocognitive impairment than in the HIV negative children.

Indeed cognitive impairment, including slowed processing and deficient memory and attention; motor symptoms, such as a loss of fine motor control and behavioral changes, such as apathy or lethargy has been observed among HIV positive individuals (Zillmer, Spiers and Culbertson, 2008). The neurocognitive scaled scores for HIV positive children in this study were significantly lower than those of HIV presumed negative children in three subdomains: sequential processing (mean score = 93 versus 101); learning (mean score = 77 versus 87) and planning (mean score = 74 versus 81).

In other words, HIV positive children are less able to process stimuli in serial order (sequential processing), which includes reading out words in the order given (word order) and repeating a string of words as given (number recall).

Furthermore, learning which incorporates long term storage and retrieval seems more impaired among HIV positive children (Zillmer, Spiers and Culbertson, 2008). In this study the HIV positive children were more likely to perform poorly on the subtests; atlantis and atlantis delayed, which measure learning ability. Lastly, HIV positive children performed significantly lower in planning, thus, they lacked logical reasoning, as evidenced by poor performance scores in the story completion subset.

In keeping with the results from this study, a study by Grant (2008) has also highlighted that learning of new information, processing speed, attention, and different levels of interference in daily functioning is impaired in HIV positive individuals. Furthermore, as HIV disease progresses, motor functioning, executive skills, and speed of information processing demonstrated the greatest decline (Macllawaine, 2014).

Other researchers such as Fraser (2014) and Mitchell (2015) have ascertained the relationship between neurocognitive deficits in memory, processing speed as well as learning and psychosocial adjustment. In this study there was no association between general psychosocial adjustment and neurocognitive deficits among the HIV positive children.

However, given that the HIV positive children generally scored lower on the KABC-II, their total difficulties score was between two and three fold higher than that of HIV presumed negative children. These total difficulties high scores have also been indicated in other non-HIV but vulnerable populations like orphans and the poor in South Africa (Cluver & Gardener, 2006).

In measuring psychosocial functioning using SDQ, some SDQ-related studies have been carried out in non-HIV related populations in South Africa (Cluver, 2012). In one study, a total of 1, 025 children were assessed. Teachers identified high levels of behavioural and emotional

problems (41%) as well as mental health outcomes for urban children aged 6 to 19 years, living in deprived settlements in Cape Town.

In another study, still in South Africa, 30 orphaned children and 30 matched controls were compared using the SDQ on emotional and behavioural problems, peer and attention difficulties as well as pro-social behaviour (Cluver & Gardener, 2006). Both groups scored highly for peer problems, emotional problems and total difficulties scores.

The SDQ scales in this study indicated that abnormal scores were more prevalent in HIV positive children than in the HIV presumed negative children. These abnormal scores were: emotional symptoms (23% versus 5%), conduct problems (31% versus 5%) and peer problems (46% versus 5%). The general high scores in total difficulties among HIV positive children in this study results are closely reflected in other SDQ-related study results among other vulnerable child populations in Southern Africa.

CHAPTER 6: CONCLUSION

6.1 Conclusion

HIV positive children had a higher prevalence of neurocognitive deficits than the HIV presumed negative children. Again, the HIV positive children had significant difficulties in emotional, peer and conduct functioning than the HIV presumed negative children. However, general psychosocial functioning was not associated to neurocognitive deficits among HIV positive and HIV presumed negative children aged 7 to 12 years in Gaborone, Botswana.

6.2 Recommendations

This study noted higher prevalence of neurocognitive deficits among HIV positive children, continuous training and monitoring should be done to teachers, health care professionals and policy makers on the relationship between neurocognitive functioning and psychosocial adjustment as well as their management thereof. Again, based on the findings on maternal and paternal differences in higher education attainment, interventions to empower and further educate HIV positive women and men are eminent. Additionally, more in depth, follow up research on maternal and paternal education among the HIV positive parents is also highly recommended.

In future researchers should consider validating or developing appropriate neurocognitive assessments to increase culture sensitivity and ultimately reliability in estimating neurocognitive deficits among children in Botswana. Health and education policies in Botswana should develop and encourage clinical assessments, interventions, projects and rehabilitative measures aimed at alleviating or controlling for psychosocial adjustments among children in Botswana.

Future research should focus on targeting larger sample sizes to establish neurocognitive norms and increase the validity and reliability of the neurocognitive assessment tools like KABC-II in Botswana.

6.3 Study Limitations

In this research, the HIV status of the children based at Ben Thema primary school was only dependant on the information retrieved from the parent/caregiver as the researcher did not test the children's HIV status. The generalizability of the study results will be limited as the results do not fully capture the entire stratum of HIV positive and HIV negative children across Botswana. Furthermore, the tests used in this study were not validated or developed for the Botswana population, to accurately determine the prevalence of neurocognitive deficits among children in Botswana.

6.4 Financial Disclosure

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APPENDIX A: Study Budget

Category	Remarks	Units	Unit Cost	Total (Botswana Pula-BWP)
Proposal	Kenyatta National Hospital Ethics Research Committee Fee			200
	Printing Proposals for Ethical Boards (In Kenya and Botswana)	5	30*5	150
Data Collection	Stationery pack (Pens, paper)	15	15*10	150
	KABC-II Complete Kit - Includes 4 Easels, 1 Manual, all necessary Stimulus and Manipulative Materials, 50 Record Forms, Soft-Sided Nylon Briefcase	1	1*15000	15 000
	Printing SDQ and Socio-demographic questionnaire	427 participants	5*427	2 135
	Refreshments (For the participants)	97 participants	20*97	1 940
Data Analysis	Statistician (to assist with data results interpretation)	1	3500	3 500
	Printing Thesis (Final copies)	10 copies	100*10	1 000
Logistics	Flight Ticket (for researcher to the data collection site-Botswana)	1	10 000	10 000
Contigency Fund (10% of total expenses)	To cater for any arising needs and payments on the ground during the data collection process			3 477
Total				**37 552 (BWP)**

APPENDIX B: Consent Form (English)

You are invited to take part in a research study entitled: **Neurocognitive Deficits and Psychosocial Adjustment among Children aged 7 to 12 years in Gaborone, Botswana: A Comparative Study.** The researcher is inviting children attending Baylor Children's Clinic to take part in this study. It is important that you understand why the research is being done and what it will involve. Please ask the researcher if there is anything that you do not understand or if you need more information to help with your decision to participate.

This study is being conducted by **Tshephiso Teseletso** (Msc Clinical Psychology); Department of Psychiatry, School of Medicine, University of Nairobi, Kenya.

Purpose of the study:

The purpose of this study is to assess the prevalence of neurocognitive deficits among children aged 7 to 12 years using a neurocognitive battery test called The Kaufman Assessment Battery for Children (KABC-II) and map any associations between neurocognitive deficits and psychosocial adjustments (SDQ).

Method/Procedure:

If you agree to take part in this study:

As a parent/caregiver you will fill in a socio-demographic questionnaire in relation to the child's social background and that will take 15 minutes.

Your child will take approximately 75 minutes to complete the KABC-II. You will then be asked to complete an SDQ which will measure psychosocial adjustment and will take approximately 15 minutes.

The research team is composed of the following individuals:

- Principal Investigator:

  Tshephiso Teseletso

Voluntary Nature of the Study:

This study is voluntary. No one at **Baylor Children's Clinic** will treat you differently if you decide not to be in the study. If you decide to join the study now, you can still change your mind later. You may stop at any time you wish to, without any penalty.

Risks and Benefits of Being in the Study:

Being in this study would not pose any physical risk to your safety or well-being. Being in this type of study involves some risk of the minor discomforts that can be encountered in daily life, such as fatigue or distress. To reduce this, your child will be free to ask and be given up to a total of 15 minutes breaks during certain times. By participating in this study, you will have opportunity to learn more by asking questions on neurocognitive deficits and obtain referral for further assessment and counselling if needed. The results will be the grounding information on neurocognitive deficits among children in Botswana and may advice policy and intervention to address the neurocognitive needs of children in Botswana.

Confidentiality

The information that you provide in this study will be kept confidential. The researcher will not use your personal information for any purposes outside of this research project. Also, the researcher will not include your name or anything else that could identify you in the study reports. Data will be kept secure by coding information such as names. Contact details will be kept away from the personal identifying data on the files. Notes and any other identifying participant information will be kept in a locked safe file cabinet in the personal possession of the researcher. When no longer necessary for research, all materials will be destroyed. Only the researcher and relevant authorities will review the collected data. Information from this research will be used solely for the purpose of this study and any subsequent related publications.

There will be no payment or thank you gifts given to participants for their participation in the study. However, yoghurt or some chips will be provided to all participants.

Your response is valuable as it will contribute towards understanding the prevalence of neurocognitive deficits among children in Botswana. I would therefore like to invite you to participate in this research.

Contacts and Questions:

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

Supervisor: **Dr. Manasi Kumar (MSc, PhD, CPsychol., AFBPsS)**
Clinical Psychologist / Senior Lecturer Department of Psychiatry
University of Nairobi

Dr Muthoni Mathai (MBBS , PhD)
Senior Lecturer in Clinical Psychology, Department of Psychiatry
University of Nairobi

Principal Investigator:
Tshephiso Teseletso (MSc, CPsychol)
University of Nairobi, Kenya or P O Box 1191, Serowe
tteseletso@gmail.com
7199 8 555 or 00254 733 772 776

If you want to talk privately about your rights as a participant, you can email or call:

Prof.M.L. Chindia, the Secretary KNH/UoN ERC
uonknh_erc@uonbi.ac.ke; Tel: +254-020-2726300 (Kenya),
extension 44355. The Ethics Research Review Committee's (ERC)

Statement of Consent:

By signing this consent form, I give permission for my child _____ to participate in this study. I verify that I have read and understood the information and have had the opportunity to ask questions where I did not understand. I understand that I can exclude my child from participating at any time without any penalty. I therefore voluntarily agree to participate in this study.

Printed Name of Participant: _____

Signed: _____ (parent/guardian)

Date: _____

Researcher's Signature: _____

APPENDIX C: Child Assent form (English)

Hello,

My name is Tshephiso Teseletso. I am an MSc in clinical psychology student at the University of Nairobi, doing a study on children at **Baylor Children's Clinic.**

I would like you to take part in the study but I need your permission before you participate. If you agree to participate, you will be required to name certain objects, repeat a series of words, numbers, count numbers of blocks, move a toy to a bone on checkerboard, do some hand movements and may other puzzles. The puzzles are fun to do and many children of your age often find them enjoyable. If you are unable to solve or complete one puzzle or game, we move on to the next one. Whenever you are tired, you can say that and you will be given a short break to reenergize. You will also be asked some questions about your home environment, school activities, exercise, sleep and peers and other things related to your home and living. The entire activity will take approximately 75 minutes. You will only take part if you want to and you are allowed to stop at any time when you wish to. There will be no penalty if you do not wish to participate in this research. At the end of the puzzles and games, you will be given some yoghurt or some chips.

Would you like to participate? (Please tick one box)

- o Yes, I want to
- o No, I do not want to

Signing at the bottom of this form means that you agree to take part in this research.
Thank you very much for your time.

Name of the child_____

Participant Signature_____ Date_____

APPENDIX D: Consent Form (Setswana)

Tumelano le Motsadi/Motlhokomedi

O lalediwa go tsaya karolo mo patisisong ya setlhogo se: **Go thathoba botsogo ja thaloganyo ya bana ba ba dingwaga tse di supa go ya ko go tse di some le bobedi mo Gaborone, Botswana**. Mmatisise o laletsa bana ba Baylor Children's Clinic go tsaya karolo mo patisisong e. Go bothokwa gore o thaloganye gore patisong e e direlwa eng le tse di tla thokegang. O amogelesegile go botsa mmatisise tsotlhe tse o sa di thaloganyeng gore a kgone go go thalosetsa.

Patisiso e e eteletswe ke **Tshephiso Teseletso** (Msc Clinical Psychology); Department of Psychiatry, School of Medicine, University of Nairobi, Kenya.

Maikaelelo a Patisiso:

Patisiso e e itebagantse le go thathoba botsogo ja thaloganyo mo baithuting ba ba dingwaga tse supa go ya ko go tse some le bobedi. Thathobo e e tla bo e dirwa ka thathobo ya thaloganyo e bidiwang The Kaufman Assessment Battery for Children (KABC-II). Maduo a thathobo a ta dirisiwa go thaloganya botsogo ja ngwana, boitsholo ja ngwana ga mmogo le tse di mo amang mo tikologong ya gagwe (SDQ).

Tsamaiso:

Ga o dumela go tsaya karolo mo patisisong e:

Wena o le motsadi/motlhokomedi wa ngwana o ta bo o tatsa dipotso tse di botsang ka ga wena ga mmogo le kgodiso ya ngwana. Go tatsa dipotso tseo go ta tsaya sebaka sa metsotso e le supa.

Ngwana wa gagoo ta tsaya oura tse pedi go thathobiwa. Morago ga se o ta kopiwa go tatsa dipotso tsa SDQ tse di ta bong di itebagantse le boitsholo ja ngwana. Dipotso tsa SDQ di tla tsaya metsotso e le lesome le boraro.

Patisiso e e dirwa ke

Moeteledipele wa Patisiso:

Tshephiso Teseletso

Boitlhaopo

Go tsaya karolo mo patisisong e ga go patelesega. Ke tsela hela ya boitlhaopo. Ga go na ditlamorago dipe tse o ta di bonang ko **Baylor Children's Clinic** ka ntlha ya go sa bata go ithaopela go tsayakarolo o patisisong e. O amogelesega go ka tswa mo boitlhaopong jo ka nako nngwe le nngwe e o eletsang go tswa ka yone.

Mosola le Ditlamorago tsa go Tsaya Karolo:

Ga o na go nna le ditlamorago dipe tsa botsogo kana pabalesego fa o itlhophela go tsaya karolo mo patisisong e. Gongwe mo tsamaong ya patlisoso o ka kukega maikutlo ka gore re ya go bua ka dintlha dinge tsa botshelo ja gago. Mo godimo ga moo, gongwe ngwana o ka lapa a ntse a atsere karolo, go leka go tokafatsa se, re ta fa ngwana sebaka sa go ikhutsa. Patlisiso e e mosola ka gore o ka nna le nako ya go itse le go botsa ka tsa botsogo ja tlhaloganyo, gape ga go tlhokege, re ka golaganya ngwana wag ago le ba bongaka go mo thusa ka fa tshwanelong. Maduo a patisiso e a ya go nna mosola thata ka gore e tla bo e le a ntlha mo Botswana ka jalo a ka thusa go baakanya melao le ditsamaiso, dikgwetlho le letlhoko la tsa botsogo ja bana mo Botswana.

Go Bipiwa Ga Tse o Tla di Buang

Tsotlhe tse o tla di buang kana o di kgaogana le nna, di ya go bipiwa. Mmatlisisi ga a na go dirisa leina la gago kgotsa dintlha tse di ka go lomaganyang le tse o di buileng. Megala le maina a gago ga a na go beiwa le dintlha dipe tse di ka go golaganyang le tse o di buileng. Morago ga patlisiso, re ya go latlha tsotlhe tse re di dirisitseng mo patlisisong. Batho ba ba tla nnang le tshono ya go bona tse o di buileng, e tla nna mmatlisisi le ba lekoko la gagwe hela.

Dituelo

Ga go na go nna le dituelo mo patlisong e. Re ta fa ngwana wa gago senotsididi le dinekere.

Go tsaya karolo gago go botlhokwa fela thata mo go re thuseng re le sechaba sa Botswana go tlhaloganya seemo le selekanyo sa botsogo jwa tlhaloganyo mo baneng ba Botswana. Ka jalo, ke go laletsa go tsaya karolo mo patlisisong e.

Megala le Dipotsoloso:

Ga o na le dipotso tse dingwe ka patlisiso e, o ka leletsa

Mogolwane: **Dr. Manasi Kumar (MSc, PhD, CPsychol., AFBPsS)**

Clinical Psychologist / Senior Lecturer Department of Psychiatry

University of Nairobi

Dr Muthoni Mathai (MBBS , PhD)

Senior Lecturer in Clinical Psychology, Department of Psychiatry

University of Nairobi

Mmatlisi Mogolo:

Tshephiso Teseletso (MSc, CPsychol)

University of Nairobi, Kenya or P O Box 1191, Serowe

tteseletso@gmail.com

7199 8 555 or 00254 733 772 776

Ga o batla go bua ka sephiri ka ditshwanelo tsa gago, o ka bua le:

Prof.M.L. Chindia, the Secretary KNH/UoN ERC

uonknh_erc@uonbi.ac.ke; Tel: +254-020-2726300 (Kenya),

extension 44355. The Ethics Research Review Committee's (ERC

Sesupo sa Tumelano:

Go baya monwana mo pampiring e, ke ha teseletso ya gore ngwanake _____ o ka tsaya karolo mo patlisong e. Ke supa fa ke tlhalogantse e bile ke boditse ha ke sa tlhaloganyang teng ka patlisiso e. Ke tlhaloganya gore ke ka ntsha ngwanake mo go tseyeng karolo k nako nge le ngwe, go sena ditlamorago dipe. Ka jalo, ke dumela go itlhaopela go tsaya karolo mo patlisisong e.

Leina la Motsaya-karolo ka botlalo_____

Monwana: _____ (motsadi/motlhokomedi)

Letsatsi: _____

Monwana wa Mmatisisi: _____

APPENDIX E: Child Assent form (Setswana)

Tumelano le Ngwana

Dumela,

Leina la me ke Tshephiso Teseletso. Ke moithuti wa MSc ya clinical psychology ko Universiti ya Nairobi, ke dira patlisiso mo baneng ba Baylor Children's Clinic.

Ke nale keletso ya gore o tseye karolo mo patlisisong e, hela ke tlhokana le teta ya gago pele o tsaya karolo. Ga o dumela go tsaya karolo, o tla kopiwa go fa maina a dilo, go bua mahoko mangwe, dinomoro, go bala ditshwantsho dingwe, godirisa sethwantsho se sengwe o se tsamaisa mo mmeleng, go dira dilo dingwe ka matsogo a gago le metshameko e mengwe e mentsi. Metshameko ya teng e ratiwa ke bana ba bangwe, gongwe le wena o ka e rata. Ga o sa kgona go ha karabo mo potsong nngwe, ga gona molato, re tabo re tswelela le metshameko e mengwe.Ga o lapile, o ka bua, ke eta bo ke go neela sebaka sa go ikhutsa. Ke tla go botsa dipotso tse dingwwe ka lelwapa la lona,sekolo, ikatiso mmele, go robala ga gago, ditsala le bankane ba gago le tse dingwe fela jalo. Go dira tse tsotlhe go tla tsaya houra le sephatlo. O tla tsaya karolo fela fa o batla, gape o ka emisa go tsaya karolo nako nngwe le nngwe ga o batla. Ga gona go nna le ditlamorago fa o sa tseye karolo mo patlisisong e. Ga o sena go hetsa metshameko e, o tla fiwa senotsididi le dinekere.

A o batla go tsaya karolo (Tlhopha karabo e le nngwe)

- Ee, ke a batla
- Nnyaa, ga ke batle

Go baya monwana mo pampiring e go raya goreo dumela go tsaya karolo mo patlisong e. Ke lebogela nako ya gago.

Leina la ngwana_____

Monwana wa motsaya-karolo_____ Letsatsi_____

APPENDIX F: Socio-demographic Questionnaire

Title: Neurocognitive Deficits and Psychosocial Adjustment among HIV Positive and HIV Negative Children aged 7 to 12 years in Gaborone, Botswana: A Comparative Study.

Get information for SECTION 1 *from the registration file.*

(Only if all boxes are ticked proceed to the questions below)

SECTION 1

Criteria for inclusion (HIV positive children)	**Tick the applicable**
Attends Baylor Children's Clinic	
HIV Positive (As confirmed in the clinic records)	
7-12 years old	
Having no obvious mental retardation	

Date……. Code……

Gender……. Age……..

D.O.B…….. Physical Address.....……..

Contact Number..... .....

Criteria for inclusion (Comparison group)	**Tick the applicable**
Attends Ben Thema Primary School	
Not HIV Positive (As stated by the parent/caregiver)	
7-12 years old	
Having no obvious mental retardation	

Date……. Code……

Gender……. Age……..

D.O.B…….. Physical Address**.....**……..

Contact Number**.....** **.....**

SECTION 2

(Get information from parent/caregiver)

I am going to start with asking you a few questions about your home and family

General Background Information

1. What is your relation with this child?
    - 1. Father
    - 2. Mother
    - 3. Sibling
    - 4. Relative
    - 5. Friend
    - 6. Other (specify)_____
2. Is the mother of the child alive?
    - 1.Yes
    - 2. No
    - 3. Don't know

3. Is the father of the child alive?
    - 1.Yes
    - 2. No
    - 3. Don't know

P.S: If ***No*** to both *Question 2* and *Question 3* above, code as ***FULL ORPHAN***

School-Related Background Information

4. Have the child ever repeated a grade at school?
    - 1. Yes
    - 2. No
    - 3. Do not know
5. Describe the child's attendance this year
    - 1.Never attended
    - 2.Often does not attend

- 3.Occasionally does not attend
- 4.Rarely misses to attend

6. How can you explain your answer to the above question?
    - 1.Financial problems
    - 2.Lack of food
    - 3. Lack of transportation
    - 4. Illness/Sickness
    - 5. Death of a parent/guardian/relative
    - 6. Other.....

Home Background Information

I am going to ask you a few questions about your home and living arrangements

7. Who lives with the child at home?

	YES	NO	
Mother?	1	0	
Father?	1	0	
Grandmother?	1	0	
Grandfather?	1	0	
Mother's boyfriend	1	0	
Father's girlfriend?	1	0	
Sisters?	1	0	How many?
Brothers?	1	0	How many?
Aunts?	1	0	How many?
Uncles?	1	0	How many?

Others? Please Specify

Personal Background Information

8. What is the mother of the child's marital status?
    - 1. Single
    - 2. Married
    - 3. Widowed
    - 4. Separated
    - 6. Cohabiting
    - Other.....

9. What is the father of the child's marital status?
    - 1. Single
    - 2. Married
    - 3. Widowed
    - 4. Separated
    - 6. Cohabiting
    - Other.....

10. What is the mother of the child's education level
    - 1. Didn't complete primary school
    - 2. Completed primary school but didn't attend post primary
    - 3. Didn't complete secondary school
    - 4. Completed secondary school but didn't attend post-secondary training
    - Tertiary training

11. What is the father of the child's education level
    - 1. Didn't complete primary school
    - 2. Completed primary school but didn't attend post primary
    - 3. Didn't complete secondary school

- 4. Completed secondary school but didn't attend post-secondary training
- 5. Tertiary training

12. What is your HIV status?
    - 1.HIV positive
    - 2. HIV negative
    - 3. Don't know

13. What is the HIV status of the child?
    - 1.HIV positive
    - 2. HIV negative
    - 3. Don't know

*P.S: If **HIV positive** go to **Question 14**, if **HIV negative** go to **Question* 15**

14. Has the HIV status of the child been disclosed to the child?
    - 1.Yes
    - 2. No
    - 3. Don't know

15. What is the monthly income of the child's family?
    - ≤1000 BWP
    - 2000-3999 BWP
    - 4000-5999 BWP
    - 6000-7999 BWP
    - 7999-10 000 BWP
    - 10 000-20 000 BWP
    - 20 000-40 000 BWP
    - ≥40 000 BWP

16. Is the mother of the child employed?
    - 1.Yes
    - 2. No

17. If yes, what is her occupation?
    - 1. Formal employment
    - 2. Self-employment
    - 3. Agriculture
    - 4. Others (specify).....

18. If not employed, what is the main source (s) of income for the family?

……

19. Is the father of the child employed?
    - 1.Yes
    - 2. No

20. If yes, what is his occupation?
    - 1. Formal employment
    - 2. Self-employment
    - 3. Agriculture
    - 4. Others (specify).....

21. If not employed, what is the main source (s) of income for the family?

…….

Thank you for participating in this study.

APPENDIX G: Strengths and Difficulties Questionnaire

Strengths and Difficulties Questionnaire

TO BE COMPLETED FOR A CHILD AGED BETWEEN 4 AND 16

For each item, **please mark the box for Not True, Somewhat True or Certainly True**. It would help us if you answered all items as best you can even if you are not absolutely certain, or the items seem daft! Please give your answers on the basis of the child's behaviour **over the last six months**.

Child's Name **Male/Female** **Date of Birth**

	Not True	Somewhat True	Certainly True
Considerate of other people's feelings			
Restless, overactive, cannot sit still for long			
Often complains of headaches, stomach-aches or sickness			
Shares readily with other children (treats, toys, pencils etc.)			
Often has temper tantrums or hot tempers			
Rather solitary, tends to play alone			
Generally obedient, usually does what adults request			
Many worries, often seems worried			
Helpful if someone is hurt, upset or feeling ill			
Constantly fidgeting or squirming			
Has at least one good friend			
Often fights with other children or bullies them			
Often unhappy, downhearted or tearful			
Generally liked by other children			
Easily distracted, concentration wanders			
Nervous or clingy in new situations, easily loses confidence			
Kind to younger children			
Often lies or cheats			
Picked on or bullied by other children			
Often volunteers to help others (parents, teachers, other children)			
Thinks things out before acting			
Steals from home, school or elsewhere			

Gets on better with adults than with other children	_____	_____	_____
Many fears, easily scared	_____	_____	_____
Sees tasks through to the end, good attention span	_____	_____	_____

APPENDIX H: Ethical Approval, Ministry of Health, Botswana

TELEPHONE: 363 2766
FAX: 391 0647
TELEGRAMS: RABONGAKA
TELEX: 2818 CARE BD

Republic of Botswana

MINISTRY OF HEALTH & HEALTH
PRIVATE BAG 0038
GABORONE

REFERENCE NO: HPDME 13/18/1 X1 (25) **8 March 2017**

Health Research and Development Division

Notification of IRB Review: **New application**

Tshepiso Teseletso
P.O. Box 1191
Serowe
Botswana

Protocol Title: **NEUROCOGNITIVE DEFICITS AND PSYCHOSOCIAL ADJUSTMENTS AMONG HIV POSITIVE AND HEALTHY CHILDREN AGED 7 TO 12 YEARS IN GABORONE, BOTSWANA: A CASE CONTROL STUDY**

HRU Approval Date:	7 March 2017
HRU Expiration Date:	6 March 2018
HRU Review Type:	HRU reviewed
HRU Review Determination:	Approved
Risk Determination:	Minimal risk

Dear Sir/Madam,

Thank you for submitting new application for the above referenced protocol. The permission is granted to conduct the study.

This permit does not however give you authority to collect data from the selected site(s) without prior approval from the management. Consent from the identified individuals should be obtained at all times.

The research should be conducted as outlined in the approved proposal. Any changes to the approved proposal must be submitted to the Health Research and Development Division in the Ministry of Health for consideration and approval.

Furthermore, you are requested to submit at least one hardcopy and an electronic copy of the report to the Health Research, Ministry of Health within 3 months of completion of the study. Approval is for academic fulfillment only. Copies should also be submitted to all other relevant authorities.

Continuing Review
In order to continue work on this study (including data analysis) beyond the expiry date, submit a Continuing Review Form for Approval at least three (3) months prior to the protocol's expiration date. The Continuing Review Form can be obtained from the Health Research Division Office (HRDD), Office No. 7A.7 or Ministry of Health website: www.moh.gov.bw or can be requested via

e-mail from Mr. Kgomotso Motlhanka, e-mail address: kgmmotlhanka@gov.bw As a courtesy, the HRDD will send you a reminder email about eight (8) weeks before the lapse date, but failure to receive it does not affect your responsibility to submit a timely Continuing Report form

Amendments
During the approval period, if you propose any change to the protocol such as its funding source, recruiting materials, or consent documents, you must seek HRDC approval before implementing it. Please summarize the proposed change and the rationale for it in the amendment form available from the Health Research Division Office (HRDD), Office No. 7A 7 or Ministry of Health website: www.moh.gov.bw or can be requested via e- mail from Mr. Kgomotso Motlhanka, e-mail address: kgmotlhanka@gov.bw . In addition submit three copies of an updated version of your original protocol application showing all proposed changes in bold or "track changes".

Reporting
Other events which must be reported promptly in writing to the HRDC include:
- Suspension or termination of the protocol by you or the grantor
- Unexpected problems involving risk to subjects or others
- Adverse events, including unanticipated or anticipated but severe physical harm to subjects.

If you have any questions please do not hesitate to contact Lemphi Moremi at Tel +267-3914467 or at lamoremi@gov.bw Thank you for your cooperation and your commitment to the protection of human subjects in research.

Yours faithfully

L.Moremi
For /Permanent Secretary

MINISTRY OF HEALTH
RESEARCH DIVISION
2017 -03- 08
P/BAG 0038
GABORONE
REPUBLIC OF BOTSWANA

APPENDIX I: Ethical Approval, Ministry of Education, Botswana

TELEPHONE: 3655400/3655483
TELEX: 2944 THUTO BD
FAX: 3914271

REPUBLIC OF BOTSWANA

MINISTRY OF BASIC EDUCATION
PRIVATE BAG 005
GABORONE, BOTSWANA

REF: DPRS 7/1/5 XXVII (119) SAO-Research

22nd December 2016

Miss Tshephiso Teseletso
P O Box 1191
Serowe

RE: PERMIT TO CONDUCT A RESEARCH STUDY

This serves to grant you permission to conduct your study in the sampled areas in Botswana to address the following research objectives/questions /topic:

Neurocognitive deficits and psychological adjustments among HIV Positive and Healthy children aged 7 to 12 years in Gaborone, Botswana: A case control study.

It is of paramount importance to seek **Assent** and **Consent** from the Directors of South East region, School Head, Teachers, Parents and students of Ben Thema Primary School that you are going to collect data from. We hope that you will conduct your study as stated in your proposal and that you will adhere to research ethics. Failure to comply with the above stated, will result in immediate termination of the research permit. The validity of the permit is from **22nd December 2016 to 22nd December 2017.**

You are requested to submit a copy of your final report of the study as stated in the Research Guidelines (para 4.5 - 4.6, 2007) to the Ministry of Basic Education, in the Department of Educational Planning and Research Services, Botswana.

Thank you.

Yours faithfully

A PHAKAMA

Agnes Kenosi Phakama
For/ Director-DEPRS

APPENDIX J: Ethical Approval, KNH/UON ERB

UNIVERSITY OF NAIROBI
COLLEGE OF HEALTH SCIENCES
P O BOX 19676 Code 00202
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Twitter: @UONKNH_ERC https://twitter.com/UONKNH_ERC

KENYATTA NATIONAL HOSPITAL
P O BOX 20723 Code 00202
Tel: 726300-9
Fax: 725272
Telegrams: MEDSUP, Nairobi

KENYATTA NATIONAL HOSPITAL APPROVED 13 MAR 2017 KNH/UON-ERC P.O. Box 20723-00202 NRB.

Ref: KNH-ERC/A/85

13th March 2017

Tshephiso Teseletso
Reg. No.H56/83207/2015
Dept.of Psychiatry
School of Medicine
College of Health Sciences
University of Nairobi

Dear Tshephiso

REVISED RESEARCH PROPOSAL: NEUROCOGNITIVE DEFICITS AND PSYCHOSOCIAL ADJUSTMENT AMONG H.I.V POSITIVE AND HEALTHY CHILDREN AGED 7 TO 12 YEARS IN GABORONE, BOTSWANA: A CASE CONTROL STUDY (P948/12/2016)

This is to inform you that the KNH- UoN Ethics & Research Committee (KNH- UoN ERC) has reviewed and **approved** your above revised proposal. The approval period is from 13th March 2017 – 12th March 2018.

This approval is subject to compliance with the following requirements:

a) Only approved documents (informed consents, study instruments, advertising materials etc) will be used.
b) All changes (amendments, deviations, violations etc) are submitted for review and approval by KNH-UoN ERC before implementation.
c) Death and life threatening problems and serious adverse events (SAEs) or unexpected adverse events whether related or unrelated to the study must be reported to the KNH-UoN ERC within 72 hours of notification.
d) Any changes, anticipated or otherwise that may increase the risks or affect safety or welfare of study participants and others or affect the integrity of the research must be reported to KNH- UoN ERC within 72 hours.
e) Submission of a request for renewal of approval at least 60 days prior to expiry of the approval period. (*Attach a comprehensive progress report to support the renewal*).
f) Clearance for export of biological specimens must be obtained from KNH- UoN ERC for each batch of shipment.
g) Submission of an *executive summary* report within 90 days upon completion of the study. This information will form part of the data base that will be consulted in future when processing related research studies so as to minimize chances of study duplication and/ or plagiarism.

For more details consult the KNH- UoN ERC website **http://www.erc.uonbi.ac.ke**

"Protect to Discover"

Yours sincerely,

PROF M. L. CHINDIA
SECRETARY, KNH-UoN ERC

c.c. The Principal, College of Health Sciences, UoN
The Director, CS, KNH
The Assistant Director, Health Information, KNH
The Chair, KNH-UoN ERC
The Dean, School of Medicine,UoN
The Chair, Dept. of Psychiatry, UoN
Supervisors: Dr. Manasi Kumar, Dr. Muthoni Mathai