KNOWLEDGE OF BASICS AND OCULAR MANIFESTATIONS OF HIV/AIDS AMONG HIGH SCHOOL LEARNERS IN THE CAPRICORN DISTRICT OF LIMPOPO PROVINCE, SOUTH AFRICA.

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This dissertation is submitted in fulfillment of the requirements for the degree of Master of Optometry (M.OPTOM) in the Department of Optometry, School of Health Care Sciences, University of Limpopo, South Africa.

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Declaration

I, the undersigned declare that this dissertation hereby submitted to the University of Limpopo for the degree of Master of Optometry has not previously been submitted by me for a degree at this or any other University; and that it is my own work in design and in execution.

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Signature

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Date

Dedication

My parents (Reuben and Jane); my beloved sister (Happy) and brother (Matala) my daughters (Lesego and Shibu) for their constant support, understanding, patience and love.

Therefore, I say to you, whatever things you ask when you pray, believe that you received them and you will have them.

Mark 11:24

Holy Bible, New King James Version (Thomas Nelson, 1982)

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ABSTRACT

Background

Human Immunodeficiency Virus (HIV) and the associated Acquired Immunodeficiency Syndrome (AIDS) are major public health concerns worldwide and present socioeconomic burden to many governments. To combat this scourge, a deep knowledge about this pandemic is required as one of the preventive methods. Also, the knowledge can serve as a tool to help those who are infected. HIV/AIDS is common among adolescents; therefore, one of the aims of this study is to establish the knowledge of basics of HIV/AIDS among high school learners in the Capricorn district of the Limpopo Province, South Africa.

HIV/AIDS also affects the eye; identification of the ocular problem can sometimes help with the diagnosis of HIV/AIDS the condition. Therefore may have both sight and life-saving implications. The school curriculum and HIV/ AIDS awareness campaigns in South Africa do not include basic knowledge of the effects of HIV/AIDS on the eye; therefore an additional aim of this study was to establish the basic knowledge of the effects of HIV/AIDS on the eye among the participants, so that an informed recommendation can be made for the inclusion of the eye component in the awareness campaign and school curriculum.

Methodology

Following relevant research and ethics approval of the proposal, relevant permissions were obtained before the study commenced. A quantitative survey design was used for the study. Stratified random sampling method was used to select high schools and students that took part in the research. The participants were learners from 18 selected high schools in the Capricorn district of the Limpopo Province. A questionnaire containing demographic data, information on general and ocular effects of HIV/AIDS was used to collect information from the learners, following a pilot study involving 20 high school learners. Data was analyzed with Statistical Packages for Social Sciences (SPSS) computer program version 16. Descriptive statistics (range, mean, standard deviations and frequencies) was used to describe the findings, and analysis of covariance (ANCOVA) model was used to

model the scores on each of the dependent variables i.e. general knowledge of HIV/AIDS and basic knowledge of the effects of HIV/AIDS on the eye.

Results

The participants were 2659 black South African learners in grades 10 to 12 in the high schools. Eighty eight percent were from rural high schools and (12%) were from a semi-urban high school. Their ages ranged from 14 to 28 years with a mean age of 17.82 and SD of ±1.766 years. The participants included (46.4%) males, (53.1%) females, and (0.5%) learners did not indicate their gender.

The meaning of the acronym HIV was known by 63.6% of the participants, and these included 65.8% of the females and 61.5% of males. A lesser proportion (61.5%) knew what the acronym AIDS stands for. They included 70.9% of the females and 60.8% of the males. Knowledge about the different modes of HIV transmission varied from 87.0% (transmission through unprotected sex) to 62.5% (transmission from mother-to–child during pregnancy). Regarding the misconception on the modes of HIV/AIDS transmission, a majority (81.5%) of the learners knew that HIV/AIDS could not be transmitted from one person to another through hugging a person infected with HIV; this percentage includes 82.6% of the females and 80.3% of the males.

Only two respondents (0.1%) out of the total population knew the meaning of window period in HIV and they were both females. Only about a third (33.2%) knew the difference between HIV positive and negative results. Majority (85.9%) knew that it is important for one to know his or her HIV status. However, only 5.6% knew the reason why people should know their HIV status. Many (60.1%) knew that the manifestation of HIV symptoms can take many years to develop on an HIV infected person, and 54.9% knew that immune system suppression is the first effect of HIV on the body. Knowledge of the effects of HIV on the body during the sero-conversion phase (acute phase), varies from 29.9% (HIV can cause continuous nausea) to 73.0% (HIV can cause tiredness). On the facilities that can be used to test for HIV status, knowledge of the participants varied from 93.4% (knew that HIV

test can be done at a hospital) to 34.2% (HIV test can be done at the offices of family general medical practitioner).

Only a few (27.8%) knew that HIV/ AIDS can affect the eye. Many (65.5%) of the participants knew that an ophthalmologist or an optometrist should be consulted for ocular problems that are related to HIV/AIDS. Knowledge on the effects of HIV on the eye ranges from 20.6% (HIV can cause an itching and burning sensation in the eye) to 58.6% (HIV can cause severe headaches). Forty six percent knew that HIV can cause blindness. Less than half of the participants (46.9%) knew that exchanging contact lenses with the infected person could not transmit HIV from an HIV positive person.

Generally the performance was poor on the ocular manifestation of HIV/AIDS. Young learners were more knowledgeable than the older ones, for both general knowledge of HIV/AIDS and knowledge of the effect of HIV/AIDS on the eye ($p < 0.05$). Gender of the participants was not statistically significant for both components of the survey ($p > 0.05$). The pattern of performance among the grades across the schools was not consistent for both components of the survey. Also ages of the learners and their grades did not correspond in terms of performance in this study.

Conclusion and recommendations

General knowledge of HIV/AIDS was fairly good, but the basic knowledge of the effects of HIV/AIDS on the eye was poor. Therefore, to improve the knowledge about HIV/AIDS of the target population people, there is a need for more awareness campaigns in the rural areas of South Africa. Also, it is recommended that basic knowledge of the effects of HIV/AIDS on the eye should be included in the awareness campaigns (e.g. TV, newspapers, radio, magazines, fliers and HIV/AIDS workshops) and should also be integrated into HIV education syllabus as early as primary level. Educators teaching life orientation and life skills should have regular continuing educational programmes to increase their knowledge on the subject of HIV/AIDS and its effects on organs of the body such as the eye.

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LIST OF ABBREVIATIONS

AIDS: Acquired immunodeficiency syndrome.

ARC: Aids related complex.

ART: Anti –retroviral therapy.

CDC: Centers for Disease Control and Prevention.

CMV: Cytomegalovirus.

CSCC: Conjunctival squamous cell carcinoma.

CWS: Cotton wool spots.

HAART: Highly active antiretroviral therapy.

HIV: Human immunodeficiency virus.

HPV: Human papillomavirus.

HSV: Herpes simplex virus.

HZO: Herpes zoster ophthalmicus.

IK: Interstitial keratitis.

IRU: Immune recovery uveitis.

KS: Kaposi's sarcoma

OBE: Out-based system of education.

OSSN: Ocular surface squamous neoplasia.

PEP: Postexposure prophylaxis.

TB: Tuberculosis.

UNAIDS: Joint United Nations Programme on HIV/AIDS.

UNESCO: United Nations Educational, Scientific and Cultural Organization.

UNGASS: United Nations General Assembly.

UNICEF: United Nations Children's Funds.

VCT: Voluntary counseling and testing.

VZV: Varicella-zoster virus.

WHO: World Health Organization.

DEFINITION OF TERMS

AIDS related complex: is a term now used to describe patients with a constellation of constitutional symptoms including weight loss, fever and diarrhea, often associated with minor opportunistic infections such as oral *candidiasis*, hairy oral leucoplakia, shingles (usually multidermatomal) and other features such as *seborrhoeic dermatitis* and retinal cotton wool spots (Brostoff *et al*. 1991).

Conjunctivitis: Inflammation of the conjunctiva.

Cytomegalovirus: A large DNA virus and a member of the herpes family of virus.

Ectropion: Outwards turning of the eyelids.

Entropion: An inversion of the eyelid.

Granuloma: A localized collection of modified macrophages often called epithelioid cells.

Haemorrhage: Leakage of blood from vessels within the circulatory system and implies that there has been damage to the integrity of the vessel in some way.

Herpes zoster: A common infection caused by human herpes virus.

Immunity: The body's natural ability to defend itself against infection and disease.

Inflammation: Reaction of vascularised living tissue to local injury.

Ischaemia: A condition of inadequate blood supply to an area of the body resulting in a reduction in oxygen.

Keratitis: Inflammation of the cornea.

Lesion: The structural or functional abnormality responsible for ill health.

Meningitis: Inflammation in the subarachnoid and the pia mater of the brain.

Necrosis: Morphological changes which occur following cell death within the living a body.

Oral thrush: Fungal (*Candida albicans*) infection of the oral cavity.

Pneumonia: Infection by *Pneumocystis jiroveci* (protozoa), affecting distal airways especially alveoli with the formation of an inflammatory exudates.

Retinitis: Inflammation of the retina.

Seroconversion: The point at which a person's HIV status changes from being negative to positive.

Syndrome: A collection of specific signs and symptoms that occur together and that are characteristic of a particular condition.

Trichiasis: An acquired posterior misdirection of previously normal lashes.

Tumour: An abnormal mass of tissue, the growth of which exceeds and is un-ordinated with that of normal tissue, and persists in the same excessive manner after cessation of the stimuli which evoked the change.

Uveitis: An inflammation of the uveal tract (iris, ciliary body and choroid).

Visual impairment: A best-corrected visual acuity less than 3/60 or central visual field not greater than 10 degrees in the better eye and low vision as best-corrected visual acuity less than 6/18 to 3/60 (World Health Organization, 2003).

CHAPTER ONE

1. INTRODUCTION

1.1 GENERAL ASPECTS OF HIV/AIDS

1.1.1 History and epidemiology of HIV/AIDS

The first report of HIV/AIDS was in the homosexual men in North America in the early 1980s (Centers for Disease Control and Prevention, 1981; Gottlieb *et al.*, 1981). The acronym HIV stands for Human Immunodeficiency Virus that causes AIDS (Acquired Immunodeficiency Syndrome) (Stephenson, 1996). In central Africa the first report of AIDS was in 1983 (Clumeck *et al.*, 1983). By 1986 HIV had already spread to the sub-Saharan countries, and was highly affected by this pandemic disease and Southern Africa was among those countries with the highest HIV prevalence (Quinn *et al.*, 1986). Even after three decades, the sub-Saharan Africa still remains the most seriously affected region in the global AIDS pandemic; and South Africa is among the countries with the highest prevalence of people living with HIV. The recently UNAIDS (2008b) report, indicated that in the African countries young people aged 15-24 account for 45.0% of HIV new infections.

1.1.2 Modes of transmission of HIV and factors causing the prevalence of HIV/AIDS to escalate

Heterosexual intercourse remains the driving force of HIV in the sub-Saharan countries and some reports have shown that condoms are rarely used in some African countries such as Burkina Faso, Cameroon, Ghana, Kenya and the United Republic of Tanzania (De Walque, 2007). Surveys have also shown a varied condom use among young people, for instance in Khutsong (South Africa) there was a low level of condom use by young peoedple (MacPhail and Campbell, 2001) but in KwaZulu-Natal condom use was sufficiently high among college students (Maharaj and Cleland, 2006). Other modes which contribute to a certain extent in escalating the prevalence are unprotected sex between men (in Kenya port city of Mombasa, 43.0% of homosexual men were found to be living with HIV) (Sanders *et al.*, 2007), and drug users in East and Southern Africa who had HIV (Sulliman *et al.*, 2004).

Risky sexual behaviors and attitudes towards condom usage among youth is also a contributing factor for instance, Macphail and Campbell (2001) found a wider range of influences on the sexual behavior including factors such as peer norms and pressures, negative and unsupportive adult attitudes to youth sexuality; restricted availability of condoms; and broader social issues related to the social construction of gender and to economic constraints on young people.

Globally a small percentage of HIV transmission among children is due to scarification, contaminated injections, blood transfusion and sexual abuse [About 20 000 girls under the age of 18 are raped each year by adult males in South Africa and Namibia (Jewkes *et al*., 2005)] (Kengeya-Kayondo *et al.,* 1995; Mulder *et al*., 1996; Hauri *et al*., 2004; Kiwanuka *et al*., 2004; Schmid *et al*., 2004). But a greater percentage (90.0%) of HIV transmission in children was through mother-to-child transmission either through pregnancy or breast feeding (UNAIDS, 2008b).

Attitudes and behaviors towards HIV/AIDS are other factors responsible for the escalation of incidences of these pandemic and increasing death rates. For instance, a series of studies which were conducted in Southern Africa suggested that alcohol use can facilitate behaviors associated with HIV transmission (Weir *et al*., 2003; Kalichman *et al*., 2007).

Stigma and discrimination are causes of HIV risk and vulnerability and consequences of being HIV-positive which results in making people living with HIV not to disclose their HIV status, not to take treatment and adhere to the drug regimen (White and Carr, 2005; Liu *et al*., 2006; Mills, 2006) and also not to use condom due to fear. To show that these two factors do not have a place in South Africa, the President addressed the people on 29 October (2009), that "South Africans need to know their HIV status and be informed of the treatment options available to them, there should be no shame, no discrimination and no recriminations (Anomynous, 2009)".

Poverty also plays a part in fueling this pandemic to a certain extent, some sex workers claim that poverty drove them from their home to the streets, for instance when women were interviewed in a survey that was conducted in Johannesburg, South Africa, they claimed that they entered the sex industry for economic reasons; in the face of poverty and to a certain extent feel trapped by their lack of education and inability to secure other employment (Wojcicki and Malala, 2001). Hence the repercussions of poverty are: low education and even decision-making that eventually increases the risk of HIV infection (Tladi, 2006).

1.1.3 Preventive measures of HIV/AIDS and awareness campaigns on HIV/AIDS

South Africa's National Strategic Plan for HIV/AIDS and sexually transmitted diseases aimed to reduce the rate of infections by 50.0% and cover 80.0% of the people who need antiretroviral therapy (ART) by 2011 (Anonymous, 2009). Measures for prevention are already in place. The Department of Health distributes condoms (education was given on how to use a condom) all over the country for easier accessibility and making accessible facilities for the prevention of mother to child transmission (PMTCT). According to Dr A Motsoaledi (South African Minister of Health on 1st of October, 2009), new plans are underway for comprehensive integrated antenatal care which includes mother-to-child transmission and voluntary counseling and testing (VCT) facilities to the public (Anonymous, 2009).

For prevention to be successful more focus should be on this target population (15-24 years old), since they account for 45.0% of new HIV infection (UNAIDS, 2008b). HIV/AIDS education played an important role in causing a decline in the prevalence of HIV worldwide. For example South Africans, gained some knowledge and started to have some understanding of this condition through the awareness campaigns via media at large, which included: TV, radio, magazines, billboards and newspapers; also there is a special day, 1 December, (world AIDS day) at which the world pays more attention to HIV/AIDS. In South Africa, media plays a role in bringing information to people (especially through TV and radio) by involving everybody in the commemoration of this day. For instance President Jacob K Zuma addressed the nation on 1 December, 2009 through the television, under the motto "I am

responsible, we are responsible, South Africa is taking responsibility". This speech will bring a positive impact on the attitude towards this pandemic among South Africans.

The more knowledge that people have on all aspects of HIV/AIDS, the less the discrimination, stigmatization and marginalization of the infected people. This will help in decreasing fear of disclosure to people wanting to test for HIV, people wanting to take treatment, and will increase the usage of condoms.

The implementation and integration of life skills education and life orientation into the school curriculum in 1998 (through the present education system called outcome-based system of education by the South African Department of Education), helped in upgrading the knowledge of the learners and educators on the issue of HIV/AIDS. For example, a study of the impact of life skills education on adolescents, sexual risk behaviors in KwaZulu-Natal, South Africa by Magnani *et al*. (2005), where the respondents (N = 2,222) aged 14-24 years revealed that school-based life education appears to be capable of communicating information and helping youth to develop skills relevant in reducing HIV risk.

South African's cultures and beliefs play an important role on the issue of HIV/AIDS. For instance previous study found that many South African patients consult traditional healers as a first effort to remedy ailments (Louw and Pretorious, 1995). Also Peltzer (2000) found that among 104 black Africans from Limpopo Province, South Africa, 68.0% sought medical treatment as their last option, (19.0%) consult the herbalist for minor and chronic conditions, (9.0%) consult the diviner and (4.0%) consult the faith healer. It will be of interest to know why people in the rural areas consult with the traditional healers on issues relating to HIV/ AIDS.

In many parts of Africa, circumcision is performed outside medical settings, often by traditional healers (Schoofs, 2007). Since the initiation practices are occasions for transmitting norms and values around masculinity, such practices may be an important opportunity for the education of HIV prevention (Peltzer *et al*., 2007),

therefore it was necessary for the traditional healer to get proper training to ensure acceptable safety and quality male circumcision procedures (Schoofs, 2007). Also Peltzer *et al.* (2006) found that, in KwaZulu-Natal, South African traditional healers demonstrated an improvement in knowledge on aspects of HIV/AIDS, sexually transmitted diseases (STD's) and tuberculosis (TB) after 7-9 months of training. Therefore, knowledge is not only important for the patients, it is also important for the traditional healers and modern medical practitioners.

1.1.4 HIV/AIDS and the eye

Blindness and visual impairment are public health problems already and constitute an important socioeconomic burden in Sub-Saharan Africa (Omgbwa *et al*., 2005). Ocular or orbital diseases may be the first manifestation of HIV/AIDS and can be an indicator of previously undiagnosed HIV infection (Lee *et al*., 2006; Kunkel *et al*., 2009). Hence early diagnosis and proper treatment is required to preserve HIV/AIDS patients' vision and control unnecessary blindness.

In 2002 a global review on visual impairment by World Health Organization (WHO) estimated that there were 161 million persons worldwide with visual impairment including 37 million with blindness (Resnikoff *et al*., 2004; Pascolini *et al*., 2004). WHO and international agency for the prevention of blindness launched a global initiative called The Right to Sight which its purpose is to help in eliminating avoidable blindness (Vision 2020). Also identification of the ocular problems can sometimes help with the systemic diagnosis [e.g. systemic toxoplasmosis (Lee *et al*., 2006)] and therefore may have both sight and life-saving implications (Kramer *et al.,* 2003).

The eye is one of the main organs of the body that is drastically affected by HIV/AIDS (Jeng *et al*., 2007). Numerous reports (Jabs and Quinn, 1996; Anonymous, 2005; Hodge *et al*., 1998; Kenstelyn and Cunningham, 2001) have described the spectrum and natural history of HIV-associated eye disorders, which affect 70-80% of all patients at some point during their illness. At the last stage (AIDS), all opportunistic organisms get access to the body, including the eye,

causing ocular complications (Moraes, 2002). Opportunistic infections are caused by a wide range of organisms such as *Cytomegalovirus*, Herpes simplex virus, Varicella zoster, *Toxoplasma gondii*, *Treponema pallidum*, *Pneumocystis jiroveci* and various fungal agents (Ah-Fat and Batterbury, 1996).

It has been reported that in Africa, most HIV-infected people succumb to the complications of the disease before reaching levels of immunosuppression that are associated with CMV retinitis (Poole, 2000; Spitzer and Szurman, 2009). In these populations, anterior segment and external ocular disease such as squamous cell carcinoma seem to predominate among ophthalmic problems (Jeng *et al.*, 2007).

Studies of ocular complications of HIV infection in the developing countries; particularly those in sub-Saharan Africa and South East Asia, suggest that cytomegalovirus retinitis occur less frequently than in developed countries and that ocular complications of toxoplasmosis and tuberculosis, herpes zoster ophthalmicus, and papillomavirus-associated conjunctival squamous–cell turmors are more prevalent (Lewallen and Courtright, 1997; Kenstelyn, 1999; Lewallen *et al.*, 1994). The reason for such an altered spectrum of ocular diseases in patients in developing countries is related to higher frequencies of exposure to causative infectious agents and higher rates of death early in the course of HIV infection (Turner *et al.*, 1994).

1.1.5 Previous studies on the knowledge of HIV/AIDS among adolescents

Previous studies in South Africa and other countries on the knowledge of HIV/AIDS among the target population focused on aspects such as etiology, attitudes and behavior towards HIV/AIDS or among people who are infected, sexual risk behaviours, modes of transmission, symptoms and prevention (e.g. attitude towards the use of condoms) (Singh *et al.*, 2005; Dadkha *et al.*, 2008; Oyo-Ita *et al.*, 2005; Cartagena *et al.*, 2006; Makuka and Slonim-Nevo, 2006; Wodi, 2005; Kyrychenko *et al.*, 2006; Wagbatsoma, 2006; Jaiswal *et al.*, 2005; Chen, 2008; Peltzer and Promtussananon, 2005; Maharaj and Cleland, 2006; MacPhail and Campbell, 2001; Magnani *et al.*, 2005; Anderson and Beutel, 2007). A recent study of HIV/AIDS prevention knowledge among youth in Cape Town, found that the majority of

respondents had some knowledge on prevention but there were some gaps on the important prevention knowledge (Anderson and Beutel, 2007). Also, a study on the effectiveness of a school-based AIDS education program among rural students in HIV high epidemic area of China, (2008) demonstrated that after a few months of receiving training on HIV, students were more aware on how to protect themselves from HIV (Cheng *et al*., 2008).

A recent study by Parmar *et al*. (2007) revealed that knowledge on the prevention of HIV/AIDS among educators in Chandigarh (India) was quite inadequate. Peltzer and Promtussananon (2005) on HIV/AIDS knowledge and sexual behavior among junior secondary school (grades 8 to 10) students in South Africa, in which 3150 participants were selected from 150 participating secondary schools (from all 9 provinces in the country) revealed that general knowledge about this condition was fairly good, although in some areas this aspect of knowledge was lacking (e.g. ± 25.0% knew what HIV infection window period is).

A recent study by Dadkha *et al*. (2008) on the knowledge and attitude towards HIV/AIDS among college students in Ardabil, Iran, where 400 participants were selected randomly from the college and stratified by gender and grade level, and their age ranged from 19 to 25 years, used almost similar criteria to the one used by Peltzer and Promtussananon (2005) to assess the participants; but found that there were alarming gaps in the knowledge about transmission of HIV for example, 67.5% of the participants had a misconception about the mode of transmission of HIV.

The present study was necessary since greater knowledge is required among the young adults and other population groups in South Africa; and the basic knowledge of the effect of HIV/AIDS on the eye was not included in the previous studies, awareness campaigns and school curriculum. This study will add more information to the existing general HIV/AIDS knowledge as well as the ocular manifestations of HIV/AIDS. This can help in preserving vision and decrease unnecessary deaths.

1.2 AIMS OF THE STUDY

The aims of this study are:

i. To establish the knowledge of the basics of HIV/AIDS among high school learners in the Capricorn district of the Limpopo Province.
ii. To establish basic knowledge of the effects of HIV/AIDS on the eye among the same target population.

1.3 OBJECTIVES OF THE STUDY

The objectives of the study are:

i. To collect and analyse data, and present findings on the basic information on HIV/AIDS among high school learners in the Capricorn district of the Limpopo Province.
ii. To collect and analyse data, and present findings on the knowledge of the effects of HIV/AIDS on the eye among high school learners in the Capricorn district of the Limpopo Province.

1.4 HYPOTHESES

i. High school learners of Capricorn district of Limpopo province in South Africa have inadequate knowledge on the basics of HIV/AIDS.
ii. High school learners of Capricorn district of Limpopo province in South Africa have little or no knowledge on the effects HIV/AIDS on the eye.

1.5 MOTIVATION

The motivation for this study was the fact that adolescents form a particularly important target group for primary prevention of HIV/AIDS. The epidemic in the Limpopo province is increasing every year with new infections being twice the number of AIDS deaths (Nathea, 2008). This is presumably because teenagers are engaged in risky behaviors like tattooing, ear piercing, tongue piercing, and use needles to inject drugs and unprotected sex (oral, anal or vaginal). Government and non-governmental organizations in South Africa are educating the people on every aspects of HIV including its health implications. Therefore, people get to know of

HIV/AIDS over the media. It is necessary to have an idea of the impact of such projects among adolescents in the country.

Health education on ocular manifestations of HIV/AIDS is not part of the awareness campaign in the country. It is necessary for people to know about HIV/AIDS and the eye. This knowledge is important because some ocular diseases might be the first sign of HIV/AIDS in some patients (Kunkel *et al.*, 2009). Also, knowledge will result in early consultation for HIV/AIDS-related eye diseases that will subsequently decrease the rate of low vision and blindness. The purpose of this study therefore, was to establish what are the basic knowledge of HIV/AIDS and the effects of the condition on the eye among high school learners in the Capricorn district of the Limpopo Province. If knowledge is found to be inadequate, recommendations will be made to government and non-governmental organizations to increase their campaigns, especially to the rural areas. Also, if knowledge on the ocular manifestations is poor, recommendations will be made to include information on the ocular manifestations of HIV/AIDS in the school curriculum and in the awareness campaigns (e.g. TV, newspapers, radio, magazines, fliers and HIV/AIDS workshops).

1.6 ADVANTAGE OF THIS STUDY

Knowledge of the basics of HIV/AIDS and the effects of HIV/AIDS on the eye among high school learners will be established. If findings are poor, appropriate recommendations will be made to the appropriate authorities.

CHAPTER TWO

2. LITERATURE REVIEW

2.1 HUMAN IMMUNODEFICIENCY VIRUS (HIV) / ACQUIRED IMMUNODEFICIENCY SYNDROME (AIDS)

HIV infection is a fatal disease which was reported to have emerged from central Africa, and subsequently introduced into susceptible populations in North America and Western Europe and spread rapidly during the latter part of 1970s and early 1980s (Van Dyk, 2005). It was introduced to the Western world only when international travel become more common and had spread worldwide by the late 1980s (Van Dyk, 2005).

2.1.1 Types of HIV

There are two types of HIV namely HIV-1 and HIV-2 (Sepkowitz, 2001). The HIV-1 has subtypes A, B, C, D, F, G, J and K, while HIV-2 has subtypes A to G and most infections are due to HIV-1C, others are due to HIV-2 A and C (Van Dyk, 2005). The HIV-1 is a single stranded diploid RNA virus 100-120 nm in diameter; its basic gene structure has *gag* (core protein), *pol* (polymerase/reverse transcriptase) and *env* (envelope protein) genes (Roitt *et al.*, 2001). It is characterized by its ability to replicate and to mutate rapidly within its host (Wilson and Walker, 2001). This high mutation rate is felt to be due to the infidelity of the viral reverse transcriptase (Coffin, 1995, Goodman, 2003). HIV-1 subtype A, C and D are predominant in Africa, HIV-1 subtype B exists predominantly in Europe, North America and Australia, (Wilson and Walker, 2001).

HIV type 2 the second AIDS–associated human retrovirus, differs from HIV-1 in its natural history, infectivity and pathogenicity as well as in details of its genomic structure and molecular behavior (Arya and Gallo, 1996). HIV-2 is less pathogenic, has a longer latency period with slower progression to disease state, lower viral count and lower rate of transmission than HIV-1 (Van Dyk, 2005). HIV-2 is predominant in West Africa (Wilson and Walker, 2001).

2.1.2 Modes of transmission of HIV

According to United Nations Educational, Scientific and Cultural Organization (UNESCO) 2006, there are three most common modes of HIV transmission and are as follows:

i. Unprotected sexual contact with an infected person. UNAIDS (2008b) reported that heterosexual intercourse remains the epidemic driving force in sub-Saharan Africa. This is also the case in other parts of the world such as Asia; for example, in the Sonagachi district of Calcutta, India, a project to empower sex workers and facilitate their access to essential information and health services lowered HIV incidence among targeted sex workers by two thirds, and increased rates of condom use from 5.0% to 90.0% (Basu *et al.*, 2004; Pardasani, 2005).

ii. Direct contact with infected blood, most often by drug injectors using needles or syringes contaminated with minute quantities of blood containing the virus, without sterilising between persons. For example, in Karachi, Pakistan, HIV prevalence among injecting drug users rose from less than 1.0% in the early 2004 to 26.0% in March 2005 (Emmanuel *et al.*, 2006). Different studies found that a small fraction of HIV infections in children are caused by contaminated injections, the transfusion of infected blood or blood products. (Kengeya-Kayondo *et al.*, 1995; Mulder *et al.*, 1996; Hauri *et al.*, 2004; Kiwanuka *et al.*, 2004; Schmid *et al.*, 2004).

The increasing knowledge of how HIV is transmitted and how exposures occur has led to improvements in healthcare worker safety, such as the formulation of infection control guidelines (Centers for Disease control and Prevention, 1999), and post-exposure management including the use of postexposure prophylaxis (PEP) with combination antiretroviral regimens (has the preventive effect for the health workers) (Centers for Disease control and Prevention, 2001) and have shown to be effective at reducing blood exposure and the risk for occupationally acquired HIV infection (Centers for Disease control and Prevention, 1997). For example, in 2003 occupationally acquired

HIV-1 infection had been documented in 57 healthcare workers in the USA (Do *et al.*, 2003).

iii. Mother-to-child transmission either during pregnancy or birth or postnatal via breastfeeding, is another common mode of HIV transmission that was also documented by UNESCO in 2006. World Health Organization (WHO) (2000) reported that about 20-30% of babies who are infected through mother-to-child transmission contract the virus through breast feeding. De Cock *et al.* (2000) reported that with prolonged breast feeding the likelihood of HIV infection can be as high as 45.0%; while timely administration of a short course of antiretroviral drugs (ART) significantly reduces the risk of HIV transmission (Guay *et al.*, 1999).

Schoub (1999) reported that most of mother-to-child transmissions occur at the time of delivery or during the birth process, and estimated that about 23% of transmission occur in the uterus even as early as the first trimester of pregnancy. The Department of Health, South Africa encourages and advocates that all pregnant women should check their HIV status in order to prevent transmission of HIV from mother to the fetus through administration of ART prophylaxis [e.g. zidovudine (AZT) (Retrovir®) and nevirapine (NVP) Viramune®] to a pregnant woman (Evian, 2003), if discovered to be HIV positive, in order to prevent the transmission of HIV to the fetus.

2.1.3 Prevalence of HIV/AIDS

A UNAIDS press release (2009) reported that the estimated number of person living with HIV worldwide was 33.4 million [31.1-35.8 million] with a reduction of 15% of new infections in sub Saharan Africa (UNAIDS/WHO, 2009). According to UNAIDS (2008b) sub-Saharan Africa remains the most seriously affected region in the global AIDS pandemic, and is home to 67% (i.e. 22 million) of all people living with HIV and for 75% of AIDS death in 2007. The number of children living with HIV increased from 1.5 million [1.3-1.9 million] in 2001 to 2.5 million [2.2-2.6 million] in 2007, however new infections among children declined in 2007, and nearly 90% of

all HIV-positive children live in Sub-Saharan Africa (UNAIDS/WHO, 2007). Young people aged 15-24 account for an estimated 45% of new HIV infection worldwide (UNAIDS, 2008b).

An estimated 5.7 million South Africans were living with HIV in 2007, and HIV data from antenatal clinics in the country suggest the stabilization of the pandemic (South African Department of Health, 2007). The prevalence of HIV is higher for women than men for the 15 to 34 age group, while it is higher for men in the older ages; and among women the rate is higher (32.5%) for the age group 25-29 years. Among men the rate peaks at slightly older ages, with 26.5% of those aged 30-34 being estimated to be infected (Dorrington *et al.*, 2006).

Nathea (2008) reported that the nine South African provinces are in different stages of the HIV epidemic but the Eastern Cape, Western Cape, Northern Cape and Limpopo are still experiencing high number of new infections almost double the number of AIDS related deaths leading to rapidly growing HIV prevalence rates. Limpopo Province has around 400 000 HIV positive people which is 7% of the population. Fourteen percent of adults between the ages of 20 and 64 were HIV positive in 2008 (Nathea, 2008).

2.1.4 CD4 count

CD4 (CD means Cluster Differentiation of Antigens and refers to the different receptors on a cell surface that makes it a distinct type of cell) is an important surface protein on the T-lymphocytes and with few exceptions serves to define the helper subset of T cells (MacLennan, 1996). A normal CD4 cell count is 600 to 1200/µL but average is 1000 cells/µL (Goodman, 2003). Viremia or viral load is monitored by measurement of HIV RNA in plasma, and immunologic status is selected in the absolute number of CD4 lymphocytes or the proportion of lymphocytes that express CD4 (Chaisson *et al.*, 2000). CD4 lymphocytes loss occurs throughout the course of HIV-infection (Fauci and Rosenberg, 1994), but the rate differs between individuals (Buchbinder *et al.*, 1994). This leaves an infected person

vulnerable to life-threatening opportunistic infections and cancers (Blattner *et al.*, 1997).

2.1.5 Phases of HIV-infection

In 1993, Centers for Disease Control and Prevention, USA, developed a classification system to categorize HIV-infected individuals according to clinical and CD4 cell count groupings (Centers for disease Control and Prevention, 1993). According to Mindel and Tenant-Flowers (2001) HIV infection has the following phases: Group I/ Primary HIV infection (acute sero-conversion illness), Group II/ Asymptomatic latent phase, Group III/ Persistent generalized lymphadenopathy, Group IV/ Symptomatic infection; Group IV is divided into several subgroups (A to E) and some of these groups (IVA, B, C1 and D) are AIDS [Acquired Immunodeficiency Syndrome – [AIDS-defining conditioning is the last stage or phase of HIV infection (Daniel and Jabs., 2004)] defining conditions.

2.1.6 Classifications of symptoms of HIV/AIDS [Mindel and Tenant-Flowers (2001)] are as follows:

2.1.6.1 Group I/ Primary phase/ Acute phase

This phase is characterized by the following symptoms:

A. Glandular Fever-like illness	B. Arthralgia
C. Fever	D. Lymphadenopathy
E. Sore Throat	F. Macular papular rash
G. Headache	H. Neuralgia
I. Diarrhoea	J. Malaise
K. Neurological symptoms include: meningitis, neuropathy, myelopathy and encephalopathy	L. Ulceration of the: Oropharynx and anogenital area

2.1.6.2 Group II/ Asymptomatic phase

No symptoms are related to this phase and this phase can take up to ten years.

2.1.6.3 Group III/ Persistent generalized lymphadenopathy

This stage is characterized by persistence of lymphadenopathy for at least three months, painful nodes, weight loss, fever lasting for at least 1 month and diarrhoea lasting for at least 1 month.

2.1.6.4 Group IV/ Symptomatic phase

The disease progresses and patients may have the following symptoms, constitutional symptoms (fever, night sweat, diarrhoea and weight loss), skin problems, mouth problems and haematological disorder.

2.1.6.5 AIDS (Acquired Immunodeficiency Syndrome)

Recurrent perianal or genital herpes which last longer and occurring frequently and persisting for more than three months, this stage is considered AIDS defining opportunistic infection (Group VI C1). Group VI C2 is characterized by persisting minor opportunistic skin and mouth lesions that are difficult to treat.

2.1.7 Current treatments of AIDS

Highly active antiretroviral therapy (HAART) (previously referred to as the AIDS cocktail) was introduced in 1995 with the Food and Drug Administration's (FDA, USA) approval of the first protease inhibitors [Saquinavir (Invirase), 1996], which lowers the copies of the HIV and allows the body to repopulate CD4 T lymphocytes effectively (Williams, 1997). Treatment is individualized and patients use many combinations of the therapy and the most commonly used combination consists of two reverse transcriptase inhibitors and one protease inhibitor (Sandstrom *et al.*, 2003). Administration of HAART to the patients is initiated when the CD4 count drops below 350 cells/μL (Dybul *et al.*, 2002; Ahdieh-Grant *et al.*, 2003). The provision of HAART in South Africa is when the CD4 count is at about 200 cells/μL, but anecdotal reports suggest that the Department of Health Guidelines to initiate antiretroviral therapy (ART) at an earlier stage is being looked at.

Highly active antiretroviral therapy (HAART) has clearly been effective at reducing morbidity and mortality of the systemic manifestation of AIDS (Deayton *et al.*, 2000). It also has altered the frequency and management of opportunistic ocular infections (Deayton *et al.*, 2000). The incidence of opportunistic infections, including CMV retinitis has decreased dramatically with the improved immune function that results from HAART (Palella *et al.*, 1998; Jabs and Bartlett, 1997; Holtzer *et al.*, 1998; Doan *et al.*, 1999; Baril *et al.*, 2000, Deayton, 2001; Kirubakaran, 2004).

The effectiveness of antiretroviral therapy (ART) is monitored with HI viral load, CD4 cell count and other supportive laboratory tests to monitor toxicity; because of the adverse effects such as nausea, vomiting and diarrhoea of HAART some patients will need to change the medication (Roels, 2004). Not all individuals infected with HIV receive potent antiretroviral therapy because of socioeconomic or other factors, and others will be intolerant of these drugs or experience drug failure (Jeng *et al.*, 2007). Administration of ART to HIV infected individuals demonstrated that AIDS can be transformed from being a deadly disease to a more manageable, still incurable but a chronic illness (Bucciardini *et al.*, 2006; Grifford and Groessl, 2002; Mocroft *et al.*, 1998; Wouters *et al.*, 2007).

2.1.8 Adolescents and HIV/AIDS

According to Singh *et al.* (2005) adolescence is a period of great physical, mental and emotional turmoil with teenagers in search of their identity. They very often start experimenting with intravenous drugs, sex, and both making them vulnerable to contracting the HI virus. Adolescents form a particularly important target group for the primary prevention of HIV, since the latest UNAIDS (2008b) report shows that young people account for all new infections.

Social learning theory predicts that adolescents will be better able to engage in positive self-directed change if they have the knowledge about HIV/AIDS (Bandura, 1989). Cartagena *et al.* (2006) demonstrated that, after three years of delivery of sexual health peer education programs, grade 10 secondary school students in Mongolia were more knowledgeable, had less traditional attitudes and had a greater

sense of their self efficacy. Cheng *et al.* (2008) reported that an intervention also influenced respondents' communication with teachers and peers regarding HIV/AIDS, which was helpful for mitigating respondents' fear of AIDS and building their HIV/AIDS awareness in a friendly atmosphere. A recent study by Mahat *et al*. (2008) showed that peer education programs seem to be effective in improving adolescents' knowledge on HIV/AIDS.

2.2 OCULAR MANIFESTATIONS OF HIV/AIDS

Ocular complications occurring in about 75-80.0% of AIDS patients may be divided into four categories: noninfectious ocular manifestation of HIV/AIDS (e.g. retinal microangiopathy), opportunistic infections, tumors and neuro-ophthalmological lesions (Meyer, 2005). Jabs and Quinn (1996) reported that other ocular complications may occur during other phases of HIV-infection.

2.2.1 Noninfectious ocular manifestations of HIV/AIDS

2.2.1.1 Conjunctival microvasculopathy

Stewart and Lambrou (1997) reported that approximately 80.0% of HIV-positive patients eventually present with asymptomatic conjunctival microvascular changes which include segmental vascular dilation and narrowing, which is correlated with retinal microvasculopathy and usually no treatment is required (Lima, 2004). Microvascular changes can be seen in the conjunctiva of at least 75% of HIV-infected individuals (Geier *et al*., 1994). Those patients may have microaneurysms and segmental vascular dilatations and narrowing (Cunningham and Margolis, 1998), with particular involvement of the inferior perilimbal bulbar conjunctiva (Acharya and Cunningham, 1998). The cause of these vascular changes is unknown, but it is probably associated with the deposition of immune complexes related to HIV or the direct infection in the conjunctival vascular endothelium (Engstrom *et al*., 1990). Microvascular changes in the conjunctiva do not have a direct clinical effect (Jeng *et al*., 2007).

2.2.1.2 Retinal microvasculopathy

Microvasculopathy is the most common ocular manifestation of AIDS (Vrabec, 2004; Yared *et al.*, 2006). It affects 40% to 60% of HIV positive patients, and is recognized in 89% autopsy specimens (Franco-Paredes *et al.*, 2002; Jabs, 1995). It is generally asymptomatic and there is no indication for treatment (Palestine and Frishberg, 1991). Different terms are used to describe the lesions appearing on the retina (Kenstelyn, 2001). These include non-infectious AIDS retinopathy, AIDS related retinopathy, and HIV related retinopathy (Kenstelyn, 2001).

Ophthalmoscopic features of HIV retinopathy include cotton wool spots, intra-retinal hemorrhages and less frequently peri-vascular sheathing (Daniel and Jabs, 2004). Pathologically, the CWS (cotton wool spots) are nerve fiber layer infarcts, related to accumulations of axoplasmic debris, subsequent to obstruction of axoplasmic flow (Dejaco-Ruhswurm *et al.*, 2001). They may represent an increased risk for CMV retinitis (Lima, 2004). Intraretinal hemorrhages, including Roth's spots, may be present in AIDS patients and they are commonly innocuous in the setting of HIV retinopathy and may occur within different layers of the retina (Sarraf and Ernest, 1996).

Ischemic maculopathy, characterized by cotton wool patches and blot hemorrhage near the fovea, results in abrupt visual loss in approximately 3% of patients (Cunningham *et al.*, 2001). Rarely, macular edema or serous maculopathy may cause blurred vision (Palestine and Frishberg, 1991). The pathogenesis of retinal microvasculopathy is probably similar to that of conjunctival microvasculopathy (Engstrom *et al.*, 1990).

2.2.1.3 Dry eye syndrome/ Keratoconjunctivitis sicca

Keratoconjunctivitis sicca occurs in 10-20 percent of patients with HIV infection, typically at later stages of the illness (Lucca *et al.*, 1990; Geier *et al.*, 1995; Cunningham and Margolis, 1998; Wilkins and Lightman, 2002). Patients with AIDS have been shown to have symptoms of dry eye (keratoconjunctivitis sicca) and clinical signs (Chronister, 1996). This is probably related to HIV-mediated

inflammation and destruction of the primary and secondary lacrimal glands (Cunningham and Margolis, 1998). Dry eye in HIV-patients is not related to the CD4 cell count or associated with severity of HIV, but it has been reported that decrease in tear production occurred in 20-25% of patients with HIV infection (Geier *et al*., 1995), and also decreased tear production has also been found among HIV-infected children (Kenstelyn *et al*., 2000). The significance of dry eye in relation to systemic HIV diseases needs further investigations (Chronister, 1996).

2.2.1.4 Allergic conjunctivitis

Some HIV/AIDS patients complain of a chronic, mildly irritated "red eye" that is resistant to treatment, this is increased after HIV sero-conversion; and patients with HIV/AIDS have a high frequency of some clinical and laboratory manifestations of allergic disease (Chronister, 1996).

2.2.2 Opportunistic ocular infections

According to Bhatia (2002) there are many ocular opportunistic infections associated with HIV/AIDS and they include the following: *Molluscum contagiosum*, *ocular syphilis*, *ocular tuberculosis*, *cytomegalovirus (CMV) retinitis*, *Pneumocystis jiroveci choroiditis* and etc. Some of the common opportunistic infections are described below:

2.2.2.1 Infectious keratitis

Although corneal infections occur in less than 5% of HIV-infected patients, they may result in permanent loss of vision (Akduman and Pepose, 1995). Varicella-zoster virus and herpes simplex virus are the most common cause of keratitis (Cunningham and Margolis, 1998). Keratitis related to varicella-zoster virus infection is often characterized by the presence of herpes zoster ophthalmicus, although the dermatitis may be mild or even absent (Karbassi *et al*., 1992; Silverstein *et al*., 1997). Both varicella-zoster virus keratitis and herpes simplex virus keratitis may recur more frequently and in some cases may be more resistant to treatment in HIV-positive patients than in other patients (Hodge and Margolis, 1997).

Numerous causative organisms have been reported, although the Candida species are particularly common in intravenous drug users (Hemady, 1995). Microsporidia are obligate intracellular parasites known to cause gastroenteritis, sinusitis, and pneumocystis in HIV-positive patients (Bryan, 1995). Ocular microsporidiosis is uncommon but can produce punctuate superficial keratopathy, often with a mild papillary conjunctivitis (Lowder *et al*., 1996).

2.2.2.2 Cytomegalovirus (CMV) retinitis

The occurrence of cytomegalovirus (CMV) retinitis indicates poor prognosis for life of the AIDS patients (Biswas *et al*., 2000a). It is also associated with a high degree of visual morbidity (Kempen *et al*., 2003a). Cytomegalovirus (CMV) retinitis is the most common AIDS related opportunistic infection of the eye, but infection usually does not spread to involve anterior segment tissues although CMV infection of the iris has been reported in one patient with CMV retinitis (Cheng *et al*., 1998). Poole (2000) reported that in some areas of the world such as Africa, most HIV-infected people succumb to complications of the disease before reaching levels of immunosuppression that are associated with CMV retinitis.

Cytomegalovirus (CMV) retinitis develops in 15% to 41% of patients with AIDS (Battu *et al*., 2000; Biswas *et al*., 1995; Crumpacker, 2000). Symptoms of CMV retinitis are blurred vision, a scotoma (dark area covering part of visual fields), light flashes or floaters (Kirubakaran, 2004). The prevalence of visual impairment at the time of CMV retinitis diagnosis is high and is related to demographic characteristics (Kempen *et al*., 2003a). Holbrook *et al*. (2003) reported that the rates of visual loss ranged from 18.8-49.1 events per 100 eye years for loss of acuity to 20/200 or worse and 51.7-97.7 events per 100 eye years for loss of acuity below 20/40.

Jabs *et al.* (2002) reported that CMV retinitis remains an important problem in the highly active antiretroviral therapy (HAART) era; new cases continue to be seen and in Kempen *et al*. (2001) reported that the frequency of occurrence is less by 60% with HAART. Soon after the introduction of HAART, there was a concern that patients with improved immune function may still be susceptible to the development

of new CMV retinitis lesions (Jacobson *et al*., 1997). Although the incidence of CMV retinitis has declined markedly, the risk of visual loss due to both retinitis and retinal detachment has decreased by 30% since the advent of HAART (Holbrook *et al*., 2003) but in contrary, Holland (1999a) reported that CMV remains a problem not only among those for whom HAART is not available but among HAART-experienced patients in whom human immunodeficiency virus drug resistance has developed.

In patients with pre-existing CMV retinitis treated with HAART, several intraocular inflammation can develop in response to CMV antigens that become possible when an immune reconstitution occur (IRU) (Kuppermann and Holland, 2000; Robinson *et al*., 2000; Kempen *et al*., 2006). Several series of studies have reported that CMV retinitis is associated with a low CD4 cell counts, and the mean count among patients with CMV retinitis is generally less than 50 cells/μL with the range from 10 to 20 cells/μL (Pertel *et al*., 1992; Kuppermann *et al*., 1993). Jabs (1995) study shows that CMV retinitis was not exclusively seen in patients with a low CD4 cell counts, because one patient in their study had CMV retinitis with a T cell counts of 115 cells/μL and another study reported the highest CD4 T cell counts (323 cells/μL) in a patient with CMV retinitis (Hochster *et al*., 1990). Bhatia (2002) reported that floaters are the earliest warning signs of CMV retinitis. It is bilateral in 50% of AIDS patients and it appears as haemorrhagic retinal necrosis with lesions along the vascular arcade and sheathing of the vessels (Kenstelyn, 2001).

Cotton wool spots and CMV retinitis are common ocular manifestations of HIV/AIDS in adults and are less prevalent in children (Kenstelyn *et al*., 2000). In early AIDS epidemic it was suggested that the treatment of CMV retinitis might predispose to retinal detachment by inhibiting scar formation, it has subsequently become clear that the rate of retinal detachment in patients not treated for CMV retinitis is substantially higher than in those treated (Jabs *et al*., 1991). Immuno-compromised individuals have an increased likelihood of more severe and atypical presentations and this highlights the need for high index of suspicion for HIV infection as ocular or orbital disease may be the first manifestation of life threatening systemic toxoplasmosis (Lee *et al*., 2006).

HIV infected patients still require close ocular follow up even if they are being treated with HAART (Jabs *et al*., 2004). Moreover virologic resistance to HAART is becoming more frequent (Scholz *et al*., 2003; Doan *et al*., 1999; Lilleri *et al*., 2003). Occasionally, HAART may cause vision loss via the mechanism of immune recovery uveitis (Kempen *et al*., 2003b). Lima (2004) reported that it is characterized by vitritis and optic disc and macular edema. Neovascularization at the optic disc and the retinal periphery may also occur, and the clinically important complications of immune recovery uveitis may include cataract, epiretinal membrane formation and cystoid macular edema (Lima, 2004).

Chee *et al*. (2007) reported that cytomegalovirus infection is an important cause of corneal endothelitis in HIV patients. Corneal endothelial deposits are seen frequently, they are fairly distinct however, (Althaus *et al*., 1996; Brody *et al*., 1995; Chevalley *et al*., 1994; Mitchell *et al*., 1994; Walter *et al*., 1996) and have been described as being fine, refractile, stellate-shape, distributed diffusely, and best seen with retro-illumination (Walter *et al*., 1996). Corneal endothelial deposits are also seen in HIV-infected individuals without CMV retinitis (Holland *et al*., 1999a; Miedziak *et al*., 1998).

Cytomegalovirus (CMV) is believed to be capable of causing either epithelial keratitis (Inoue *et al*., 1998; Wilhelmus *et al*., 1996; Yee *et al*., 1991) or stromal keratitis (Inoue *et al*., 1998; Wehrly *et al*., 1995; Wilhelmus *et al*., 1996) although both conditions are probably uncommon (Jeng *et al*., 2007). Jeng *et al*. (2007) reported that epithelial keratitis has been characterized by slightly elevated, opaque, branching non-ulcerative lesions that closely resemble varicella-zoster virus (VZV) dendrites. In the report by Inoue *et al*. (1998), stromal keratitis was attributed to CMV, which was found in both tears and the aqueous humor.

2.2.2.3 Immune recovery uveitis (IRU)

Studies estimated the difference in occurrence of IRU from 10.0% to 83.0% per person per year (Nguyen *et al*., 2000; Karavellas *et al*., 1999). Immune recovery uveitis (IRU) is a result of heightened immunological reaction against intraocular pathogens, usually CMV that become possible with immune reconstitution (Karavellas *et al*., 1998; Karavellas *et al*., 1999; Nussenblatt and Lane, 1998). Inflammation is most prominent in the vitreous cavity, but can also involve the anterior segment (Cunningham, 2000). In some cases it can be sufficiently severe to cause a hypopyon (Biswas *et al*., 2000b).

The complications of IRU include optic disc edema, cystoid macular edema (Karavellas *et al*., 2000), epiretinal membrane formation, vitreomacular traction syndrome, retinal neovascularization, posterior synechiae and cataract (Cunningham, 2000; Aarevalo *et al*., 2003; Kempen *et al*., 2006). IRU may be sight-threatening (Holland, 1999b; Kempen *et al*., 2006; Kuppermann and Holland, 2000; Whitcup, 2000). Initial symptoms of IRU include mild blurring of vision and floaters (Karavellas *et al*., 2000) but loss of vision can be more severe and permanent if complications of inflammation occur (Jeng *et al*., 2007). People with large CMV retinitis lesions are at increased risk for IRU, presumably because there is more viral antigen in the eye (Kempen *et al*., 2006). IRU can occur as a result of similar, increased inflammatory reactions against other pathogens including *Toxoplasma gondii, Mycobacterium avium* complex and *Leishmania sp* (Blanche *et al*., 2002; Zamir *et al*., 2002).

2.2.2.4 Herpes zoster ophthalmicus (HZO)

Varicella-zoster virus (VZV) is the second most common ocular pathogen in patients with HIV infection (Franco-Paredes *et al*., 2002). Netland *et al*. (1993) reported HZO as an initial manifestation of HIV infection. HZO affects 5 to 15% of HIV positive patients (Jabs and Quinn, 1996). HZO is a vesiculobullous dermatitis caused by varicella-zoster virus (Cunningham and Margolis, 1998). The infection involves the ophthalmic distribution of the trigeminal nerve (Karbassi, *et al*., 1992; Jeng *et al*., 2007), produces a vesicular rash over the distribution of the first division of the

trigeminal nerve which can include the eyelids (Jeng *et al.*, 2007) and pain may be severe (Cunningham and Margolis, 1998).

With the AIDS epidemic, HZO is being found more in young individuals because HIV infection appears to increase the risk of HZO and younger individuals are more likely to be infected with HIV (Liesegang, 1991). Also Palexas and Welsh (1992) in their study reported that the clinical manifestations of herpes zoster ophthalmicus has a higher positive predictive value for HIV positivity in young patients than in older patients (40 years and above) and it is an initial ocular manifestation of AIDS. More recently, in 2003 a study from Nigeria found that half of 10 healthy appearing individuals with HZO were infected with HIV (Owoeye and Ademola-Popoola, 2003).

The virus resides latent in the trigeminal ganglion until reactivated, often affecting the sensory nerve, skin, eye and adnexa (Gurwood *et al.*, 2002). A study by Looney (1997) has shown ophthalmic involvement in 99% of HIV patients with Hutchinson's sign. Ocular complications results from inflammation, nerve damage and tissue scarring (Lewallen, 1994; Sellitti *et al.*, 1993). Corneal involvement can be either epithelial or stromal and occurs in approximately 20% of patients with HIV and HZO, the stromal keratitis can be disciform, non-disciform, or manifest as avascular stromal infiltrates (Margolis *et al.*, 1998). An uncommon but particularly painful chronic infectious pseudodendritic epithelial keratitis is characterized by elevated, gray, pleomorphic pseudodendritiform lesions distributed over the corneal, limbal and conjunctival epithelium and are not common in patients with HIV and HZO (Margolis *et al.*, 1998).

In one series, three individuals with skin involvement developed bilateral ulcerative keratouveitis, and peripheral ulcerative keratitis can occur in HIV-infected patients with HZO (Neves *et al.*, 1996). According to Pavan-Langston (2002) corneal complications occur in approximately 65% of cases with herpes zoster ophthalmicus and this can result in significant loss of vision (Wiafe, 2003).

Significant entropion or trichiasis may result from herpes zoster, because the virus can cause permanent contraction scars of the deep dermal tissue of the eyelids (Looney, 1997; Wiafe, 2003). Jeng *et al*. (2007) reported that other disorders of HZO can include retinal vasculitis necrotizing, herpetic retinopathy, optic neuritis and oculomotor palsies.

2.2.2.5 Herpes simplex virus (HSV)

Liesegang (2001) reported that herpes simplex infection can manifest as blepharitis, conjunctivitis, epithelial keratitis, stromal keratitis, keratouveitis, iridocyclitis, or retinitis. It is the leading cause of chronic infectious ocular disease in the USA with an estimated annual incidence of 20.7 cases per 100,000 people (Liesegang, 2001). Also it is the most common cause of corneal blindness in North America (Liesegang, 2001). Morbidity from the recurrent episodes of disease is high (Sudesh and Laibson, 1999). Although ocular infection usually occurs with HSV -1 documented cases of HSV-2 ocular infection have been reported (Rummelt *et al*., 1995) including an individual with AIDS who was found to have simultaneous HSV-1 and -2 infection of the cornea (Rosenwasser and Greene, 1992).

2.2.2.6 Molluscum contagiosum

Molluscum contagiosum is a disease of the skin of the eyelid and conjunctiva that can occur in a severe form in HIV-infected patients (Biswas and Sudharshan, 2008). It is a highly contagious dermatitis which is caused by a DNA virus of the poxvirus group (Chronister, 1996; Kenstelyn and Cunningham, 2001). The overall incidence of molluscum contagiosum is estimated to be 243 new infections per 100,000 person-years in males and 241 per 100, 00 person years in females (Pannell *et al*., 2005). Occurrence of molluscum contagiosum in AIDS patients inversely correlated with the CD4 cell counts and usually starts only if these fall below 100 cells/µL, suggesting molluscum lesions to be a cutaneous correlate of cellular immune deficiency (Schwartz and Myskowski, 1992; Cursiefen and Holbach, 1998).

Molluscum contagiosum is more common and tends to be more severe in HIV-positive persons than in HIV-negative persons, with larger, more numerous and more rapidly growing lesions (Tschachler *et al*., 1996). Involvement of the eyelids occurs in up to 5% of HIV-infected patients (Bardenstein and Elmets, 1995). Molluscum contagiosum lesions of the eyelid have been reported as the initial clinical manifestation of HIV disease (Leahey *et al*., 1997).

In HIV-infected patients, it can have a rapid onset, numerous papules that are quite large in size and follow a prolonged course (Robinson *et al*., 1992). In the general population, primary ophthalmic lesions typically involve the periocular skin, especially at the eyelid margins, where smaller lesions may be hidden by the eyelashes (Jeng *et al*., 2007). If the virus particles are shed onto the ocular surface, secondary complications of chronic follicular conjunctivitis and epithelial keratitis can occur (Charteris *et al*., 1995).

They are usually multiple, bilateral, confluent and tend to recur (Biswas *et al*., 2000a), when CD4 T cell counts decreases (Bardenstein and Elmets, 1995). Cursiefen *et al*. (2002) reported multiple bilateral molluscum contagiosum lesions of the upper and lower eyelids and predominantly normal CD4 and CD8 cell counts on a 67 year old woman. Many cases of Molluscum contagiosum in HIV-infected patients are resistant to therapy (Robinson *et al*., 1992).

2.2.2.7 Pneumocystis Jiroveci choroiditis

Pneumocystis Jiroveci has traditionally been considered a parasite, but evidence suggests that it is a fungus (Cailliez *et al*., 1996). It is an important opportunistic pathogen in individuals with HIV infection and is the most common life-threatening complication of AIDS (Ruggli *et al*., 1997). The choroid (Shami *et al*., 1991), retina and orbit (Friedberg *et al*., 1992) can be infected, but Ruggli *et al*. (1997) reported only one case of P. Jiroveci infection of the conjunctiva.

Choroidal infection with the unicellular Pnuemocystis Jiroveci is uncommon, occurring in less than 1% of patients with AIDS in the pre-HAART era, but accounting for 22% of infectious choroidopathies (Jabs, 1995). Ocular manifestations of P. Jiroveci include conjunctivitis, orbital mass, optic neuropathy, and choroiditis (Friedberg *et al.,* 1992; Ross *et al*., 1994; Ruggli *et al*., 1997). Most, but not all patients with Pneumocytis Jiroveci choroiditis have a history of Pneumocystis Jiroveci pneumonia (*PJP*) (Jab, 1995; Shami *et al*., 1991). Clinically, the lesions are 1/3 to 2-disc diameter in size; creamy-white, round or oval, and located at the level of the choroids (Shami *et al*., 1991). The choroidal infection is classically bilateral and multifocal, although unifocal infection in one eye has been described (Foster *et al*., 1991). It is slowly progressive and often not associated with visual loss. The multiple, yellowish, well-demarcated, choroidal lesions located in the posterior pole are not associated with vitritis, iritis, or vasculitis (Shami *et al*., 1991). The lesions are generally asymptomatic although patients may complain of blurry vision (Dugel *et al*., 1990a).

2.2.2.8 Ocular syphilis

Acquired syphilis is a sexually transmitted infection caused by *Treponema pallidum* (Durnian *et al*., 2004)*.* Ocular involvement previously was reported to be rare, but recent studies demonstrated frequent occurrence (Doris *et al*., 2006; Basta *et al*., 2007). Ocular syphilis is the most common intraocular bacterial infection in HIV-positive persons, affecting 1 to 2 percent of patients (Jabs and Quinn, 1996; Shalaby *et al*., 1997; Cunningham and Margolis, 1998). It has been estimated that 1.1% of uveitis cases are due to ocular syphilis (Tamesis and Foster, 1990).

Syphilis is the most common intraocular bacterial infection in patients with HIV infection (Cunningham and Margolis, 1998; McLeish *et al*., 1990). It has been argued that syphilis is not an opportunistic infection in AIDS because of a similar prevalence among HIV-positive and HIV-negative patients (Hodge *et al*., 1998). A recent study found that previously unknown HIV infection can be detected from ocular syphilis (Kunkel *et al*., 2009). Also, because *treponemes* are more virulent than other organisms, and syphilis in AIDS may develop when the CD4 cell counts is greater

than 200 cells/μL, and consequently, syphilis, including ocular syphilis, may be the presenting illness leading to the diagnosis of AIDS (Browning, 2000).

Clinical findings of ocular syphilis in AIDS may include iritis, vitritis, retrobulbar optic neuritis, papillitis, neuroretinitis, retinal vasculitis, a necrotizing retinitis which may be clinically indistinguishable from CMV and exudative retinal detachment (Becerra *et al*., 1989; Musher *et al*., 1990). Also another study reported that posterior segment complications include choroiretinitis, retinochoroiditis, serous retinal detachment, pseudoretinitis pigmentosa (Ormerod *et al*., 2001).

According to Jeng *et al*. (2007) syphilitic corneal interstitial keratitis (IK) is usually a feature of the congenital disease, although it may occasionally be associated with acquired infection. Syphilis is well established, but often an unrecognized, cause of anterior uveitis with non-specific inflammatory signs (Aldave *et al*., 2001; Durnian *et al*., 2004). It can occur with or without posterior segment findings (Aldave *et al*., 2001; Durnian *et al*., 2004; Shalaby *et al*., 1997). Cataracts can occur in individuals with syphilis usually because of uveal inflammation (Margo and Hamed, 1992). Aside from the generalized skin rash seen with secondary syphilis, cutaneous involvement of the eyelids is rare, but temporary loss of the eyelashes and eyebrows have been seen with secondary syphilis (Margo and Hamed, 1992). Anterior segment involvement includes episcleritis, scleritis, interstitial keratitis (Kuo *et al*., 1998) *granulomatous* and non-*granulomatous* keratic precipitates (McLeish *et al*., 1990). Elevated intraocular pressure on presentation occurs in only 4% of eyes (Browning, 2000). Kenstelyn and Cunningham (2001) reported that vision loss associated with infection is attributed to uveitis and optic nerve disease.

2.2.2.9 Ocular tuberculosis

Forty-six percent of people in the developing world with HIV are co-infected with tuberculosis (TB), and 13% of the deaths among HIV-infected individuals are from disseminated tuberculosis (WHO, 2005). Early diagnosis and prompt treatment may be sight-saving in patients with ocular TB (Alvarez *et al*., 2009). HIV-infected persons are at markedly increased risk for primary or reactivation TB and for repeat

episodes of TB from exogenous re-infection (Babu *et al.,* 2006). Given the huge number of patients with HIV/AIDS and active tuberculosis in developing countries, it is probable that ocular complications of tuberculosis occur more frequently than has been recognized (Cunningham, 2001). Ocular TB is rare and can occur even when the CD4 cell counts is greater than 200 cells/µL (Babu *et al*., 2006).

Extraocular TB has several potential manifestations (Sheu *et al*., 2001). It can appear on the external eye as a lid abscess or manifest as chronic blepharitis or atypical chalazions, mucopurulent conjunctivitis with regional lymphadenopathy, phlyctenule, infectious keratitis, inflammation within the cornea stroma or infectious scleritis (Alvarez *et al*., 2009).

Uveitis from TB is intraocular and may present as an iritis or iridocyclitis; iritis may be granulomatous which presents as an aggressive anterior uveitis with smudgy inflammatory exudates on the corneal endothelium (Alvarez *et al*., 2009). Ocular TB most commonly occurs after primary pulmonary infection attributable to direct hematogenous spread or by hypersensitivity responses and presents with choroidal *granuloma*, subretinal abscess, which worsen to *panophthalmitis* and conjunctival mass (Babu *et al*., 2006). Choroidal granuloma has been the most common presentation in the many studies (Mehta and Gilada, 2005; Shimakawa, 2000; DiLoreto and Rao, 2001; Beare *et al*., 2002; Sheu *et al*., 2001; Mercanti *et al*., 2001). The study by Babu *et al*. (2006) reported only one case with panophthalmitis with a higher CD4 cell counts and also one case of conjunctival tuberculosis.

There are few reports of anterior segment tuberculosis presenting with conjunctival involvement in immunocompetent patients such as unilateral tuberculous conjunctivitis with tarsal necrosis (Rosenbaum *et al*., 1998), tuberculous scleral granuloma (Gopal *et al*., 2003), primary conjunctival tuberculosis and scleritis (Salas *et al*., 2001). Babu *et al*. (2006) reported progression to panophthalmitis in three cases, which presented initially with subretinal abscess and also reported that this suggests that subretinal abscess from TB may have more severe clinical courses in patients with AIDS.

Alvarez *et al*. (2009) reported that the optic nerve may be inflamed mimicking an ischemic optic neuropathy and it can also present as an optic neuritis or papillitis, and inflammation can involve the posterior structures. Endogenous endophthalmitis results when the infection and inflammation extends through the choroids and retina to involve the vitreous, which mimics the post-operative exogenous endophthalmitis after cataract surgery (Alvarez *et al*., 2009).

2.2.2.10 Ocular toxoplamosis

Ocular toxoplasmosis is caused by a *Toxoplasma gondii* (protozoan parasite) (Jabs, 1995; Cochereau-Massin *et al*., 1992). According to Bhatia (2002) toxoplasmicchoroiditis is rare and accounts for 1.0% of AIDS-related retinal infections only. Ocular toxoplasmosis is one of the most common infectious causes of retinitis in young immunocompetent subjects and this form is attributed to the reactivation of the congenital retinal cyst (Cochereau-Massin *et al*., 1992).

Toxoplasmosis may cause a variety of ocular abnormalities in patients with AIDS including iritis (Cano-Parra *et al*., 2000), vitritis, choroiditis, multifocal military (Berger *et al*., 1993) or diffuse necrotizing retinitis (Lee *et al*., 2000), papillitis or retrobulbar neuritis (Grossniklaus *et al*., 1990; Wei *et al*., 1996) or outer retinal toxoplasmosis (Morales, 1999), and a primary toxoplasmosis anterior uveitis, which can occur in the absence of retinal lesions (Cano-Parra *et al*., 2000).

Toxoplasmosis retinitis may resemble CMV retinitis, however, intraocular inflammation is usually more severe (Vrabec, 2004). Kramer *et al*. (2003) reported that Toxoplasma retinitis in AIDS patients appears more frequently when the CD4 cell counts falls below 150 cells/µL. This infection may be primary, reactivation (Gagliuso *et al*., 1990) of previous ocular infection or metastatic from another part of the body (Cochereau-Massin *et al*., 1992). Progression to *panophthalmitis* and cellulites occur rarely and in spite of therapy, results in no light perception (Moorthy *et al*., 1993).

2.2.2.11 Other fungal infections

Hemady (1995) reported 16 cases of keratitis in HIV-infected patients that were caused by fungal infection and *Candida albicans* was the most common pathogen. *Histoplasma capsulatum* has been identified in scleral vessels (Font *et al*., 1995), the optic nerve (Specht *et al*., 1991), the choroidal vessels (Morinelli *et al*., 1993; Font *et al*., 1995), all layers of the retina (Specht *et al*., 1991), the ciliary body (Specht *et al*., 1991), trabecular meshwork, and Schlemm's canal (Font *et al*., 1995) of HIV/AIDS patients.

2.2.2.12 Iridocyclitis

A mild iridocyclitis is common in HIV-positive patients and is usually observed in association with retinitis caused by cytomegalovirus (Holland *et al*., 1996) or varicella-zoster virus (Engstrom *et al*., 1994). Iridocyclitis may be part of a more generalized autoimmune and endogenous uveitis, such as Reiter's syndrome, which may be more common in patients with HIV infection than in those without it (Berenbaum *et al*., 1996). An HIV-infected patient complains of photophobia and red eye, he or she may have iridocyclitis and this presentation requires a thorough ocular examination in order to rule out anterior or posterior segment infection (Sarraf and Ernest, 1996).

Severe inflammation of the anterior chamber is uncommon but can occur in association with syphilitic retinochoroiditis (Shalaby *et al*., 1997) or a rare form of bacterial or fungal retinitis (Jabs and Quinn, 1996). It may be associated with retinal or choroidal infection with multiple opportunistic organisms, such as cytomegalovirus, herpes simplex virus, varicella zoster virus, *Candida species*, *Cryptococcus species*, *Toxoplasma gondii*, *Treponema pallidum* and *Mycobacterium species* (Rosberger *et al*., 1998). A study by Cano-Parra *et al*. (2000) showed that *Encysted T. gondii* organisms have been found in an iris biopsy specimen from an AIDS patient presenting with iridocyclitis.

2.2.2.13 Candidal endophthalmitis

Typical candidal fungal lesions appear as fluffy white "moulds" which are frequently bilateral and superficially located and often extend into the vitreous (Ahmed *et al.*, 2006). Lima (2004) reported that it presents as a focal white infiltrate in the choroids and may break through the retina into the vitreous.

2.2.2.14 Cryptococcus chorioretinitis

Cryptococcus neoformans infection of the eye usually involves the posterior segment (Charles *et al.*, 1992); however rare anterior segment infections have been reported (Balmes *et al.*, 1992; Coccia *et al.*, 1999). Manifestations have also included focal granulomatous conjunctivitis (Balmes *et al.*, 1992) and lesions resembling squamous cell carcinoma (Waddell *et al.*, 2000). Limbal cryptococcosis is presented as elevated white granulomatous lesion (Muccioli *et al.*, 1995). Cryptococcus choroiditis is uncommon as in other types of multifocal choroiditis; ocular infection is believed to be as a result of infectious emboli in the choroicapillaries (Vrabec, 2004). The lesions of cryptococcal choroiditis may be multifocal, solitary or confluent (Verma and Graham, 1995). In addition to choroiditis, clinical manifestations of ophthalmic cryptococcosis include eyelid nodule (Coccia *et al.*, 1999), conjunctival mass (Muccioli *et al.*, 1995; Waddell *et al.*, 2000), granulomatous iritis, iris mass (Charles *et al.*, 1992), vitritis, necrotizing retinitis, endophthalmitis and optic neuritis (Vrabec, 2004).

2.2.3 Ocular neoplasms

Ocular neoplasms are common occurrences in HIV/AIDS (Ali *et al.*, 2007). Beare and Batumba (2006) reported that in the Sub-Saharan African countries, there had been a dramatic increase of ocular surface squamous neoplasia (OSSN) and other AIDS-related malignancies such as non-Hodgkin's lymphomas and Kaposi'sarcoma, with OSSN being the most common. These three neoplasms are discussed below.

2.2.3.1 Kaposi's sarcoma (KS)

Kaposi's sacorma is a vascularized tumor of the skin and mucous membrane and it is associated with herpes virus 8 (Cunningham and Margolis, 1998; Acharya and Cunningham, 1998). They are painless mesenchymal tumors affecting the skin and mucous membranes and occur in up to 25% percent of such patients' (Tschachler *et al*., 1996), internal organs and lymph nodes (Yanoff and Fine, 2002). The ocular involvement includes the eyelids, the conjunctiva (Kurumety and Lustbader, 1995) and rarely the lacrimal sac, the orbit (Kramer *et al*., 2003; Collaco *et al*., 2000) and lacrimal gland (Scheschonka *et al*., 2003). Conjunctival Kaposi's sarcoma has been reported as the initial sole manifestation of HIV infection (Curtis and Durairaj, 2005; Kurumety and Lustbader, 1995; Schmid *et al*., 2003), and may occur in up to 1% of patients with HIV infection (Lima, 2004). Kaposi's sarcoma lesions may be flat or raised and is bright red, painless, and surrounded by tortuous, dilated vessels (Hasche *et al*., 2003).

Conjunctival Kaposis' sarcoma may be initially misdiagnosed as subconjunctival hemorrhages (Verma *et al*., 2008; Jeng *et al*., 2007). Jeng *et al*. (2007) reported that it might include conjunctival inflammation, melanosis, malignant melanoma, squamous cell carcinoma, pyogenic granuloma, lymphangioma, cavernous hemangioma, and nodular scleritis. Kaposi's sarcoma of the conjunctiva most commonly occurs along the inferior fornix but they can occur along the upper palpebral and bulbar conjunctiva as well, and even small lesions can cause important cosmetic and functional discomfort, which may be related to mass effect or secondary corneal changes (Sarraf and Ernest, 1996; Kirova *et al*., 1998). Dugel *et al*. (1990b) have classified adnexal KS lesions clinically and histopathologically: stage I and II lesions are flat (less than 3mm in height), patchy and less than 4 months in duration; stage III lesions are nodular, greater than 3mm in height, and greater than 4 months in duration.

2.2.3.2 Conjunctival squamous cell carcinoma (CSCC)

Conjunctival squamous cell carcinoma occur more frequently in AIDS patients, as it is illustrated by its high HIV prevalence in the African population (Chisi *et al*., 2006; Porges and Groisman, 2003). A study by Verma *et al*. (2008) also shows evidence that conjunctival squamous cell carcinoma is increasing in developing nations, particularly in sub-Saharan Africa, including Uganda (Parkin *et al*., 2003). Conjunctival squamous cell carcinoma in HIV/AIDS patients presents on average at a younger age (35-40 years old) than in HIV-negative patients (Timm *et al*., 2004). There has been speculation that the role of HIV in conjunctival squamous cell carcinoma is through immunosuppression and activation of oncogenic viruses such as human papillomavirus (HVP) in the conjunctiva, thus far only oral and anogenital (HVP) have been shown to occur more frequently in HIV-positive patients (Aynaud *et al*., 1998; Cameron and Hagensee, 2007).

Other neoplastic lesions identified in patients with HIV include conjunctival intra-epithelial neoplasia and basal cell carcinoma (Acharya and Cunningham, 1998). A histopathology study of the excised tissue by Fogla *et al*. (2000) revealed that conjunctival dysplasia occur on the nasal side and squamous cell carcinoma on the temporal bulbar conjunctiva. These tumors have also been related to exposure to ultraviolet light and conjunctival papillomavirus infection and usually arise in the limbus of the eye (Agaba, 1995).

The clinical features of conjunctival neoplasias in HIV-infected patients may be similar to the typical features described in immunocompetent patients except that it occurs at a much younger age and are more aggressive (Kim *et al*., 1990; Muccioli *et al*. 1996; Lewallen *et al*., 1996; Soong *et al*. 1999). The lesions may vary from patient to patient, but a typical pattern is the presence of a grayish white keratinized mass surrounded by an abundant blood supply of engorged conjunctival vessels, and a large amount of pigmentation can obscure the prognosis (Kenstelyn, 2001). Recurrence rates from previous surgery are high and patients present late with advanced lesions as an active search for early manifestation of CSCC in HIV/AIDS is necessary (Chisi *et al*., 2006).

2.2.3.3 Non Hodgkin's lymphomas

Non Hodgkin's lymphoma (NHL) is the second most common opportunistic neoplasm in HIV-infected individuals (Kuo and Rao, 1999). Jeng *et al*. (2007) reported that in HIV-infected individuals NHL, should be suspected in patients of any age who have prominent vitreous humor cells with or without subretinal material. Intraocular lymphoma usually occurs when CD4+ T-lymphocytes counts are less than 50 cells/μL (Kuo and Rao, 1999). Intraocular lymphoma can also cause anterior chamber cellular reaction (Espana-Gregori *et al*., 1997; Rivero *et al*., 1999). Primary NHL has also been found in the eyelids of the patients with AIDS, presenting as rapidly enlarging erythematous lesions (Goldenberg *et al*., 1992; Tunc *et al*., 1997). Lymphoma can also occur in the orbit (Lim *et al*., 1997) where it can cause painful proptosis (Matzkin *et al*., 1994).

Non Hodgkin's lymphomas (NHL) is a malignancy of B-cell origin associated with Epstein-Barr virus infection and is secondary to toxoplasmosis as a cause of cortical visual loss; however, intraocular lymphomas is quite uncommon (Vrabec, 2004). Posterior segment manifestations of NHL include necrotizing retinitis, multifocal choroiditis, retinal vasculitis, vitritis, subretinal mass, and pseudo-hypopyon uveitis (Espana-Gregori *et al*., 1997; Matzkin *et al*., 1994; Mittra *et al*., 1999; Ormerod and Puklin, 1997; Rivero *et al*., 1999).

2.2.4 Neuro-ophthalmic complications of HIV infection

The most common etiology for neuro-ophthalmic lesions was cryptococcal meningitis, accounting for 54% of the neuro-ophthalmic lesions reported in one series (Jabs, 1995; Kenstelyn *et al*., 1993). Other causes of neuro-ophthalmic lesions in patients with HIV include Herpes zoster ophthalmicus, toxoplasmosis syphilis, viral encephalitis (Cunningham and Margolis, 1998). Progressive multi-leukoencephalopathy, a demylelinating disorder of the CNS that is among the most frequent causes of neuro-ophthalmic disorder in HIV-infected individuals, is also caused by an opportunistic infection (human polymavirus JC) (Wein *et al*., 1998).

Lima (2004) reported that neuro-ophthalmic complications of HIV have also been reported in the absence of associated opportunistic infections and HIV may also cause diplopia due to palsies of cranial nerves III, IV, and VI. Optic neuritis associated with a multiple sclerosis-like illness in the presence of HIV has also been described (Lee *et al*., 2000).

Other neuro-ophthalmic complications are visual field defects, papilledema secondary to elevated intracranial pressure and ocular motility disorders, occurring in up to 15% of HIV infected patients (Sarraf and Ernest, 1996; Miller, 1995). Yared *et al*. (2006) reported 10% of patients with neuro-ophthalmic disorders and the most common presentation was papilledema followed by optic atrophy and cranial nerve (CN III & VI) palsy. Papillitis results from a direct infection of the tissue of the optic disc by various agents like *Treponema pallidum* (McLeish *et al*., 1990), *Toxoplasma gondii* (Wei *et al*., 1996) and most commonly CMV (Vrabec, 2004). Two possible mechanisms for the optic neuropathy have been proposed: a direct invasion of the optic nerve by cryptococcal organsms and an adhesive arachnoiditis (Cohen and Glasgow, 1993).

The diagnosis of progressive multifocal leukoencephalopathy (PML) should be considered in immunocompromised patients with neuro-ophthalmic findings, especially in those presenting with homonymous hemianopia and nystagmus (Wein *et al*., 1998; Mwanza *et al*., 2004). External ocular manifestations of neuro-ophthalmic abnormalities include facial paralysis (Bell palsy) (Piluso *et al*., 1991; Sasaki *et al*., 2002; Uldry and Regli, 1998), gaze palsies (Kenstelyn *et al*., 1993; Kitthaweesin, 2002; Mwanza *et al*., 2004) and ptosis (Uldry and Regli, 1998).

Neuro-ophthalmic findings that are indicative of the central nervous system (CNS) diseases include gaze paresis, papillary abnormalities such as light near dissociation and Horner's syndrome visual fields defects (Wein *et al*., 1998). Ophthalmologic manifestations include homonymous visual field defects, cerebellar signs and brain stem nuclear and supranuclear palsies in addition to occipital blindness (Ormerod *et al*., 1996). Visual loss from cryptococcal meningitis occurs in 1-9% of patients

(Kenstelyn *et al*., 1993; Rex *et al*., 1993). This loss may occur from direct invasion of the optic nerve by *C. neoformans,* elevated intracranial pressure, or adhesive arachnoiditis (Rex *et al*., 1993).

2.2.5 Ocular manifestations of HIV/AIDS in the pediatric group

The most frequent ocular manifestation in the pediatric group is dry eye syndrome (Kenstelyn *et al*., 2000). Dry eye syndrome occurs in approximately 20 to 25% of patients (Geier *et al*., 1995). Ikoona *et al*. (2003) reported that cotton wool spots (CWS) and CMV retinitis were the most common ocular manifestations of HIV/AIDS in adults, but much less prevalent in children. However, conjunctivitis, perivasculitis and molluscum contagiosum were the three commonest ocular findings by Pannel *et al*. (2005). Presentation of CMV retinitis in children has been reported to be bilateral and the retinitis was noted to have a predisposition for the posterior pole of the eye in the infants as compared to adults (Baumal *et al*., 1999). These findings were also discovered in infants with congenital CMV or infants with HIV, but congenital CMV infections do not present with the typical haemorrhagic manner as seen in immunocompromised children (Coats *et al*., 2000).

There are several reasons for this different presentation of CMV, for example reactivation of the latent infections is less likely to be present in children which makes the infection more likely to be primary infection (Coats *et al*., 2000). The immaturity of the immune system in infants is likely to make infection very severe (Williams *et al*., 2001) and exposure to the virus through breast feeding in the perinatal period (Du *et al*., 1999).

CHAPTER THREE

3. METHODOLOGY

3.1 STUDY DESIGN AND INSTRUMENT

This is a descriptive study designed to determine the knowledge of basics of HIV/AIDS and the ocular complications of the condition among high school learners in Capricorn district of Limpopo Province, South Africa. A self administered questionnaire, written in English was used to collect necessary information from the participants. The questionnaire (Appendix A) consists of closed and open ended questions and had three sections (A - C). Section A contains demographic data and general questions about the participants. Section B contains questions on general information on HIV/AIDS. Section C contains questions on the basic information on complications of HIV/AIDS on the eye. Clear instructions on how to complete the questionnaire were given in the questionnaire and instructions were clarified by the researcher, when necessary.

3.2 STUDY POPULATION, SAMPLING METHOD AND SAMPLE SIZE

The study population was high school learners in the Capricorn district of Limpopo Province of South Africa. Both genders from grades 10 to 12 were included in the study. A list of high schools in the Capricorn district of Limpopo was obtained from the Department of Education in February, 2007. The total number of high schools in the district was 371, with 251,196 learners. Cluster sampling was used to select the schools that were included in the study. A sample of schools was drawn at random from the list. A random selection of every 20^{th} school was done in order to arrive at a value close to the sample size needed for the study. Therefore, a total number of 18 schools were selected for this study. The total number of grades 10-12 learners in the 18 schools selected was 6,141 and it was decided to include 50% of these, therefore the number of subjects estimated for the study 3,000 – 3,070 learners of both genders.

3.3 SAMPLING PROCEDURES

The researcher phoned each of the principals of the selected high schools to book an appointment for a visit. On the day of appointment, each principal was given the University of Limpopo consent form (stating the aims and objective of the study) and a letter of approval of the study from Department of Education after a brief explanation of the study. Each principal chose a suitable date on which the research was to be conducted. All principals allowed the researcher to use the class registers for selection of the learners, and 2659 learners were systematically selected from the registers. The selected learners were given the University of Limpopo consent form for the parent or guardian/s to sign. The form was accompanied by a covering letter (Appendix E), stating the aims and objective of the study. A parent or guardian was required to sign the consent form to confirm that he or she permits his or her child to participate in the survey. Also, the learner was asked to assent to participate in the study by signing below the parent or guardian's signature. Learners were given two days to return the consent forms.

3.4. PILOT STUDY AND DATA COLLECTION

3.4.1 Pilot study

A pilot study was conducted at a high school in Seshego, a township about 10 kilometers from Polokwane to validate the questionnaire. Twenty learners (grades 10 to 12) in a high school were randomly selected and given the questionnaire to respond to. The difficulties that the learners had in answering the questions were used in modifying the questionnaire.

3.4.2 Data Collection

The questionnaire was distributed to the learners in the 18 high schools by the researcher. All learners returned consent forms signed by both the parent or guardian and the learner. Completion of the questionnaire was done by learners after school hours with the assistance of the researcher and the research assistant. The researcher read out and clarified the questionnaire before they started to fill out the questionnaire. Anonymity and confidentiality were assured to the learners.

Learners were co-operative and no difficulties were encountered during administration of the questionnaires.

3.5 DATA ANALYSIS AND PRESENTATION

Data was coded appropriately and analyzed using the Statistical Packages for Social Sciences (SPSS) computer program version 16. Descriptive statistics (Range, mean, standard deviations and frequencies) were used to describe the findings and present the results. Analysis of Covariance (ANCOVA) model was used to model the scores on each of the dependent variables: general knowledge of HIV/AIDS and basic knowledge of the effects of HIV/AIDS on the eye.

ANCOVA modeling was used because:

i. Each of the dependent variables was numerical (scale). The response from each subject was conjectured to be related to unique characteristics of the respondents (gender, grade, school and age).
ii. Three of the factors which were conjectured to have an influence on the dependent variables were on the nominal scale (gender, grade and school).
iii. There was one factor which was numerically measured on a continuous variable (age of respondent).

The purpose of the ANCOVA model was to determine if, considered jointly, there were any significant differences in each of the response (or dependent) variables due to the nominal factors (gender, grade and school) after controlling for the continuous factor (age). The ANCOVA model also enabled us to deduce if the covariate is significantly associated with the dependent variable, controlling for the nominal factors.

3.6 ETHICAL AND LEGAL CONSIDERATIONS

Approval to conduct the study was obtained from:

i. Research and senior degrees committee, School of Heath Sciences and University of Limpopo ethics committee.
ii. Limpopo Department of education (for learners).

iii. Principals or appropriate officers of the concerned schools.

iv. Parents and learners who signed the University of Limpopo consent forms.

3.7 RELIABILITY, VALIDITY, OBJECTIVITY AND BIAS OF THE STUDY

3.7.1 Reliability

The questionnaire was pre-tested on the learners who were similar to the target population and expected responses were provided by the respondents. This was considered to ensure reliability of the responses and conclusions.

3.7.2 Validity

Questionnaire adequately covered the domain under investigation, and conclusions were drawn on the findings (internal validity), but could be generalized to other youths elsewhere in the country (population validity). The questions were not ambiguous, the sampling methodology was stringent enough and sample population was large enough for the findings to be valid.

3.7.3 Objectivity and Bias

A conclusion was drawn entirely from the responses on the questionnaire. Careful sampling procedure (stratified random sampling) was used; also the population sample size was large enough to represent the population being sampled.

CHAPTER FOUR

4. RESULTS

This chapter presents the results of the two components of the survey: knowledge of the basics of HIV/AIDS and the basic effects of HIV/AIDS on the eye. The results are presented firstly as profiles of the study participants, knowledge on the basics of HIV/AIDS including knowledge of signs, symptoms and sequelae of HIV/AIDS, knowledge on establishing HIV/AIDS status and overall knowledge of the participants on the above. The second components of the results are presented as knowledge of the effects of HIV/AIDS on the eye and overall performance of the participants on the various components of the effects of HIV/AIDS on the eye.

4.1 PROFILE OF THE PARTICIPANTS

A total of 2659 black South African learners participated in this study. They included 1234 (46.4%) males and 1412 (53.1%) females, thirteen (0.5%) did not indicate their gender. The majority 2346 (88.2%) were from rurally-located high schools and only a few 313 (11.8%) were from a semi-urban high school (Bokamoso high school, in Seshego). The highest proportion of respondents, 383 (14.4%) were from Kgakoa high school in Moletjie, and the least, 55 (2.1%) were from Raphatlha high school in Sefihlampyana village. The total number of learners from each high school is shown in Table 1.

The ages of the participants ranged from 14 to 28 years, with a mean of 17.82 and standard deviation (SD) of ±1.77 years. Fifty four (2.0%) learners did not indicate their ages. The minimum and maximum age of the learners in relation to their genders and grades are shown in Table 2. The highest age group was 19-21 years (see Fig. 1) and a total of 726 (27.3%) of respondents were in this age group. Of the 722 in this age group who indicated their gender, 385 (53.3%) were males and 337 (46.7%) were females. The least age group was those over 21 years (N = 82, 3.1% of the total population) (see Fig. 1). They were 40 (49%) male and 42 (51%) female constituents Figure 2 illustrates the total number and percentage of the learners in each grade, and grade 10 had the highest 1099 (41.0%) number of learners.

Table 1: Showing the 18 high schools which took part in the study, the number of the learners from each school and their percentages.

School	Number of learners(*N*)	Percentage (%)
Kgakoa	383	14.4
Bokamoso	313	11.8
Matladi	224	8.4
Kgolouthwana	187	7.0
Mankoeng	177	6.7
Makgwading	173	6.5
Mmanare	162	6.1
Mmapadi	130	4.9
Dikoloi	122	4.6
Mapeloana	119	4.5
J. K. Tabane	111	4.2
Mamagogo	107	4.0
Phuti Seopa	101	3.8
Tshukutswe	94	3.5
Boshego	80	3.0
Mashaha	61	2.3
Boikhutsong	60	2.3
Raphatlha	55	2.1
Total	2659	100

Table 2: Shows the gender, grades, number, age range, mean and standard deviation (SD) of the participants who indicated their ages.

Gender	Grade	*N*	Minimum age	Maximum age	Mean	Std. Deviation
Male	10	514	15	22	17.45	1.59
	11	377	16	28	18.23	1.69
	12	303	18	24	18.83	1.63
	Total	1194	15	28	18.04	1.73
Female	10	547	14	27	16.77	1.61
	11	474	16	26	18.10	1.81
	12	363	17	25	18.29	1.42
	Total	1384	14	27	17.62	1.78
Total	10	1061	14	27	17.10	1.64
	11	851	16	28	18.16	1.76
	12	666	17	25	18.54	1.54
	Total	2578	14	28	17.82	1.77

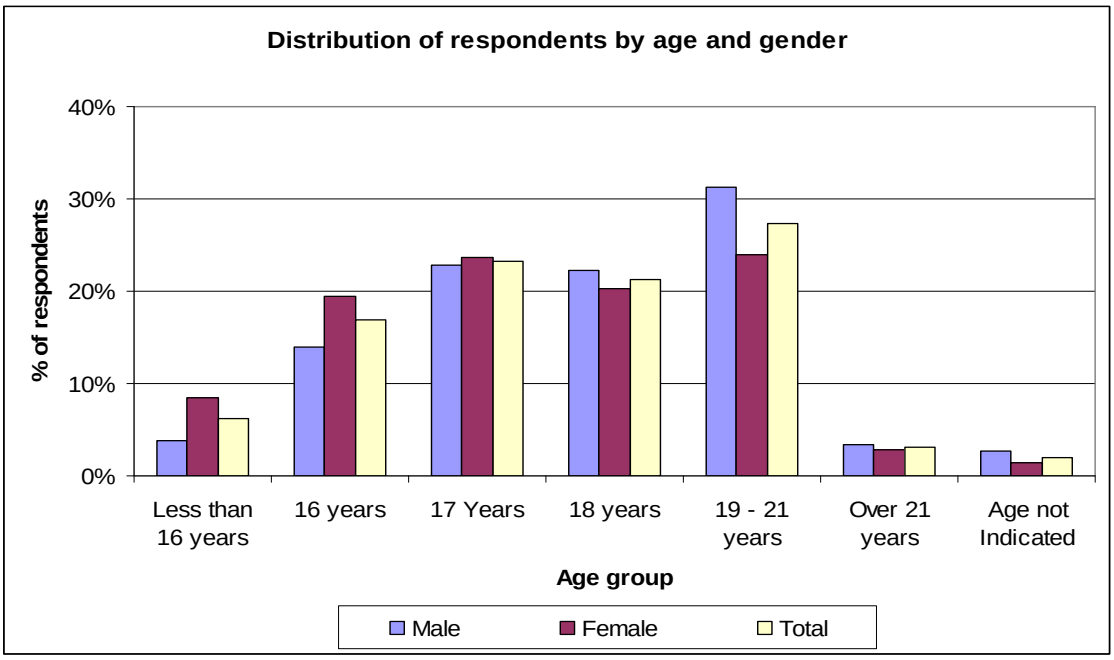

Figure 1: Illustrates the percentages of the different age groups of the respondents for both genders. Age group 19-21 years had more males (*N* = 385, 31.2%) than other age groups. Age group over 21 years had few 42 (2.8%) females than other age groups.

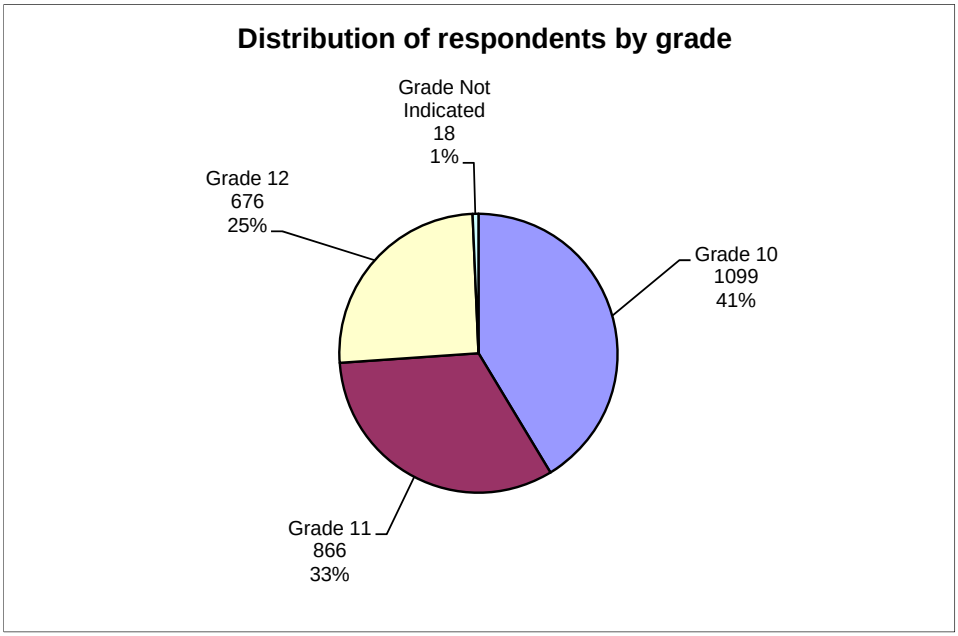

Figure 2: Illustrates the number and percentages of learners in the three different grades and also those who did not indicate their grades. Grade 10 learners were more (*N* = 1099, 41.3%) than learners in other grades.

4.2 KNOWLEDGE OF THE PARTICIPANTS ON THE BASICS OF HIV/AIDS

Many learners, 1692 (63.6%) knew what the acronym HIV stands for, but 898 (33.8%) did not know and 69 (2.6%) did not respond to the question. The age distributions of the respondents are shown in Table 3, the gender representations are shown in Table 4 and the distribution according to grades are shown in Table 5. The greatest knowledge was recorded among those who were less than 16 years of age in which 72.3% correct responses were recorded. The least knowledge (52.4% correct responses) was recorded among those who were over 21 years of age (Table 3). More of the females (65.8%) than males (61.5%) knew what HIV/AIDS stands for (Table 4). A greater percentage (67.8%) of those in grade 12 knew what HIV means than those in other grades (Table 5).

Table 3: Showing the age distribution, number (*N*) and percentage (%) of the responses of the learners, on what the acronym HIV stands for.

	Responses			
Age Group (Years)	Correct *N* (%)	Wrong *N* (%)	No answer *N* (%)	Total *N* (%)
<16 years	120 (72.3)	43 (25.9)	3 (1.8)	166 (100.0)
16 years	303 (67.5)	137 (30.5)	9 (2.0)	449 (100.0)
17 years	396 (64.0)	204 (33.0)	19 (3.1)	619 (100.0)
18 years	363 (64.5)	188 (33.4)	12 (2.1)	563 (100.0)
19 – 21 years	435 (59.9)	272 (37.5)	19 (2.6)	726 (100.0)
> 21 years	43 (52.4)	36 (43.9)	3 (3.7)	82 (100.0)
Not indicated	32 (59.3)	18 (33.3)	4 (7.4)	54 (100.0)
Total	1692 (63.6)	898 (33.8)	69 (2.6)	2659 (100.0)

Table 4: Showing the gender, number (*N*) and percentages (%) of the responses of the learners, on what the acronym HIV stands for.

	Responses			
Gender	Correct *N* (%)	Wrong *N* (%)	No answer *N* (%)	Total *N* (%)
Male	759 (61.5)	424 (34.4)	51 (4.1)	1234 (100.0)
Female	929 (65.8)	467 (33.1)	16 (1.1)	1412 (100.0)
Not indicated	4 (30.8)	7 (53.8)	2 (15.4)	13 (100.0)
Total	1692 (63.6)	898 (33.8)	69 (2.6)	2659 (100.0)

Table 5: Showing the grades, number (*N*) and percentages (%) of the responses of the learners, on what the acronym HIV stands for.

Grade	Responses			
	Correct *N* (%)	Wrong *N* (%)	No answer *N* (%)	Total *N* (%)
10	679 (61.8)	378 (34.4)	42 (3.8)	1099 (100.0)
11	548 (63.3)	302 (34.9)	16 (1.8)	866 (100.0)
12	458 (67.8)	209 (30.9)	9 (1.3)	676 (100.0)
Not indicated	7 (38.9)	9 (50.0)	2 (11.1)	18 (100.0)
Total	1692 (63.6)	898 (33.8)	69 (2.6)	2659 (100.0)

Many 1757 (66.1%) of the participants knew what the acronym AIDS stands for, 761 (28.6%) did not know and 141 (5.3%) did not respond to the question. The age distributions of the respondents who gave the correct answer are shown in Table 6, the gender representations are shown in Table 7 and the distributions according to grades are shown in Table 8. More (72.3%) of those respondents who were less than 16 years of age than learners in other age groups and more of the females (70.9%) than males (60.8%) gave correct answers (Tables, 6 and 7). Majority (76.2%) of the grade 12 learners gave correct answers than learners in other grades (Table 8).

Table 6: Showing number (*N*) and percentages (%) of the responses of the learners for different age groups, on what the acronym AIDS stands for.

Age Group (Years)	Responses			
	Correct *N* (%)	Wrong *N* (%)	No answer *N* (%)	Total *N* (%)
<16 years	120 (72.3)	38 (22.9)	8 (4.8)	166 (100.0)
16 years	316 (70.4)	114 (25.4)	19 (4.2)	449 (100.0)
17 Years	421 (68.0)	164 (26.5)	34 (5.5)	619 (100.0)
18 years	394 (70.0)	141 (25.0)	28 (5.0)	563 (100.0)
19 - 21 years	432 (59.5)	253 (34.8)	41 (5.6)	726 (100.0)
Over 21 years	42 (51.2)	35 (42.7)	5 (6.1)	82 (100.0)
Not indicated	32 (59.3)	16 (29.6)	6 (11.1)	54 (100.0)
Total	1757 (66.1)	761 (28.6)	141 (5.3)	2659 (100.0)

Table 7: Showing number (*N*) and percentages (%) of the responses of the learners for both genders, on what the acronym AIDS stands for.

Responses	Gender			
	Males	Females	Gender not indicated	Total
Correct *N* (%)	750 (60.8)	1001 (70.9)	6 (46.2)	1757 (66.1)
Wrong *N* (%)	390 (31.6)	366 (25.9)	5 (38.5)	761 (28.6)
No answer *N* (%)	94 (7.6)	45 (3.2)	2 (15.4)	141 (5.3)
Total *N* (%)	1234 (100.0)	1412 (100.0)	13 (100.0)	2659 (100.0)

Table 8: Showing number (*N*) and percentages (%) of the responses of the learners in relation to their grades, on what the acronym AIDS stands for.

Grade	Responses			
	Correct *N* (%)	Wrong *N* (%)	No answer *N* (%)	Total *N* (%)
10	615 (56.0)	392 (35.7)	92 (8.4)	1099 (100.0)
11	618 (71.4)	215 (24.8)	33 (3.8)	866 (100.0)
12	515 (76.2)	147 (21.7)	14 (2.1)	676 (100.0)
Not indicated	9 (50.0)	7 (38.9)	2 (11.1)	18 (100.0)
Total	1757 (66.1)	761 (28.6)	141 (5.3)	2659 (100.0)

Approximately eighty six percent (*N* = 2279; 85.7%) of the learners agreed that a person can get HIV through unprotected sex, 258 (9.7%) learners disagreed. Only a few, 91 (3.4%) learners reported that they did know the answer and 31 (1.2%) learners did not respond to the question. The ages, gender distribution and grade of the learners who responded to this question are shown in Tables 9, 10 and 11 respectively. A vast majority (90.0%) of those who were 16 years of age knew that a person could get HIV through unprotected sex than learners in other grades (Table 9). More of the females (86.6%) than males (84.8%) knew this aspect of HIV (Table 10). Again, a greater percentage (93.2%) of those in grade 12 knew this aspect of HIV than learners in other grades (Tables 11).

Table 9: Showing number (*N*) and percentages (%) of the responses of the learners for different age groups, on whether a person could get HIV by unprotected sex.

Age group (Years)	Responses				
	Yes *N* (%)	No *N* (%)	Don't know *N* (%)	No answer *N* (%)	Total *N* (%)
<16 years	148 (89.2)	13 (7.8)	5 (3.0)	0 (0.0)	166 (100.0)
16 years	404 (90.0)	25 (5.6)	18 (4.0)	2 (0.4)	449 (100.0)
17 years	556 (89.8)	46 (7.4)	13 (2.1)	4 (0.6)	619 (100.0)
18 years	463 (82.2)	68 (12.1)	22 (3.9)	10 (1.8)	563 (100.0)
19-21 years	600 (82.6)	88 (12.1)	25 (3.4)	13 (1.8)	726 (100.0)
>21 years	61 (74.4)	14 (17.1)	6 (7.3)	1 (1.2)	82 (100.0)
Not indicated	47 (87.0)	4 (7.4)	2 (3.7)	1 (1.9)	54 (100.0)
Total	2279 (85.7)	258 (9.7)	91 (3.4)	31 (1.2)	2659 (100.0)

Table 10: Showing number (*N*) and percentages (%) of the responses of the learners for both genders, on whether a person could get HIV by unprotected sex.

Responses	Gender			
	Male	Female	Not indicated	Total
Yes *N* (%)	1046 (84.8)	1223 (86.6)	10 (76.9)	2279 (85.7)
No *N* (%)	136 (11.0)	121 (8.6)	1 (7.7)	258 (9.7)
Don't know *N* (%)	36 (2.9)	54 (3.8)	1 (7.7)	91 (3.4)
No answer *N* (%)	16 (1.3)	14 (1.0)	1 (7.7)	31 (1.2)
Total *N* (%)	1234 (100.0)	1412 (100.0)	13 (100.0)	2659 (100.0)

Table 11: Showing number (*N*) and percentages (%) of the responses of the learners in relation to their grades, on whether a person could get HIV by unprotected sex.

Responses	Grade				
	10	11	12	Not indicated	Total
Yes *N* (%)	893 (81.3)	742 (85.7)	630 (93.2)	14 (77.8)	2279 (85.7)
No *N* (%)	141 (12.8)	75 (8.7)	40 (5.9)	2 (11.1)	258 (9.7)
Don't know *N* (%)	52 (4.7)	37 (4.3)	1 (0.1)	1 (5.6)	91 (3.4)
No answer *N* (%)	13 (1.2)	12 (1.4)	5 (0.7)	1 (5.6)	31 (1.2)
Total *N* (%)	1099 (100.0)	866 (100.0)	676 (100.0)	18 (100.0)	2659 (100.0)

Many (*N* = 1662, 62.5%) of the learners knew that a child could get HIV from the mother during pregnancy, but 562 (21.1%) learners disagreed; 340 (12.8%) learners did not know the answer and 95 (3.6%) learners did not respond to the question. The ages, gender distribution and grade of the learners who responded to the question are shown in Tables 12, 13 and 14 respectively. Again, many (67.5%) of those who were less than 16 years of age agreed that a child can get HIV from the mother during pregnancy than learners in other age groups (Table 12). More of the females (63.5%) than males (61.1%) knew this aspect of HIV (Tables 13).

Again, many (64.9%) of learners in grade 12 knew this aspect of HIV than those in other grades (Table 14).

Table 12: Showing number (*N*) and percentages (%) of the responses of the learners in different age groups, on whether a child could get HIV from the mother during pregnancy.

Age Group (Years)	Responses				
	Yes *N* (%)	No *N* (%)	Don't know *N* (%)	No answer *N* (%)	Total *N* (%)
< 16 years	112 (67.5)	26 (15.7)	23 (13.9)	5 (3.0)	166 (100.0)
16 years	297 (66.1)	82 (18.3)	53 (11.8)	17 (3.8)	449 (100.0)
17 years	382 (61.7)	132 (21.3)	78 (12.6)	27 (4.4)	619 (100.0)
18 years	363 (64.5)	116 (20.6)	68 (12.1)	16 (2.8)	563 (100.0)
19 – 21 years	431 (59.4)	174 (24.0)	97 (13.4)	24 (3.3)	726 (100.0)
>21 years	44 (53.7)	23 (28.0)	12 (14.6)	3 (3.7)	82 (100.0)
Not indicated	33 (61.1)	9 (16.7)	9 (16.7)	3 (5.6)	54 (100.0)
Total	1662 (62.5)	562 (21.1)	340 (12.8)	95 (3.6)	2659 (100.0)

Table 13: Showing number (*N*) and percentages (%) of the responses of the learners for both genders, on whether a child could get HIV from the mother during pregnancy.

Responses	Gender			
	Male	Female	Not indicated	Total
Yes *N* (%)	754 (61.1)	897 (63.5)	11 (84.6)	1662 (62.5)
No *N* (%)	277 (22.4)	284 (20.1)	1 (7.7)	562 (21.1)
Don't know *N* (%)	167 (13.5)	172 (12.2)	1 (7.7)	340 (12.8)
No answer *N* (%)	36 (2.9)	59 (4.2)	0 (0.0)	95 (3.6)
Total *N* (%)	1234 (100.0)	1412 (100.0)	13 (100.0)	2659 (100.0)

Table 14: Showing number (*N*) and percentages (%) of the responses of the learners in relation to their grades, on whether a child could get HIV from the mother during pregnancy.

Responses	Grade				
	10	11	12	Not indicated	Total
Yes *N* (%)	659 (60.0)	553 (63.9)	439 (64.9)	11 (61.1)	1662 (62.5)
No *N* (%)	231 (21.0)	181 (20.9)	148 (21.9)	2 (11.1)	562 (21.1)
Don't know *N* (%)	165 (15.0)	112 (12.9)	61 (9.0)	2 (11.1)	340 (12.8)
No answer *N* (%)	44 (4.0)	20 (2.3)	28 (4.1)	3 (16.7)	95 (3.6)
Total *N* (%)	1099 (100.0)	866 (100.0)	676 (100.0)	18 (100.0)	2659 (100.0)

Majority (*N* = 2064, 77.6%) of the learners disagreed, that a person can get HIV by talking to an HIV infected person. However, 347 (13.1%) agreed, 173 (6.5%) did not know the answer to the question and 75 (2.8%) did not respond to the question. The ages, gender distribution and grade of the respondents who responded to the question are shown in Tables 15, 16 and 17 respectively. A greater percentage (86.7%) of those who were less than 16 years of age disagreed that a person can get HIV by talking to an HIV infected person than learners in other grades (Table 15). The correct responses for males (77.8%) were marginally higher than that of females (77.5%) (Table 16). More (87.3%) of those who were in grade 12 gave more correct answers than those in other grades (Table 17).

Table 15: Showing number (*N*) and percentages (%) of the responses of the learners in different age groups, on whether a person could get HIV by talking to an HIV infected person.

Age group (Years)	**Responses**				
	Yes *N* (%)	No *N* (%)	Don't know *N* (%)	No answer *N* (%)	Total *N* (%)
<16 years	13 (7.8)	144 (86.7)	7 (4.2)	2 (1.2)	166 (100.0)
16 years	48 (10.7)	373 (83.1)	17 (3.8)	11 (2.4)	449 (100.0)
17 years	62 (10.0)	507 (81.9)	34 (5.5)	16 (2.6)	619 (100.0)
18 years	70 (12.4)	447 (79.4)	30 (5.3)	16 (2.8)	563 (100.0)
19 – 21 years	130 (17.9)	501 (69.0)	69 (9.5)	26 (3.6)	726 (100.0)
> 21 years	16 (19.5)	54 (65.9)	9 (11.0)	3 (3.7)	82 (100.0)
Not indicated	8 (14.8)	38 (70.4)	7 (13.0)	1 (1.9)	54 (100.0)
Total	347 (13.1)	2064 (77.6)	173 (6.5)	75 (2.8)	2659 (100.0)

Table 16: Showing number (*N*) and percentages (%) of the responses of the learners for both genders, on whether a person could get HIV by talking to an HIV infected person.

Responses	**Gender**			
	Males	Female	Not indicated	Total
Yes *N* (%)	162 (13.1)	184 (13.0)	1 (7.7)	347 (13.1)
No *N* (%)	960 (77.8)	1095 (77.5)	9 (69.2.8)	2064 (79.9)
Don't know *N* (%)	83 (6.7)	89 (6.3)	1(7.7)	173 (6.7)
No answer *N* (%)	29 (2.4)	44 (3.1)	2 (15.4)	75 (2.8)
Total *N* (%)	1234 (100.0)	1412 (100.0)	13 (100.0)	2659 (100.0)

Table 17: Showing number (*N)* and percentages (%) of the responses of the learners in relation to their grades, on whether a person could get HIV by talking to an HIV infected person.

Responses	Grade				
	10	11	12	Not indicated	Total
Yes *N* (%)	174 (15.8)	113 (13.0)	55 (8.1)	5 (27.8)	347 (13.1)
No *N* (%)	778 (70.8)	687 (79.3)	590 (87.3)	9 (50.0)	2064 (77.6)
Don't know *N* (%)	104 (9.5)	47 (5.4)	20 (3.0)	2 (11.1)	173 (6.5)
No answer *N* (%)	43 (3.9)	19 (2.2)	11 (1.6)	2 (11.1)	75 (2.8)
Total *N* (%)	1099 (100.0)	866 (100.0)	676 (100.0)	18 (100.0)	2659 (100.0)

Many (*N* = 1711, 64.3%) of the learners agreed that a child can get HIV from the mother through breast feeding, 445 (16.7%) learners disagreed, 418 (15.7%) did learners not know the answer. A few 85 (3.2%) of the learners did not respond to the question. The ages, gender distribution and grade of the learners who responded to the question are shown in Tables 18, 19 and 20 respectively. Majority (68.6%) of those who were 16 years of age agreed that a child can get HIV from a mother through breast feeding than learners in other age groups (Table 18). More of the females (70.2%) than males (57.7%) also agreed (Table 19). More (70.3%) of those who were in grade 12 gave more correct answers than those in other grades (Table 20).

Table 18: Showing number (*N*) and percentages (%) of the responses of the learners in different age groups, on whether a child could get HIV from the mother through breast feeding.

Age Group (Years)	Responses				
	Yes *N* (%)	No *N* (%)	Don't know *N* (%)	No Answer *N* (%)	Total *N* (%)
<16 years	106 (63.9)	25 (15.1)	33 (19.9)	2 (1.2)	166(100.0)
16 years	308 (68.6)	70 (15.6)	55 (12.2)	16 (3.6)	449 (100.0)
17 years	410 (66.2)	100 (16.2)	91 (14.7)	18 (2.9)	619 (100.0)
18 years	371 (65.9)	81 (14.4)	93 (16.5)	18 (3.2)	563 (100.0)
19 – 21 years	442 (60.9)	139 (19.1)	122 (16.8)	23 (3.2)	726 (100.0)
> 21 years	45 (54.9)	17 (20.7)	15 (18.3)	5 (6.1)	82 (100.0)
Not indicated	29 (53.7)	13 (24.1)	9 (16.7)	3 (5.6)	54 (100.0)
Total	1711 (64.3)	445 (16.7)	418 (15.7)	85 (3.2)	2659 (100.0)

Table 19: Showing number (*N*) and percentages (%) of the responses of the learners for both genders, on whether a child can get HIV from the mother through breast feeding.

Responses	Gender			
	Male	Female	Not indicated	Total
Yes *N* (%)	712 (57.7)	991 (70.2)	8 (61.5)	1711 (64.3)
No *N* (%)	260 (21.1)	182 (12.9)	3 (23.1)	445 (16.7)
Don't know *N* (%)	222 (18.0)	195 (13.8)	1 (7.7)	418 (15.7)
No answers *N* (%)	40 (3.2)	44 (3.1)	1 (7.7)	85 (3.2)
Total *N* (%)	1234 (100.0)	1412 (100.0)	13 (100.0)	2659 (100.0)

Table 20: Showing number (*N*) and percentages (%) of the responses of the learners in relation to their grades, on whether a child could get HIV from the mother through breast feeding.

Responses	Grade				
	10	11	12	Not indicated	Total
Yes *N* (%)	630 (57.3)	592 (68.4)	475 (70.3)	14 (77.8)	1711 (64.3)
No *N* (%)	226 (20.6)	128 (14.8)	90 (13.3)	1 (5.6)	866 (17.3)
Don't know *N* (%)	200 (18.2)	125 (14.4)	92 (13.6)	1 (5.6)	418 (15.7)
No answer *N* (%)	43 (3.9)	21 (2.4)	19 (2.8)	2 (11.1)	85 (3.2)
Total *N* (%)	1099 (100.0)	866 (100.0)	676 (100.0)	18 (100.0)	2659(100.0)

Sixty four percent (*N* = 1703) of the learners agreed that a person can get HIV by sharing needles with the drug users, 550 (20.7%) learners disagreed, 337 (12.7%) learners did not know the answer and 69 (2.6%) learners did not respond to the question. The ages, gender distribution and grade of the learners who responded to the question are shown in Tables 21, 22 and 23 respectively. More (72.3%) of those who were less than 16 years of age agreed that a person can get HIV by sharing needle with the drug users than those in other age groups (Table 21). More of the females (64.8%) than males (63.3%) also agreed (Table 22). More (75.6%) of those in grade 12 knew this aspect than those in other grades (Table 23).

Table 21: Showing number (*N*) and percentages (%) of the responses of the learners for different age groups, on whether a person can get HIV by sharing needle with the drug users.

Age Group (Years)	Responses				
	Yes *N* (%)	No *N* (%)	Don't know *N* (%)	No answer *N* (%)	Total *N* (%)
<16 years	120 (72.3)	34 (20.5)	11 (6.6)	1 (0.0)	166 (100.0)
16 years	298 (66.4)	87 (19.4)	54 (12.0)	10 (2.2)	449 (100.0)
17 years	429 (69.3)	98 (15.8)	75 (12.1)	17 (2.7)	619 (100.0)
18 years	368 (65.4)	105 (18.7)	74 (13.1)	16 (2.8)	563 (100.0)
19-21 years	405 (55.8)	191 (26.3)	109 (15.0)	21 (2.9)	726 (100.0)
>21 years	52 (63.4)	20 (24.4)	8 (9.8)	2 (2.4)	82 (100.0)
Not indicated	31 (57.4)	15 (27.8)	6 (11.1)	2 (3.7)	54 (100.0)
Total	1703 (64.0)	550 (20.7)	337 (12.7)	69 (2.6)	2659 (100.0)

Table 22: Showing number (*N*) and percentages (%) of the responses of the learners for both genders, on whether a person could get HIV by sharing needle with drug users.

Responses	Gender			
	Male	Female	Not indicated	Total
Yes *N* (%)	781 (63.3)	915 (64.8)	7 (53.8)	1703 (64.0)
No *N* (%)	276 (22.4)	271 (19.2)	3 (23.1)	550 (20.7)
Don't know *N* (%)	144 (11.7)	191 (13.5)	2 (15.4)	337 (12.7)
No answer *N* (%)	33 (2.7)	35 (2.5)	1 (7.7)	69 (2.6)
Total *N* (%)	1234 (100.0)	1412 (100.0)	13 (100.0)	2659 (100.0)

Table 23: Showing number (*N*) and percentages (%) of the responses of the learners in relation to their grades, on whether a person could get HIV by sharing needle with the drug users.

Responses	Grade				
	10	11	12	Not indicated	Total
Yes *N* (%)	576 (52.4)	603 (69.6)	511 (75.6)	13 (72.2)	1703 (64.0)
No *N* (%)	313 (28.5)	152 (17.6)	84 (12.4)	1 (5.6)	550 (20.7)
Don't know *N* (%)	167 (15.2)	96 (11.1)	72 (10.7)	2 (11.1)	337 (12.7)
No answers *N* (%)	43 (3.9)	15 (1.7)	9 (1.3)	2 (11.1)	69 (2.6)
Total *N* (%)	1099 (100.0)	866 (100.0)	676 (100.0)	18 (100.0)	2659 (100.0)

Majority (*N* = 1881, 70.7%) of the learners agreed that a person can get HIV through blood transfusion, but 307 (11.5%) learners disagreed. Three hundred and sixty five (13.7%) learners did not know the answer and 106 (4.0%) learners did not respond to the question. The ages, gender distribution and grade of the learners who responded to the question are shown in Tables 24, 25 and 26 respectively. Again, majority (74.5%) of those who were 17 years of age agreed that a person

can get HIV through blood transfusion than those in other age groups (Table 24). More of the females (71.5%) than males (69.9%) also agreed (Table 25). Those in grade 12 gave more correct answers (77.7%) than those in other grades (Table 26).

Table 24: Showing number (*N*) and percentages (%) of the responses of the learners for different age groups, on whether a person could get HIV through blood transfusion.

Age Group (Years)	Responses				
	Yes *N* (%)	No *N* (%)	Don't know *N* (%)	No answer *N* (%)	Total *N* (%)
< 16 years	120 (72.3)	22 (13.3)	19 (11.4)	5 (3.0)	166 (100.0)
16 years	320 (71.3)	46 (10.2)	70 (15.6)	13 (2.9)	449 (100.0)
17 years	461 (74.5)	57 (9.2)	70 (11.3)	31 (5.0)	619 (100.0)
18 years	404 (71.8)	67 (11.9)	82 (14.6)	10 (1.8)	563 (100.0)
19 – 21 years	485 (66.8)	99 (13.6)	105 (14.5)	37 (5.1)	726 (100.0)
> 21 years	55 (67.1)	12 (14.6)	9 (11.0)	6 (7.3)	82 (100.0)
Not indicated	36 (66.7)	4 (7.4)	10 (18.5)	4 (7.4)	54 (100.0)
Total	1881 (70.7)	307 (11.5)	365 (13.7)	106 (4.0)	2659 (100.0)

Table 25: Showing number (*N*) and percentages (%) of the responses of the learners for both genders, on whether a person could get HIV through blood transfusion.

Responses	Gender			
	Male	Female	Not indicated	Total
Yes *N* (%)	862 (69.9)	1009 (71.5)	10 (76.9)	1881 (70.7)
No *N* (%)	162 (13.1)	143 (10.1)	2 (15.4)	307 (11.5)
Don't know *N* (%)	162 (13.1)	202 (14.3)	1 (7.7)	365 (13.7)
No answer *N* (%)	48 (3.9)	58 (4.1)	0 (0.0)	106 (4.0)
Total *N* (%)	1234 (100.0)	1412 (100.0)	13 (100.0)	2659 (100.0)

Table 26: Showing number (*N*) and percentages (%) of the responses of the learners in relation to their grades, on whether a person could get HIV through blood transfusion.

Responses	Grade				
	10	11	12	Not indicated	Total
Yes *N* (%)	719 (65.4)	629 (72.6)	525 (77.7)	8 (44.4)	1881 (70.7)
No *N* (%)	141 (12.8)	94 (10.9)	71 (10.5)	1 (5.6)	307 (11.5)
Don't know *N* (%)	182 (16.6)	117 (13.5)	60 (8.9)	6 (33.3)	365 (13.7)
No answer *N* (%)	57 (5.2)	26 (3.0)	20 (3.0)	3 (16.7)	106 (4.0)
Total *N* (%)	1099 (100)	866 (100)	676 (100.0)	18 (100)	2659 (100.0)

A large proportion (*N* = 2167, 81.5%) of the learners disagreed, that a person can get HIV by hugging a person infected with HIV, 189 (7.1%) learners agreed, 182 (6.8%) learners did not know the answer and 121 (4.6%) learners did not respond to the question. The ages, gender distribution and grade of the learners who responded correctly to the question are shown in Tables 27, 28 and 29 respectively. A greater percentage (88.0%) of those who were less than 16 years of age disagreed that a person can get HIV by hugging a person infected with HIV than learners in other age groups (Table 27). More of the females (82.6%) than males (80.3%) disagreed (Table 28). A vast majority (91.4%) of those in grade 12 gave correct answers than those in other grades (Table 29).

Table 27: Showing number (*N*) and percentages (%) of the responses of the learners in different age groups, on whether a person could get HIV by hugging a person infected with HIV.

Age group (Years)	Responses				
	Yes *N* (%)	No *N* (%)	Don't Know *N* (%)	No answer *N* (%)	Total *N* (%)
<16 years	10 (6.0)	146 (88.0)	4 (2.4)	6 (3.6)	166 (100.0)
16 years	26 (5.8)	387 (86.2)	23 (5.1)	13 (2.9)	449 (100.0)
17 years	36 (5.8)	511 (82.6)	44 (7.1)	28 (4.5)	619 (100.0)
18 years	36 (6.4)	474 (84.2)	33 (5.9)	20 (3.6)	563 (100.0)
19 – 21 years	68 (9.4)	549 (75.6)	64 (8.8)	45 (6.2)	726 (100.0)
> 21 years	9 (11.0)	63 (76.8)	7 (8.5)	3 (3.7)	82 (100.0)
Not indicated	4 (7.4)	37 (68.5)	7 (13.0)	6 (11.1)	54 (100.0)
Total	189 (7.1)	2167 (81.5)	182 (6.8)	121 (4.6)	2659 (100.0)

Table 28: Showing number (*N*) and percentages (%) of the responses of the learners for both genders, on whether a person could get HIV by hugging a person infected with HIV.

Responses	Gender			
	Male	Female	Not indicated	Total
Yes *N* (%)	91 (7.4)	94 (6.7)	4 (30.8)	189 (7.1)
No *N* (%)	991 (80.3)	1167 (82.6)	9 (69.2)	2167 (81.5)
Don't know *N* (%)	95 (7.7)	87 (6.2)	0 (0.0)	182 (6.8)
No answer *N* (%)	57 (4.6)	64 (4.5)	0 (0.0)	121 (4.6)
Total *N* (%)	1234 (100.0)	1412 (100.0)	13 (100.0)	2659 (100.0)

Table 29: Showing number (*N*) and percentages (%) of the responses of the learners in relation to their grades, on whether a person could get HIV by hugging a person infected with HIV.

Responses	Grade				
	10	11	12	Not indicated	Total
Yes *N* (%)	107 (9.7)	53 (6.1)	26 (3.8)	3 (16.7)	189 (7.1)
No *N* (%)	805 (73.2)	733 (84.6)	618 (91.4)	11 (61.1)	2167 (81.5)
Don't know *N* (%)	113 (10.3)	47 (5.4)	20 (3.0)	2 (11.1)	182 (6.8)
No answer *N* (%)	74 (6.7)	33 (3.8)	12 (1.8)	2 (11.1)	121 (4.6)
Total *N* (%)	1099 (100.0)	866 (100.0)	676 (100.0)	18 (100.0)	2659 (100.0)

Only two (0.1%) learners who were aged 17 years and who were females in grade 12 knew the definition of window period in HIV testing, 1239 (46.6%) provided incorrect answers, 747 (28.1%) did not know the answer and 671 (25.2%) did not respond to the question. The ages, gender distribution and grade of the learners who responded to the question are shown in Tables 30, 31 and 32 respectively.

Table 30: Shows number (*N*) and percentages (%) of the responses of the learners, for different age groups, on the definition of window period in HIV testing.

Age Group (Years)	Responses				
	Correct *N* (%)	Wrong *N* (%)	Don't know *N* (%)	No answer *N* (%)	Total *N* (%)
<16 years	0 (0.0)	71 (42.8)	53 (31.9)	42 (25.3)	166 (100.0)
16 years	0 (0.0)	196 (43.7)	131 (29.2)	122 (27.2)	449 (100.0)
17 years	2 (0.3)	280 (45.2)	183 (29.6)	154 (24.9)	619 (100.0)
18 years	0 (0.0)	285 (50.6)	146 (25.9)	132 (23.4)	563 (100.0)
19 - 21 years	0 (0.0)	356 (49.0)	196 (27.0)	174 (24.0)	726 (100.0)
> 21 years	0 (0.0)	31 (37.8)	27 (32.9)	24 (29.3)	82 (100.0)
Not indicated	0 (0.0)	20 (37.0)	11 (20.4)	23 (42.6)	54 (100.0)
Total	2 (0.1)	1239 (46.6)	747 (28.1)	671 (25.2)	2659 (100.0)

Table 31: Shows number (*N*) and percentages (%) of the responses of the learners for both genders, on the definition of window period in HIV testing.

Gender	Responses				
	Correct *N* (%)	Wrong *N* (%)	Don't know *N* (%)	No answer *N* (%)	Total *N* (%)
Male	0 (0.0)	569 (46.1)	347 (28.1)	318 (25.8)	1234 (100.0)
Female	2 (0.1)	665 (47.1)	395 (28.0)	350 (24.8)	1412 (100.0)
Not indicated	0 (0.0)	5 (38.5)	5 (38.5)	3 (23.1)	13 (100.0)
Total	2 (0.1)	1239 (46.6)	747 (28.1)	671 (25.2)	2659 (100.0)

Table 32: Shows number (*N*) and percentages (%) of the responses of the learners, in relation to their grades, on the definition of window period in HIV testing.

Grade	Responses				
	Correct *N* (%)	Wrong *N* (%)	Don't know *N* (%)	No answer *N* (%)	Total *N* (%)
10	0 (0.0)	436 (39.7)	353 (32.1)	310 (28.2)	1099 (100.0)
11	0 (0.0)	399 (46.1)	219 (25.3)	248 (28.6)	866 (100.0)
12	2 (0.3)	398 (58.9)	171 (25.3)	105 (15.5)	676 (100.0)
Not indicated	0 (0.0)	6 (33.3)	4 (22.2)	8 (44.4)	18 (100.0)
Total	2 (0.1)	1239 (46.6)	747 (28.1)	671 (25.2)	2659 (100.0)

About a third, (*N* = 882, 33.2%) knew the difference between HIV positive and HIV negative results, 1189 (44.7%) learners answered incorrectly, 274 (10.3%) learners did not know the answer and 314 (11.8%) learners did not respond to the question. The ages, gender distribution and grade of the learners who responded to the question are shown in Tables 33, 34 and 35 respectively. Those who were less than 16 years of age gave more correct answers (40.4%) than those in other age groups (Table 33). More of the females (35.5%) than males (30.5%) knew the difference (Table 34). Those who were in grade 12 gave more correct answers (42.6%) than those who were in other grades (Table 35).

Table 33: Shows number (*N*) and percentages (%) of the responses of the learners in different age groups, on the difference between HIV positive results and negative results.

Age Group (Years)	Responses				
	Correct *N* (%)	Wrong *N* (%)	Don't know *N* (%)	No answer *N* (%)	Total *N* (%)
<16 years	67 (40.4)	68 (41.0)	12 (7.2)	19 (11.4)	166 (100.0)
16 years	174 (38.8)	191 (42.5)	37 (8.2)	47 (10.5%)	449 (100.0)
17 years	228 (36.8)	266 (43.0)	60 (9.7)	65 (10.5)	619 (100.0)
18 years	180 (32.0)	264 (46.9)	56 (9.9)	63 (11.2)	563 (100.0)
19 - 21 years	204 (28.1)	337 (46.4)	96 (13.2)	89 (12.3)	726 (100.0)
>21 years	15(18.3)	44 (53.7)	9 (11.0)	14 (17.1)	82 (100.0)
Not indicated	14 (25.9)	19 (35.2)	4 (7.4)	17 (31.5)	54 (100.0)
Total	882 (33.2)	1189 (44.7)	274 (10.3)	314 (11.8)	2659 (100.0)

Table 34: Shows number (*N*) and percentages (%) of the responses of the learners, for both genders, on the difference between HIV positive and negative results.

	Responses				
Gender	Correct *N* (%)	Wrong *N* (%)	Don't know *N* (%)	No answer *N* (%)	Total *N* (%)
Male	376 (30.5)	538 (43.6)	154 (12.5)	166 (13.5)	1234 (100.0)
Female	501 (35.5)	646 (45.8)	120 (8.5)	145 (10.3)	1412 (100.0)
Not indicated	5 (38.5)	5 (38.5)	0 (0.0)	3 (23.1)	13 (100.0)
Total	882 (33.2)	1189 (44.7)	274 (10.3)	314 (11.8)	2659 (100.0)

Table 35: Shows number (*N*) and percentages (%) of the responses of the learners in relation to their grades, on the difference between HIV positive and negative results.

	Responses				
Grade	Correct *N* (%)	Wrong *N* (%)	Don't know *N* (%)	No answer *N* (%)	Total *N* (%)
10	270 (24.6)	500 (45.5)	147 (13.4)	182 (16.6)	1099 (100.0)
11	319 (36.8)	372 (43.0)	87 (10.0)	88 (10.2)	866 (100.0)
12	288 (42.6)	309 (45.7)	39 (5.8)	40 (5.9)	676 (100.0)
Not indicated	5 (27.8)	8 (44.4)	1 (5.6)	4 (22.2)	18 (100.0)
Total	882 (33.2)	1189 (44.7)	274 (10.3)	314 (11.8)	2659 (100.0)

A vast majority (*N* = 2285, 85.9%) of the learners agreed that it is important for one to know his or her HIV status, 130 (4.9%) learners disagreed, 82 (3.1%) learners did not know the answer and 162 (6.1%) learners did not respond to the question. The ages, gender distribution and grade of the learners who responded to the question are shown in Tables 36, 37 and 38 respectively. A greater percentage (90.6%) of those who were 16 years of age agreed that it is important for one to check his or her HIV status than those in other age groups (Table 36). More of the females (87.7%) than males (84.0%) agreed, and a vast majority (89.9%) of those who were in grade 12 also agreed than those in other grades (Table, 37 and 38).

Table 36: Shows number (*N*) and percentages (%) of the responses of the learners for different age groups, on whether it is important for one to check his or her HIV status.

Age group (years)	Responses				
	Yes *N* (%)	No *N* (%)	Don't know *N* (%)	No answer *N* (%)	Total *N* (%)
< 16 years	144 (85.7)	6 (3.6)	4 (2.4)	12 (7.2)	166 (100.0)
16 years	407 (90.6)	14 (3.1)	7 (1.6)	21 (4.7)	449 (100.0)
17 years	541 (87.4)	26 (4.2)	18 (2.9)	34 (5.5)	619 (100.0)
18 years	484 (86.0)	26 (4.6)	17 (3.0)	36 (6.4)	563 (100.0)
19-21 years	601(82.8)	49 (6.7)	27 (3.7)	49 (6.7)	726 (100.0)
> 21 years	67 (81.7)	5 (6.1)	6 (7.3)	4 (4.9)	82 (100.0)
Age not indicated	41 (75.9)	4 (7.4)	3 (5.6)	6 (11.1)	54 (100.0)
Total	2285 (85.9)	130 (4.9)	82 (3.1)	162 (6.1)	2659 (100.0)

Table 37: Showing number (*N*) and percentages (%) of the responses of the learners for both genders, on whether it is important for one to check his or her HIV status.

Responses	Gender			
	Males	Females	Gender not indicated	Total
Yes *N* (%)	1036 (84.0)	1239 (87.7)	10 (76.9)	2285(85.9)
No *N* (%)	79 (6.4)	51 (3.6)	0 (0.0)	130 (4.9)
Don't know *N* (%)	42 (3.4)	40 (2.8)	0 (0.0)	82 (3.1)
No answer *N* (%)	77 (6.2)	82 (5.8)	3 (23.1)	162 (6.1)
Total *N* (%)	1234 (100.0)	1412 (100.0)	13 (100.0)	2659 (100.0)

Table 38: Showing number (*N*) and percentages (%) of the responses of the learners in relation to their grades, on whether it is important for one to check his or her HIV status.

Responses	Grade				
	10	11	12	Not indicated	Total
Yes *N* (%)	909 (82.7)	755 (87.2)	608 (89.9)	13 (72.2)	2285 (85.9)
No *N* (%)	64 (5.8)	42(4.8)	23 (3.4)	1 (5.6)	130 (4.9)
Don't know *N* (%)	46 (4.2)	29 (3.3)	6 (0.9)	1 (5.6)	82 (3.1)
No answer *N* (%)	80 (7.3)	40 (4.6)	39 (5.8)	3 (16.7)	162 (6.1)
Total *N* (%)	1099 (100.0)	866 (100.0)	676 (100.0)	18 (100.0)	2659 (100.0)

Just a few (*N* = 149, 5.6%) of the learners knew why should one know his or her HIV status, 2167 (81.5%) learners answered incorrectly, 66 (2.5%) learners did not know the answer and 277 (10.4%) learners did not respond to the question. The ages, gender distribution and grade of the learners who responded to the question are shown in Tables 39, 40 and 41 respectively. Those who were 18 years of age gave more correct answers (7.1%) than those who were in other age groups (Table 39). More of the females (6.0%) gave correct answers than males (5.2%). Again,

those who were in grade 11 gave more correct answers (7.2%) than those who were in other grades (Table, 40 and 41).

Table 39: Shows number (*N*) and percentages (%) of the responses of the learners in different age groups, on why one should know his or her HIV status.

Age Group (Years)	Responses				
	Correct *N* (%)	Wrong *N* (%)	Don't know *N* (%)	No answer *N* (%)	Total *N* (%)
<16 years	7 (4.2)	144 (86.7)	3 (1.8)	12 (7.2)	166 (100.0)
16 years	19 (4.2)	388 (86.4)	5 (1.1)	37 (8.2)	449 (100.0)
17 years	33 (5.3)	525 (84.8)	12 (1.9)	49 (7.9)	619 (100.0)
18 years	40 (7.1)	457 (81.2)	10 (1.8)	56 (9.9)	563 (100.0)
19-21 years	44 (6.1)	565 (77.8)	32 (4.4)	85 (11.7)	726 (100.0)
>21 years	5 (6.1)	60 (73.2)	3 (3.7)	14 (17.1)	82 (100.0)
Not indicated	1 (1.9)	28 (51.9)	1 (1.9)	24 (44.4)	54 (100.0)
Total	149 (5.6)	2167 (81.5)	66 (2.5)	277 (10.4)	2659 (100.0)

Table 40: Shows number (*N*) and percentages (%) of the responses of the learners for both genders, on why one should know his or her HIV status.

Gender	Responses				
	Correct *N* (%)	Wrong *N* (%)	Don't know *N* (%)	No answer *N* (%)	Total *N* (%)
Male	64 (5.2)	970 (78.6)	36 (2.9)	164 (13.3)	1234 (100.0)
Female	84 (5.9)	1187 (84.1)	30 (2.1)	111 (7.9)	1412 (100.0)
Not indicated	1 (7.7)	10 (76.9)	0 (0.0)	2 (15.4)	13 (100.0)
Total	149 (5.6)	2167 (81.5)	66 (2.5)	277 (10.4)	2659 (100.0)

Table 41: Shows number (*N*) and percentages (%) of the responses of the learners in relation to their grades, on why one should know his or her HIV status.

Grade	Responses				
	Correct *N* (%)	Wrong *N* (%)	Don't know *N* (%)	No answer *N* (%)	Total *N* (%)
10	43 (3.9)	861 (78.3)	43 (3.9)	152 (13.8)	1099 (100.0)
11	62 (7.2)	695 (80.3)	20 (2.3)	89 (10.3)	866 (100.0)
12	42 (6.2)	597 (88.3)	3 (0.4)	34 (5.0)	676 (100.0)
Not indicated	2 (11.1)	14 (77.8)	0 (0.0)	2 (11.1)	18 (100.0)
Total	149 (5.6)	2167 (81.5)	66 (2.5)	277 (10.4)	2659 (100.0)

4.3 KNOWLEDGE OF SYMPTOMS AND SEQUELAE OF HIV/AIDS

Many (*N* = 1627, 61.2%) of the learners agreed that a person can live many years before showing any sign or developing any physical changes related to HIV/AIDS, 499 (18.8%) learners disagreed, 481 (18.1%) learners did not know the answer and 52 (2.0%) learners did not respond to the question. The ages, gender distribution and grade of the learners who responded correctly to the question are shown in Tables 42, 43 and 44 respectively. Many (64.6%) of those who were 17 years of age agreed that a person can live many years before showing any sign or developing any physical changes related to HIV/AIDS than those in other age groups (Table 42), and more of the females (63.6%) than males (58.8%) also agreed (Table 43). Majority (74.0%) of those who were in grade 12 also knew this aspect of HIV than those in other grades (Table 44).

About half (*N* = 1340, 50.4%) of the learners disagreed that the effect of HIV on the body is bleeding nose and ears, 325 (12.2%) learners agreed, 865 (32.5%) learners did not know the answer and 129 (4.9%) learners did not respond to the question. The ages, gender distribution and grade of the learners who responded correctly to the question are shown in Tables 42, 43 and 44 respectively. Most (53.8%) of those who were 18 years of age disagreed that the first effect of HIV on the body is bleeding nose and ears than those in other age groups (Table 42) and more of the males (52.4%) than females (48.7%) also disagreed (Table 43). More (57.5%) of those who were in grade 12 gave correct answers than those who were in other grades (Table 44).

Over half (*N* = 1460, 54.9%) of the learners agreed that the first effect of HIV on the body is to suppress the immune system, 235 (8.8%) learners disagreed, 898 (33.8%) learners did not know the answer and 66 (2.5%) learners did not respond to the question. The ages, gender distribution and grade of the learners who responded correctly to the question are shown in Tables 42, 43 and 44 respectively. Many (64.6%) of those who were 16 years of age agreed that the first effect of HIV on the body is to suppress the immune system than those in other age groups (Table 42), and more of the males (55.8%) than females (54.1%) knew this aspect

of HIV (Table 43). Those who were in grade 11 gave correct answers marginally greater (57.0%) as those in grade 12 (56.7%) (Table 44).

Forty six percent (*N* = 1224) of the learners disagreed that due to HIV infection and depressed immune system, HIV patient cannot develop TB, 655 (24.6%) learners agreed, 676 (25.4%) learners did not know the answer and 104 (3.9%) learners did not respond to the question. The ages, gender distribution and grade of the learners who responded correctly to the question are shown in Tables 42, 43 and 44 respectively. Most (59.0%) of those who were less than 16 years of age disagreed that HIV patient cannot develop TB due to HIV infection and depressed immune system than those in other age groups (Table 42), and more of the females (47.1%) than males (45.1%) also disagreed (Table 43). More (59.3%) of those in grades 12 gave correct answers compared to those in other grades who gave correct responses (Table 44).

Many (*N* = 1601, 60.2%) of the learners agreed that HIV/AIDS can cause continuous diarrhoea, 402 (15.1%) learners disagreed, 611 (23.0%) learners did not know the answer and 45 (1.7%) learners did not respond to the question. The ages, gender distribution and grade of the learners who responded correctly to the question are shown in Tables 42, 43 and 44 respectively. Again, many (64.5%) of those who were less than 16 years of age agreed that HIV/AIDS can cause continuous diarrhoea (Table 42), and more of the females (65.2%) than males (54.6%) also agreed (Table 43). Also, many (71.2%) of those who were in grade 12 answered correctly than those who were in other grades (Table 44).

Only a few (*N* = 794, 29.9%) on the learners agreed that HIV/AIDS can cause continuous nausea, 521 (19.6%) learners disagree, 1255 (47.2%) learners did not know the answer, and 89 (3.3%) learners did not respond to the question. The ages, gender distribution and grade of the learners who responded correctly to the question are shown in Tables 42, 43 and 44 respectively. Respondents who were 17 years of age gave more correct answers (33.8%) than those who were in other age groups (Table 42) and more of the males (31.0%) than females (28.8%) also

agreed (Table 43). Those who were in grade 12 gave more correct answers (37.9%) than those in other grades (Table 44).

Half (*N* = 1332, 50.1%) of the learners agreed that HIV/AIDS can cause continuous vomiting, 454 (17.1%) learners disagreed, 789 (29.7%) learners did not know the answer and 84 (3.2%) learners did not respond to the question. The ages, gender distribution and grade of the learners who responded correctly to the question are shown in Tables 42, 43 and 44 respectively. Again, most (53.0%) of those who were 16 years of age agreed that HIV/AIDS can cause continuous vomiting than those in other age groups (Table 42) and also more of the females (52.0%) than males (48.1%) also agreed (Table 43). More (57.4%) of those in grade 12 gave correct answers than those in other grades (Table 44).

Many (*N* = 1657, 62.3%) of the learners disagreed that HIV/AIDS can cause continuous weight gain, 541 (20.3%) learners agreed, 388 (14.6%) learners did not know the answer and 73 (2.7%) learners did not respond to the question. The ages, gender distribution and grade of the learners who responded correctly to the question are shown in Tables 42, 43 and 44 respectively. Many (71.1%) of those who were less than 16 years of age disagreed that HIV/AIDS can cause continuous weight gain than those in other age groups (Table 42); and more of the males (64.3%) than females (60.7%) also disagreed (Table 43). Again, many (74.4%) of those who were in grade 12 disagreed than those in other grades (Table 44).

Forty seven percent (*N* = 1250) of the learners agreed that HIV/AIDS can cause skin cancer to HIV patient, 646 (2 4.3%) learners disagreed, 738 (27.8%) learners did not know the answer and 25 (0.9%) learners did not answer the question. The ages, gender distribution and grade of the learners who responded correctly to the question are shown in Tables 42, 43 and 44 respectively. More (56.1%) of those who were over 21 years of age agreed that HIV/AIDS can cause skin cancer to HIV patients than those in other age groups (Table 42). More of the males (51.8%) than females (42.7%) and about half (50.4%) of those in grade 10 answered correctly compared to those in other grades (Table, 43 and 44).

Less than half of the learners (*N* = 1060, 39.9%) agreed that HIV/AIDS can cause pneumonia, 440 (16.5%) learners disagreed, 1119 (42.1%) learners did not know the answer, and 40 (1.5%) learners did not respond to the question. The ages, gender distribution and grade of the learners who responded correctly to the question are shown in Tables 42, 43 and 44 respectively. Those who were less than 16 years of age gave more correct answers (47.0%) than those in other age groups (Table 42). More of the females (41.8%) than males (37.8%) and those in grade 12 gave more correct answers (42.9%) compared to those who gave correct responses in other grades (Table, 43 and 44).

Table 42: Showing the correct responses of the learners in percentages (%) for different age groups, on the knowledge of symptoms and sequelae of HIV/AIDS.

	Age group (Years) and Responses (%)							
Questions	<16 years	16 years	17 years	18 years	19-21 years	>21 years	Not indicated	Total (%)
HIV patients show signs of HIV/AIDS after many years?	64.5	61.5	64.6	60.4	58.7	53.7	63.0	61.2
Bleeding nose and ears?	51.2	47.7	50.4	53.8	49.6	51.2	44.4	50.4
Suppresses the immune system?	62.7	64.6	57.4	53.5	48.3	43.9	42.6	54.9
HIV patients cannot develop TB?	59.0	52.1	51.9	47.6	36.8	26.8	25.9	46.0
HIV/AIDS can cause continuous diarrhea?	64.5	57.7	62.5	64.3	56.7	61.0	44.4	60.2
HIV/AIDS can cause continuous nausea?	28.3	26.1	33.8	31.1	29.1	26.8	24.1	29.9
HIV/AIDS can cause continuous vomiting?	49.4	53.0	51.2	51.2	47.9	45.1	40.7	50.1
HIV/AIDS can cause continuous weight gain?	71.1	65.9	63.3	64.5	56.7	59.8	50.0	62.3
HIV/AIDS can cause skin cancers to HIV patients?	46.4	41.6	45.6	45.3	51.5	56.1	53.7	47.0
HIV/AIDS can cause pneumonia?	47.0	35.6	40.4	43.5	38.0	39.0	35.2	39.9
HIV/AIDS affects the eye?	32.5	29.4	26.2	25.6	28.8	28.0	29.6	27.8

Table 43: Showing the correct responses of the learners in percentages (%) for both genders, on the knowledge of symptoms and sequelae of HIV/AIDS.

Questions	Gender and Responses (%)			
	Male	Female	Not Indicated	Total
HIV patients show signs of HIV/AIDS after many years?	58.8	63.6	30.8	61.2
Bleeding nose and ears?	52.4	48.7	46.2	50.4
Suppresses the immune system?	55.8	54.1	53.8	54.9
HIV patients cannot develop TB?	45.1	47.1	23.1	46.0
HIV/AIDS can cause continuous diarrhea?	54.6	65.2	46.2	60.2
HIV/AIDS can cause continuous nausea?	31.0	28.8	30.8	29.9
HIV/AIDS can cause continuous vomiting?	48.1	52.0	30.8	50.1
HIV/AIDS can cause continuous weight gain?	64.3	60.7	53.8	62.3
HIV/AIDS can cause skin cancers to HIV patients?	51.8	42.7	61.5	47.0
HIV/AIDS can cause pneumonia.	37.8	41.8	30.8	39.9
HIV/AIDS affects the eye?	29.3	26.6	30.8	27.8

Table 44: Showing the correct responses of the learners in percentages (%) in relation to their grades, on the knowledge of symptoms and sequelae of HIV/AIDS.

Questions	Grade and Responses (%)				
	10	11	12	Not indicated	Total
HIV patients show signs of HIV/AIDS after many years?.	53.6	61.3	74.0	38.9	61.2
Bleeding nose and ears?	44.9	52.0	57.5	38.9	50.4
Suppresses the immune system?	52.2	57.0	56.7	50.0	54.9
HIV patient cannot develop TB?	37.9	46.5	59.3	22.2	46.0
HIV/AIDS can cause continuous diarrhea?	50.5	64.1	71.2	55.6	60.2
HIV/AIDS can cause continuous nausea?	25.1	29.7	37.9	27.8	29.9
HIV/AIDS can cause continuous vomiting?	43.2	53.2	57.4	44.4	50.1
HIV/AIDS can cause continuous weight gain?	51.9	66.7	74.4	33.3	62.3
HIV/AIDS can cause skin cancers to HIV patients?	50.4	48.5	39.6	44.4	47.0
HIV/AIDS can cause pneumonia?	37.4	40.9	42.9	27.8	39.9
HIV/AIDS affect the eye?	26.4	31.4	25.4	33.3	27.8

On the symptoms of HIV, forty nine percent (*N* = 1304) of the learners agreed that headache can be a symptom when the HIV status of a person changes from negative to positive, 525 (19.7%) learners disagreed, 749 (28.2%) learners did not know the answer and 81 (3.0%) learners did not respond to the question. The ages, gender distribution and grade of the learners who responded correctly to the question are shown in Tables 45, 46 and 47 respectively. More (55.4%) of those who were less than 16 years of age knew that headache could be a symptom when the HIV status of a person changes from negative to positive than those who were in other age groups (Table 45) and also more of the females (50.8%) than males (47.0%), knew this aspect (Table 46). Again, more (53.7%) of those who were in grade 12 knew this aspect of HIV than those in other grades (Table 47).

A small proportion (*N* = 1027, 38.6%) of the learners agreed that sore throat could be a symptom when the HIV status of a person changes from negative to positive, 545 (20.5%) learners disagreed, 966 (36.3%) learners did not know the answer and 121 (4.6%) learners did not respond to the question. The ages, gender distribution and grade of the learners who responded correctly to the question are shown in Tables 45, 46 and 47 respectively. Those who were less than 16 years of age gave more correct answers (42.2%) than those in other grades, and also more of the females (40.7%) than males (36.1%), knew this aspect (Table, 45 and 46). Those who were in grade 12 gave more correct answers (45.3%) compared to those who gave correct responses in other grades (Table 47).

Only a few (*N* = 701, 26.4%) of the learners disagreed that hair colour changes to grey when the HIV status of a person changes from negative to positive, 1300 (48.9%) learners agreed, 583 (21.9%) learners did not know the answer and 75 (2.8%) learners did not respond to the question. The ages, gender distribution and grade of the learners who responded correctly to the question are shown in Tables 45, 46 and 47 respectively. Those who were 16 years of age gave more correct answers (33.0%) than those who were in other age groups (Table 45). More of the females (28.0%) than males (24.6%) answered correctly (Table 46). Of those who

were in grade 12 gave more correct answers (30.6%) compared to those who gave correct responses in other grades (Table 47).

Many (*N* = 1941, 73.0%) of the learners agreed that tiredness could be a symptom when the HIV status of a person changes from negative to positive, 235 (8.8%) learners disagreed, 386 (14.5%) learners did not know the answer and 97 (3.6%) learners did not respond to the question. The ages, gender distribution and grade of the learners who responded correctly to the question are shown in Tables 45, 46 and 47 respectively. A greater percentage (79.3%) of those who were over 21 years of age knew that tiredness could be a symptom when the HIV status of a person changes from negative to positive than those in other grades (Table 45). More of the females (75.1%) than males (70.7%) knew this aspect of HIV and again a greater percentage (80.2%) of those who were in grade 12 knew this aspect than learners in other grades (Table, 46 and 47).

Many (*N* = 1618, 60.8%) of the learners agreed that rashes on the body could be a symptom when the status of a person changes from negative to positive, 400 (15.0%) learners disagreed, 545 (20.5%) learners did not know the answer and 96 (3.6%) learners did not respond to the question. The ages, gender distribution and grade of the learners who responded correctly to the question are shown in Tables 45, 46 and 47 respectively. Majority (72.0%) of those who were over 21 years of age agreed that rash could be a symptom when the HIV status of a person changes from negative to positive than learners in other grades (Table 45). More of the females (61.9%) than males (59.7%) and also many (62.9%) of those in grade 12 also agreed compared to learners in other grades (Table, 46 and 47).

Many (*N* = 1583, 59.5%) of the learners agreed that pain in the joints could be a symptom when the HIV status of a person changes from negative to positive, 354 (13.3%) learners disagreed, 627 (23.6%) learners did not know the answer and 95 (3.6%) learners did not respond to the question. The ages, gender distribution and grade of the learners who responded correctly to the question are shown in Tables 45, 46 and 47 respectively. Many (65.9%) of those who were over 21 years of age

agreed that pain in the joints can be a symptom when the HIV status of a person changes from negative to positive than learners in other age groups (Table 45). More of the females (60.3%) than males (58.5%) also agreed (Table 46). Many (61.3%) of those in grade 11 gave correct answers compared to learners in other grades (Table 47).

Many (*N* = 1689, 63.5%) of the learners disagreed that weight gain could not be a symptom when HIV status of a person changes from positive to positive; 525 (19.7%) learners agreed, 364 (13.7%) learners did not know the answer and 81 (3.0%) learners did not respond to the question. The ages, gender distribution and grade of the learners who responded correctly to the question are shown in Tables 45, 46 and 47 respectively. Many (70.2%) of those who were 16 years of age knew that weight gain could not be a symptom when the HIV status of a person changes from negative to positive than learners in other age groups (Table 45). More of the males (64.7%) than females (62.5%) knew this aspect. Also, many (73.7%) of those in grade 12 knew this aspect compared to those in other grades (Table, 46 and 47).

Table 45: Showing correct responses of the learners in percentages (%) for different age groups, on the knowledge of symptoms and sequelae of HIV/AIDS.

	Age group (Years) and Responses (%)							
Questions	< 16 years	16 years	17 years	18 years	19 – 21 years	> 21 years	Not indicated	Total (%)
Headaches	55.4	50.8	49.1	47.8	48.1	51.2	37.0	49.0
Sore throat	42.2	37.6	38.4	39.3	38.8	32.9	37.0	38.6
Grey hair	31.3	33.0	24.7	28.4	22.6	12.2	25.9	26.4
Tiredness	77.1	76.2	75.0	74.2	67.6	79.3	61.1	73.0
Rash	62.7	55.9	60.3	62.7	63.4	72.0	33.3	60.8
Painful joints	64.5	58.8	57.7	57.9	62.0	65.9	46.3	59.5
Weight gain	65.7	70.2	64.5	64.7	59.0	62.2%	42.6	63.5

Table 46: Showing correct responses of the learners in percentages (%) for both genders, on the knowledge of symptoms and sequelae of HIV/AIDS.

Questions	Gender and Responses (%)			
	Male	Female	Not indicated	Total (%)
Headaches	47.0	50.8	53.8	49.0
Sore throat	36.1	40.7	53.8	38.6
Grey hair	24.6	28.0	7.7	26.4
Tiredness	70.7	75.1	69.2	73.0
Rash	59.7	61.9	53.8	60.8
Painful joint	58.5	60.3	69.2	59.5
weight gain	64.7	62.5	61.5	63.5

Table 47: Showing correct responses of the learners in percentages (%) in relation to their grades, on the knowledge of symptoms and sequelae of HIV/AIDS.

Questions	Grade and Responses (%)				
	10	11	12	Not indicated	Total (%)
Headaches.	42.8	53.0	53.7	66.7	49.0
Sore throat.	31.0	43.2	45.3	33.3	38.6
Grey hair.	25.4	24.1	30.6	33.3	26.4
Tiredness.	66.8	75.6	80.2	55.6	73.0
Rash.	60.0	60.4	62.9	61.1	60.8
Painful joints.	60.6	61.3	55.3	66.7	59.5
Weight gain.	53.9	68.1	73.7	50.0	63.5

4.4 ESTABLISHING HIV/AIDS STATUS

About half (*N* = 1356, 51.0%) of the learners knew that one can check his or her HIV status at their family medical practitioner, 720 (27.1%) learners disagreed, 414 (15.6%) learners did not know the answer and 169 (6.4%) learners did not respond to the question. The ages, gender distribution and grade of the learners who responded correctly to the question are shown in Tables 48, 49 and 50 respectively. Most (57.7%) of those who were 18 years of age knew that one can check his or her HIV status at family general practitioner than those in other age groups (Table 48) and more of the females (51.6%) than males (50.3%) knew this (Table 49). Over half (59.2%) of those in grade 12 gave correct answers compared to those in other grades (Table 50).

Majority (*N* = 2484, 93.4%) of the learners knew that one can check his or her HIV status at the hospital, 58 (2.2%) learners disagreed, 43 (1.6%) learners did not know the answer and 74 (2.8%) learners did not respond to the question. The ages, gender distribution and grade of the learners who responded correctly to the question are shown in Tables 48, 49 and 50 respectively. Again, a vast majority (95.8%) of those who were less than 16 years of age agreed that one can check his or her HIV status at the hospital than those in other age groups (Table 48). More of the females (94.3%) than males (92.6%) agreed. Also, majority (95.6%) of those in grade 12 agreed compared to learners in other grades (Table, 49 and 50).

Just over a third (*N* = 910, 34.2%) of the learners knew that one can check his or her HIV status at the family general medical practitioner and also at the hospital, 764 (28.7%) learners disagreed, 732 (27.5%) learners did not know the answer and 253 (9.5%) learners did not respond to the question. The ages, gender distribution and grade of the learners who responded correctly to the question are shown in Tables 48, 49 and 50 respectively. Those who were over 21 years of age gave more correct answers (37.8%) than those who were in other age groups, and also more of the males (34.6%) gave correct answers than females (33.9%) (Table, 48 and 49). Those who were in grade 12 gave more correct answers (44.5%) than those who were in other grades (Table 50).

Many (*N* = 1764, 66.3%) of the learners knew that one could not check his or her HIV status at the traditional healer, 318 (12.0%) learners agreed that one can check his or her HIV status at a traditional healer, 390 (14.7%) learners did not know the answer and 187 (7.0%) learners did not respond to the question. The ages, gender distribution and grade of the learners who responded correctly to the question are shown in Tables 48, 49 and 50 respectively. Again, majority (69.9%) of those who were 16 years of age knew that one could not check his or her HIV status at a traditional healer than those in other age groups, and more of the males (67.4%) than females (65.2%) also knew this aspect (Table, 48 and 49). Many (73.7%) of those in grade 12 knew this aspect compared to learners in other grades (Table 50).

Many (*N* = 2078, 78.1%) of the learners knew that one could not check his or her HIV status at school, 220 (8.3%) learners agreed that one can check his or her HIV status at school, 179 (6.7%) learners did not know the answer and 182 (6.8%) learners did not respond to the question. The ages, gender distribution and grade of the learners who responded correctly to the question are shown in Tables 48, 49 and 50 respectively. Again, majority (83.1%) of those who were less than 16 years of age knew that one could not check his or her HIV status at school those in other age groups (Table 48). More of the males (79.0%) than females (77.4%) knew this aspect and majority (83.1%) of those in grade 12 knew this too compared to learners in other grades (Table, 49 and 50).

Table 48: Showing correct responses of the learners in percentages (%), for different age groups, on where one can check his or her HIV status.

	Responses on where can one go to check his or her HIV status				
Age group (Years)	Family general practitioner (GP)	Hospital	Family GP & Hospital	Traditional healer	School
<16 years	47.6	95.8	26.5	69.3	83.1
16 years	49.9	93.1	37.2	69.9	80.6
17 years	53.3	94.3	37.2	68.8	80.5
18 years	57.7	93.4	34.3	68.2	81.0
19 – 21 years	45.9	92.4	30.7	61.8	74.2
> 21 years	43.9	90.2	37.8	48.8	62.2
Not indicated	53.7	96.3	40.7	66.7	63.0
Total	51.0	93.4	34.2	66.3	78.1

Table 49: Shows correct responses of the learners in percentages (%), for both genders, on where one can check his or her HIV status.

Where to check HIV status	**Gender and Responses (%)**			
	Male	Female	Not indicated	Total
Family general practitioner (GP)	50.3	51.6	53.8	51.0
Hospital	92.6	94.3	76.9	93.4
Only Family GP and hospital	34.6	33.9	30.8	34.2
Traditional healer	67.4	65.2	84.6	66.3
School	79.0	77.4	76.9	78.1

Table 50: Shows correct responses of the learners in percentages (%) in relation to their grades, on where one can check his or her HIV status.

Where to check HIV status	Grade and Responses (%)				
	10	11	12	Not indicated	Total
Family general practitioner (GP)	46.0	51.2	59.2	44.4	51.0
Hospital	91.3	94.5	95.6	94.4	93.4
Family GP and hospital	26.2	36.8	44.5	11.1	34.2
Traditional Healer	58.1	71.2	73.7	55.6	66.3
School	72.2	81.9	83.1	72.2	78.1

4.5 OVERALL KNOWLEDGE OF THE BASICS OF HIV/AIDS

This section evaluates the overall performance of the participating learners on the basic knowledge of HIV/AIDS. The performance of the learners in relation to their age and gender is illustrated in Figure 3. Age was statistically significant, ($p < 0.05$). Learners who were less than 16 years of age had the highest score of correct answers (21.48) while those who were over 21 years of age had the least score of correct answers (18.44), out of 36 questions. There was no statistically significant difference in gender responses ($p > 0.05$), e.g. males who were less than 16 years answered 20.64 questions correctly and females from same age group answered 21.81 questions correctly (Fig. 3).

There was a significant interaction between school and grade ($p < 0.05$). This means that among the grades there was no uniform pattern in responses across the schools. The overall scores of three grades in percentages for the 18 selected high schools, on the knowledge of the general effects of HIV/AIDS are shown in Table 51. The interaction of school by grade on the general knowledge of HIV/AIDS is illustrated in Figure 4. The analysis of the covariance for modeling the knowledge of the systemic effects of HIV/AIDS is shown in Table 52 and all $p > 0.05$ are coloured in blue.

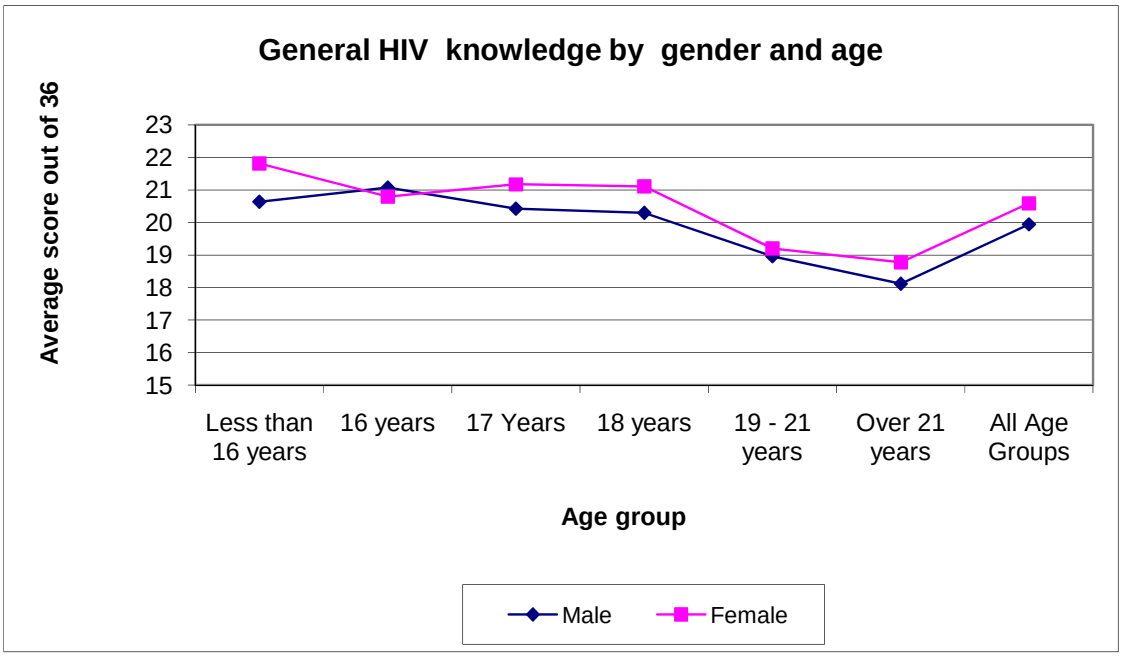

Figure 3: Illustrates the performance of the learners in relation to their age and gender. Females who are less than 16 years were the highest (21.81) with correct answers, and the least (18.12) were males who are over 21years.

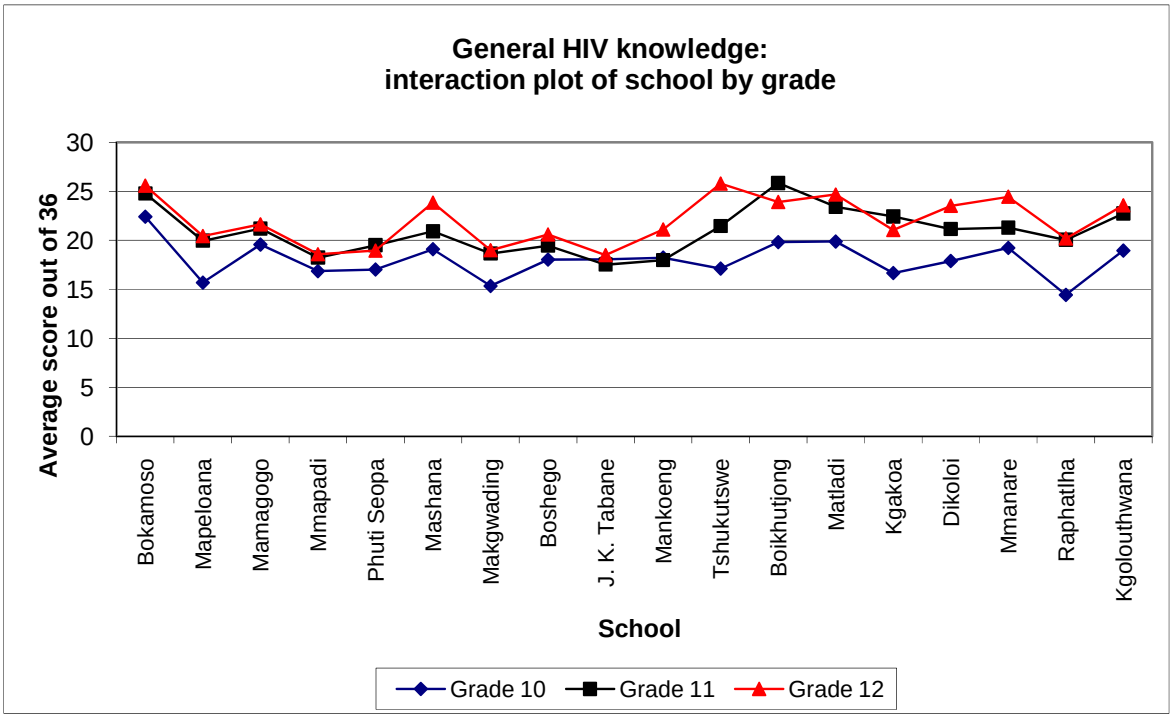

Figure 4: Illustrates interaction of school by grade on the general knowledge of HIV/AIDS, and there is no uniform pattern across the schools by grades.

Table 51: Showing overall scores of three grades in percentages (%) for 18 selected high schools, on the general knowledge of HIV/AIDS. Bokamoso high school had the highest 93.5% average score on the general knowledge of HIV/AIDS and Boshego high school had the least 66.2% average score.

Name of the school	Grades			
	10	11	12	All grades
Bokamoso	86.2%	95.3%	98.4%	**93.5%**
Matladi	76.5%	90.1%	94.9%	85.8%
Boikhutjong	76.2%	**99.5%**	92.0%	85.0%
Mmanare	74.0%	81.9%	94.1%	80.8%
Mashana	73.5%	80.5%	91.7%	80.4%
Mamagogo	**75.3%**	81.6%	83.2%	80.0%
Kgolouthwana	72.9%	87.5%	90.7%	80.0%
Tshukutswe	65.8%	82.5%	**99.2**%	77.7%
Dikoloi	68.8%	81.3%	90.5%	76.5%
Kgakoa	64.1%	86.3%	81.0%	75.4%
Boshego	69.4%	74.8%	79.2%	74.2%
Mapeloana	60.3%	76.8%	78.6%	72.7%
Mankoeng	70.2%	69.2%	81.2%	72.7%
Phuti Seopa	65.5%	75.0%	72.9%	71.2%
Raphatlha	55.5%	77.2%	77.7%	70.4%
J. K. Tabane	69.5%	67.4%	71.2%	68.8%
Mmapadi	64.8%	70.2%	71.5%	68.5%
Makgwading	59.0%	71.8%	73.1%	66.2%
All Schools	70.3%	80.8%	86.5%	78.1%

Table 52: Showing analysis of the covariance for modeling the general knowledge of HIV/AIDS. There was no statistically significant difference between males and females, ($p > 0.05$).

Source	Type III Sum of Squares	Degree (D) Freedom (f)	Mean Square	F-value	p-value
Corrected Model	24 396.540	108	225.894	9.361	0.000
Age in Years	3 038.945	1	3 038.945	125.934	0.000
School	6 649.414	17	391.142	16.209	0.000
Grade	7 314.201	2	3 657.101	151.550	0.000
Gender	8.607	1	8.607	0.357	0.550
School by Grade	1 881.019	34	55.324	2.293	0.000
School by Gender	485.760	17	28.574	1.184	0.269
Grade by Gender	89.242	2	44.621	1.849	0.158
School by Grade, by Gender	767.399	34	22.571	0.935	0.576
Error	59 580.064	2 469	24.131		
Corrected Total	83 976.604	2 577			

4.6 KNOWLEDGE OF THE EFFECTS OF HIV/AIDS ON THE EYE

On whether HIV/AIDS infection can affect the eye, only a few learners (*N* = 740, 27.8%) knew that HIV/AIDS infection does affect the eye, 1137 (42.8%) learners disagreed, 709 (26.7%) learners did not know the answer and 73 (2.7%) did not respond to the question. The ages, gender distribution and grade of the learners who responded correctly to the question are shown in Tables 42, 43 and 44 respectively. Those who were less than 16 years of age gave more (32.5%) correct answers compared to learners in other age groups (Table 42). More of the males (29.3%) than females (26.6%) answered correctly and those who were in grade 11 gave more correct answers (31.4%) compared to learners in other grades (Table, 43 and 44).

On who should be consulted for symptoms that are related to HIV/AIDS in the eye, many (*N* = 1744, 65.6%) of the learners agreed that an eye specialist or optometrist, 339 (12.7%) learners disagreed, 498 (18.7%) learners did not know the answer and 78 (2.9%) learners did not respond to the question. The ages, gender distribution and grade of the learners who responded to the question are shown in Tables 53, 54 and 55 respectively. Many (71.9%) of those who were 16 years of age agreed that an eye specialist or optometrist can be consulted for symptoms that are related to HIV/AIDS in the eye compared to learners in other age groups (Table 53). More of the females (66.6%) than males (64.6%) agreed and more (74.7%) of those in grade 12 agreed compared to learners in other grades (Table, 54 and 55).

About half (*N* = 1345, 50.6%) of the learners disagreed that an ear specialist should be consulted for symptoms that are related to HIV/AIDS in the eye, 631 (23.7%) learners agreed, 505 (19.0%) learners did not know the answer and 178 (6.7%) learners did not respond to the question. The ages, gender distribution and grade of the learners who responded correctly to the question are shown in Tables 53, 54 and 55 respectively. Many (60.4%) of those who were 16 years of age disagreed that an ear specialist can be consulted for symptoms that are related to HIV/AIDS in the eye than learners in other age groups (Tables 53). There was a marginal difference on the correct responses for males (50.7%) and females (50.6%) and

more (60.7%) of the grade 12 gave correct responses compared to learners in other grades (Table, 54 and 55).

Above half (*N* = 1512, 56.9%) of the learners correctly disagreed that a traditional healer should be consulted for symptoms that are related to HIV/AIDS in the eye, 439 (16.5%) learners agreed, 518 (19.5%) learners did not know the answer and 190 (7.1%) learners did not respond to the question. The ages, gender distribution and grade of the learners who responded correctly to the question are shown in Tables 53, 54 and 55 respectively. Many (61.9%) of those who were 16 years of age disagreed that traditional healer can be consulted for symptoms that are related to HIV/AIDS in the eye compared to learners in other age groups (Table 53). More of the males (58.8%) than females (55.2%) disagreed. Also, many (64.6%) of those who were in grade 12 disagreed than learners in other grades (Table, 54 and 55).

Many (*N* = 1904, 71.6%) of the learners disagreed that the school principal should be consulted for symptoms that are related to HIV/AIDS in the eye, 225 (8.5%) learners agreed, 350 (13.2%) learners did not know the answer and 180 (6.8%) learners did not respond to the question. The ages, gender distribution and grade of the learners who responded correctly to the question are shown in Tables 53, 54 and 55 respectively. A greater percentage (81.3%) of those who were less than 16 years of age knew that a school principal could not be consulted for symptoms that are related to HIV/AIDS in the eye than learners in other age groups (Table 53). More of the males (72.2%) than females (71.0%) knew this aspect and many (78.4%) of those in grade 12 knew this aspect compare to leaners in other grades (Table, 54 and 55).

A very small proportion (*N* = 614, 23.1%) of learners wrongly agreed that both eye specialist and ear specialist should be consulted for symptoms that are related to HIV/AIDS in the eye, 1211 (45.5%) learners disagreed, 640 (24.1%) learners did not know the answer; and 194 (7.3%) learners did not respond to the question. The ages, gender distribution and grade of the learners who responded correctly to the question are shown in Tables 53, 54 and 55 respectively. More (54.2%) of those

who were less than 16 years of age disagreed that both eye and ear specialists can be consulted for symptoms that are related to HIV/AIDS in the eye compared to learners in other age groups who disagreed (Table 52). More of the males (47.0%) than females (44.3%) disagreed (Table 52). Just over half (52.7%) of those in grade 12 also disagreed compared to learners in other grades (Table 54-55).

Table 53: Showing correct responses of the learners in percentages (%) for different age groups, on who should be consulted for symptoms that are related to HIV/AIDS in the eye.

	Age group (Years) and Responses (%)							
Questions	<16 years	16 years	17 years	18 years	19 - 21 years	> 21 years	Not indicated	Total (%)
Eye specialist/ Optometrist	71.7	71.9	70.6	69.1	55.9	53.7	48.1	65.6
Ear specialist	59.6	60.4	50.2	50.6	45.3	46.3	22.2	50.6
Traditional healer	57.2	61.9	58.8	59.7	50.6	58.5	44.4	56.9
School principal	81.3	77.7	69.6	76.9	65.7	57.3	59.3	71.6
Both eye specialist and ear specialist	54.2	52.3	46.4	47.4	39.3	37.8	29.6	45.5

Table 54: Showing correct responses of the learners for both genders in percentages (%), on who should be consulted for symptoms that are related to HIV/AIDS in the eye.

	Gender and Responses (%)			
Questions	Male	Female	Not indicated	Total (%)
Eye specialist/optometrist	64.6	66.6	46.2	65.6
Ear specialist	50.7	50.6	38.5	50.6
Traditional healer	58.8	55.2	53.8	56.9
School principal	72.2	71.0	76.9	71.6
Both Eye specialist & ear specialist	47.0	44.3	46.2	45.5

Table 55: Showing correct responses of the learners in percentages for the three grades, on who should be consulted for symptoms that are related to HIV/AIDS in the eye.

	Grade and Responses (%)				
Questions	10	11	12	Not indicated	Total (%)
Eye specialist/optometrist	56.8	70.2	74.7	38.9	65.6
Ear specialist	44.2	51.3	60.7	27.8	50.6
Traditional healer	50.4	59.1	64.6	50.0	56.9
School principal	64.9	75.4	78.4	44.4	71.6
Both eye specialist & ear specialist	40.6	46.3	52.7	44.4	45.5

Less than half (*N* = 1248, 46.9%) of the learners disagreed that a person can be infected with HIV by exchanging contact lenses with the infected person, 601 (22.6%) learners agreed, 746 (28.1%) learners did not know the answers and 64 (2.4%) learners did not respond to the question. The ages, gender distribution and grade of the learners who responded correctly to the question are shown in Tables 56, 57 and 58 respectively. Those who were less than 16 years of age gave more correct answers (52.4%) than those in other age groups (Table 56), and also more of the males (47.8%) than females (46.1%) answered correctly (Table 57). Almost fifty percent (49.7%) of those who were in grade 12 gave correct answers than those in other grades who gave correct responses (Table 58).

A small proportion (*N* = 706, 26.6%) of the respondents agreed that HIV/AIDS decrease the risk of eye infections, 1072 (40.3%) learners disagreed, 825 (31.0%) learners did not know the answer and 56 (2.1%) learners did not respond to the question. The ages, gender distribution and grade of the learners who responded correctly to the question are shown in Tables 56, 57 and 58 respectively. Those who were 16 years of age gave more correct answers (46.1%) than those in other age groups (Table 56). There was a marginal difference between males (40.4%) and females (40.2%) correct responses (Table 57). Those who were in grade 12 gave more correct answers (44.8%) than those in other grades (Table 58).

Less than a third (*N* = 836, 31.4%) of the learners agreed that HIV/AIDS related infections can change the colour of the white part of the eye of an HIV patient to red, 834 (31.4%) learners disagreed, 935 (35.2%) learners did not know the answer and 54 (2.0%) learners did not respond to the question. The ages, gender distribution and grade of the learners who responded correctly to the question are shown in Tables 56, 57 and 58 respectively. Those who were over 21 years of age gave more (41.5%) correct answers than those who were in other age groups (Table 56) and also more of the males (33.3%) than females (29.7%) answered correctly (Table 57). Learners in grade 11 gave more correct answers (34.8%) than those in other grades (Table 58).

Again, less than a third (*N* = 838, 31.5%) of the learners agreed that HIV/AIDS related infections cause can cancer of the eyelids were 692 (26.0%) learners disagreed, 1084 (40.8%) learners did not know the answer and 45 (1.7%) learners did not respond to the question. The ages, gender distribution and grade of the learners who responded correctly to the question are shown in Tables 56, 57 and 58 respectively. Those who were over 21 years of age gave more (37.8%) correct answers than those in other age groups (Table 56), and also more of the males (32.7%) than females (30.5%) answered correctly (Table 57). Those who were in grade 10 gave more correct answers (34.0%) compared to learners in other grades who gave (Table 58).

A few (*N* = 752, 28.3%) of the learners agreed that HIV/AIDS related infections can affect eye-lashes of HIV patients, 772 (29.0%) learners disagreed, 1079 (40.6%) learners did not know the answer and 56 (2.1%) learners did not respond to the question. The ages, gender distribution and grade of the learners who responded correctly to the question are shown in Tables 56, 57 and 58 respectively. There was a marginal difference on the correct responses of learners who were 16 years of age 29.4% and those who were 19-21 years of age (29.5%) (Table 56). More of the males (31.1%) than females (25.8%) answered correctly (Table 57). Participants in grade 11 gave more correct answers (30.3%) than learners those in other grades (Table 58).

Again, a few (*N* = 738, 27.8%) of the learner agreed that HIV/AIDS related infections can cause dry eye, 824 (31.0%) learners disagreed, 1043 (39.2%) learners did not know the answer, and 54 (2.0%) learners did not respond to the question. The ages, gender distribution and grade of the learners who responded correctly to the question are shown in Tables 56, 57 and 58 respectively. Those who were 19-21 years of age gave more correct answers (30.6%) than those who were in other age groups (Table 56), and also more of the males (28.6%) answered correctly than females (27.0%) (Table 57). Those who were in grade 10 gave more correct answers (30.4%) than learners in other grades (Table 58).

A few (*N* = 697, 26.2%) of the learners agreed that a cornea of an HIV patient can change from transparent colour to white due to HIV related infections, 668 (25.1%) learners disagreed 1244 (46.8%) learners did not know the answer and 50 (1.9%) learners did not respond to the question,. The ages, gender distribution and grade of the learners who responded correctly to the question are shown in Tables 56, 57 and 58 respectively. Those who were less than 16 years of age gave more correct answers (30.1%) than learners in other age groups (Table 56), and more of the males (26.5%) than females (25.8%) also answered correctly (Table 57). Learners in grade 10 gave more correct answers (28.1%) compared to those learners in other grades (Table 58).

Over a third (*N* = 1031, 38.1%) agreed that tumour can develop on an eye ball due HIV/AIDS related diseases, 604 (22.7%) learners disagreed, 992 (37.3%) learners did not know the answer and 50 (1.9%) learners did not answer the question. The ages, gender distribution and grade of the learners who responded correctly to the question are shown in Tables 56, 57 and 58 respectively. Those who were over 21 years of age gave more correct answers (43.9%) than those in other age groups (Table 56), and more of the females (39.2%) than males (37.0%) also answered correctly (Table 57). There was a marginal difference on the correct responses for grade 10 (39.9%) and grade 11 (39.5%) (Table 58).

One thousand three hundred and eighty three (52.0%) of the learners agreed that HIV/AIDS opportunistic infections can cause swollen lids, discharge on eyelids margin and lids, 423 (15.9%) learners disagreed, 798 (30.0%) learners did not know the answer and 55 (2.1%) learners did not respond to the question. The ages, gender distribution and grades of the learners who responded correctly to the question are shown in Tables 56, 57 and 58 respectively. Most (57.3%) of those who were over 21 years of age agreed that the eyelids of an HIV/AIDS patient can be swollen with discharge on the eyelids margin than those in other age groups (Table 56). More of the females (55.9%) than males (47.6%) agreed; and there was a marginal difference on the correct responses for the grade 11 (53.3%) and grade 12 (53.0%) (Table, 57 and 58).

Just above half (*N* = 1369, 51.5%) of the learners did not know the answer on whether HIV/AIDS can cause a persistent gritty (sandy) sensation in the eye, 530 (19.9%) learners agreed, 702 (26.4%) learners disagreed and 58 (2.2%) learners did not respond to the question. The ages, gender distribution and grade of the learners who responded correctly to the question are shown in Tables 56, 57 and 58 respectively. Those who were less than 16 years of age gave more (22.9%) correct answers than those in other age groups (Table 56); and more of the males (21.7%) than females (18.3%) answered correctly (Table 57). Those in grade 11 gave more correct answers (22.3%) than those in other grades (Table 58).

Six hundred and ninety two (26.0%) of the learners agreed that HIV/AIDS can cause itching and burning sensation in the eye, 749 (28.2%) learners disagreed, 1162 (43.7%) learners did not know the answer 56 (2.1%) learners did not respond to the question. The ages, gender distribution and grade of the learners who responded correctly to the question are shown in Tables 56, 57 and 58 respectively. Those who were less than 16 years of age (31.3%) gave more correct answers than those in other age groups and more of the males (28.0%) than females (24.2%) answered correctly (Table, 56 and 57). There was a marginal difference on the correct responses for grade 11 (26.3%) and grade 12 (26.0%) (Table 58).

Many (*N* = 1732, 65.1%) of learners disagreed that HIV/AIDS cause good vision, 327 (12.3%) learners agreed, 543 (20.4%) learners did not know the answer and 57 (2.1%) learners did not respond to the question. The ages, gender distribution and grades of the learners who responded correctly to the question are shown in Tables 56, 57 and 58 respectively. A high percentage (72.4%) of those who were 16 years of age knew that HIV/AIDS could not cause good vision than those in other age groups (Table 56). More of the females (65.5%) than males (64.8%) knew this aspect (Table 57). Also, more (67.2%) of those in grade 11 knew this than those in other grades (Table 58).

One thousand two hundred and twenty four (46.0%) of learners agreed that HIV/AIDS can cause loss of vision (blindness), 746 (28.1%) learners disagreed, 644 (24.2%) learners did not know the answer and 45 (1.7%) learners did not respond to the question. The ages, gender distribution and grades of the learners who responded to the question are shown in Tables 54, 55 and 56 respectively. About half (51.2%) of those who were over 21 years of age knew that HIV/AIDS could cause blindness (loss of vision) than learners in other age groups, and more of the males (46.3%) than females (45.8%) also knew this aspect (Table, 56 and 57). There was a marginal difference on the correct responses for grade 11 (47.8%) and grade 10 (47.1%) (Table 58).

Less than a half (*N* = 1141, 42.9%) of the learners agreed that HIV/AIDS related infections can cause painful eyes, 617 (23.2%) learners disagreed, 853 (32.1%) learners did not know the answer and 48 (1.8%) learners did not respond to the question. The ages, gender distribution and grades of the learners who responded correctly to the question are shown in Tables 56, 57 and 58 respectively. Those who were less than 16 years of age gave more correct answers (47.6%) than those in other age groups, and also more of the females (43.1%) than males (42.6%) answered correctly (Table, 56 and 57). Learners in grade 11 gave more correct answers (46.0%) than those in other age groups (Table 58).

Over half (*N* = 1558, 58.6%) of the learners agreed that HIV/AIDS-related infection can cause severe headache, 349 (13.1%) learners disagreed, 707 (26.6%) learners did not know the answer and 45 (1.7%) learners did not respond to the question. The ages, gender distribution and grades of the learners who responded correctly to the question are shown in Tables 56, 57 and 58 respectively. Many (62.4%) of those who were 16 years of age knew that HIV/AIDS related infections can cause severe headache than those in other age groups (Table 56), and also more of the females (61.9%) than males (54.7%) knew this aspect (Table 57). Many (66.7%) of those in grade 12 knew this aspect than those in other grades (Table 58).

Table 56: Shows the correct responses of the learners in percentages (%) for different age groups, on the effects of HIV/AIDS on the eye.

Questions	Age Group (Years) and Responses (%)							
	<16 years	16 years	17 years	18 years	19 – 21 years	>21 years	Not indicated	Total (%)
A person can get HIV by exchanging contact lenses with HIV patient?	52.4	49.2	47.8	50.1	42.8	40.2	33.3	46.9
HIV/AIDS decrease the risk of eye infection?	39.2	46.1	44.7	38.9	35.8	29.3	37.0	40.3
HIV/AIDS change colour of the eye to red?	30.1	33.9	27.5	28.1	35.1	41.5	31.5	31.4
HIV/AIDS cause cancer of the eyelids?	37.3	32.5	32.8	28.8	30.3	37.8	25.9	31.5
HIV/AIDS affects eye - lashes of HIV patient?	28.9	29.4	26.8	27.7	29.5	26.8	25.9	28.3
HIV/AIDS cause dry eye?	28.3	25.8	25.0	27.0	30.6	30.5	38.9	27.8
Cornea of HIV patient can change to white?	30.1	23.6	24.4	25.9	28.7	26.8	25.9	26.2
Tumour can develop on an eyeball due HIV/AIDS	42.8	37.2	37.0	36.9	40.1	43.9	20.4	38.1
HIV/AIDS cause swollen lids, discharge on eyelids margin and lids?	54.2	52.1	51.5	52.6	50.8	57.3	51.9	52.0
HIV/AIDS cause persistent gritty sensation in the eye?	22.9	18.0	17.8	20.8	21.2	22.0	22.2	19.9
HIV/AIDS cause itching and burning sensation in the eye?	31.3	27.6	22.6	28.8	24.1	28.0	29.6	26.0
HIV/AIDS cause good vision?	68.1	72.4	64.8	67.0	59.8	68.3	48.1	65.1
HIV/AIDS cause loss of vision?	45.2	46.5	44.1	46.2	47.0	51.2	44.4	46.0
HIV/AIDS infections cause painful eyes?	47.6	41.0	43.8	43.3	42.3	43.9	37.0	42.9
HIV/AIDS infection cause severe headache?	62.0	62.4	58.8	59.9	54.7	57.3	55.6	58.6

Table 57: Shows the correct responses of the learners for both genders in percentages (%) on the effects of HIV/AIDS on the eye.

Questions	Gender and Responses (%)			
	Male	Female	Not indicated	Total (%)
A person can get HIV by exchanging contact lenses with HIV patient?	47.8	46.1	53.8	46.9
HIV/AIDS decrease the risk of eye infection?	40.4	40.2	46.2	40.3
HIV/AIDS change colour of the eye to red?	33.3	29.7	38.5	31.4
HIV/AIDS cause cancer of the eyelids?	32.7	30.5	30.8	31.5
HIV/AIDS infections eye-lashes of HIV patient?	31.1	25.8	30.8	28.3
HIV/AIDS cause dry eye?	28.6	27.0	30.8	27.8
Cornea of HIV patient can change to white?	26.5	25.8	46.2	26.2
Tumour develop on an eyeball due HIV/AIDS	37.0	39.2	30.8	38.1
HIV/AIDS can swollen lids, discharge on eyelids margin and lids?	47.6	55.9	53.8	52.0
HIV/AIDS cause persistent gritty sensation in the eye?	21.7	18.3	30.8	19.9
HIV/AIDS cause itching and burning sensation in the eye?	28.0	24.2	38.5	26.0
HIV/AIDS cause good vision?	64.8	65.5	53.8	65.1
HIV/AIDS cause loss of vision?	46.3	45.8	53.8	46.0
Can HIV/AIDS infections cause painful eyes?	42.6	43.1	46.2	42.9
Can HIV/AIDS infection cause severe headache?	54.7	61.9	69.2	58.6
Total (%)	100.0	100.0	100.0	100.0

Table 58: Shows the correct responses of the learners in relation to their grades in percentages (%) on the effects of HIV/AIDS on the eye.

Questions	Grade and Responses (%)				
	10	11	12	Not indicated	Total (%)
A person can get HIV by exchanging contact lenses with HIV patient?	44.9	47.3	49.7	44.4	46.9
HIV/AIDS decreases the risk of eye infection?	38.6	39.4	44.8	22.2	40.3
HIV/AIDS change colour of the eye to red?	33.8	34.8	23.2	33.3	31.4
HIV/AIDS cause cancer of the eyelids?	34.0	32.0	26.9	27.8	31.5
HIV/AIDS infections eye-lashes of HIV patient?	28.5	30.3	25.6	22.2	28.3
HIV/AIDS can cause dry eye?	30.4	29.1	22.0	16.7	27.8
Cornea of HIV patient can change to white?	28.1	27.3	21.9	22.2	26.2
Tumour can develop on an eyeball due HIV/AIDS	39.9	39.5	33.1	44.4	38.1
HIV/AIDS cause swollen lids, discharge on eyelids margin and lids?	50.7	53.3	53.0	33.3	52.0
HIV/AIDS cause persistent gritty sensation in the eye?	19.7	22.3	17.3	22.2	19.9
HIV/AIDS cause itching and burning sensation in the eye?	25.8	26.3	26.0	22.2	26.0
HIV/AIDS cause good vision?	64.5	67.2	63.5	66.7	65.1
HIV/AIDS can cause loss of vision?	47.1	47.8	41.9	50.0	46.0
HIV/AIDS infections cause painful eyes?	43.3	46.0	37.9	61.1	42.9
HIV/AIDS infection cause severe headache?	51.3	61.4	66.7	61.1	58.6

4.7 OVERALL KNOWLEDGE OF THE EFFECTS OF HIV/AIDS ON THE EYE

This section evaluates the overall performance of the participating learners on the effects of HIV/AIDS on the eye. The performance of both genders in relation to their age is illustrated in Figure 5. Age was statistically significant, ($p < 0.05$). Those who were less than 16 years of age scored highest 9.50 (correct answers) and the least 8.36 (correct answers) were from those who were 19-21 years of age.

Gender effect or difference was not statistically significant, ($p > 0.05$). The average score for correct answers was 8.90 for males and 8.73 for females (Fig. 5). There was a significant interaction between school and grade ($p < 0.05$). This means that

there was no consistent pattern among the grades across the schools e.g. the results indicate that in some schools, the average scores for grade 12 does not differ to the average score for grade 11 from other schools; or the average score grade 12 score was lower than grade 11, or the average score for grade 10 was higher that of grade 11 (Table 59) (Figure 6).

The average score on the knowledge of the effects of HIV/AIDS on the eye was 41.9% (1114 learners). The overall scores of three grades in percentages for the 18 selected high schools, on the knowledge of HIV/AIDS on the eye are shown in Table 59. The average percentages for correct answers per grade are as follows: grade 10 was 40.3% and grade 11 was 43.5% and grade 12 was 42.2%. However, it was noted that the ages of the learners and their level of study did not correspond in certain cases. The interaction of school by grade on the systemic effects of HIV/AIDS is illustrated in Figure 6. The analysis of the covariance for modeling the knowledge of the effects of HIV/AIDS on the eye is shown in Table 60, all $p > 0.05$ are coloured in blue.

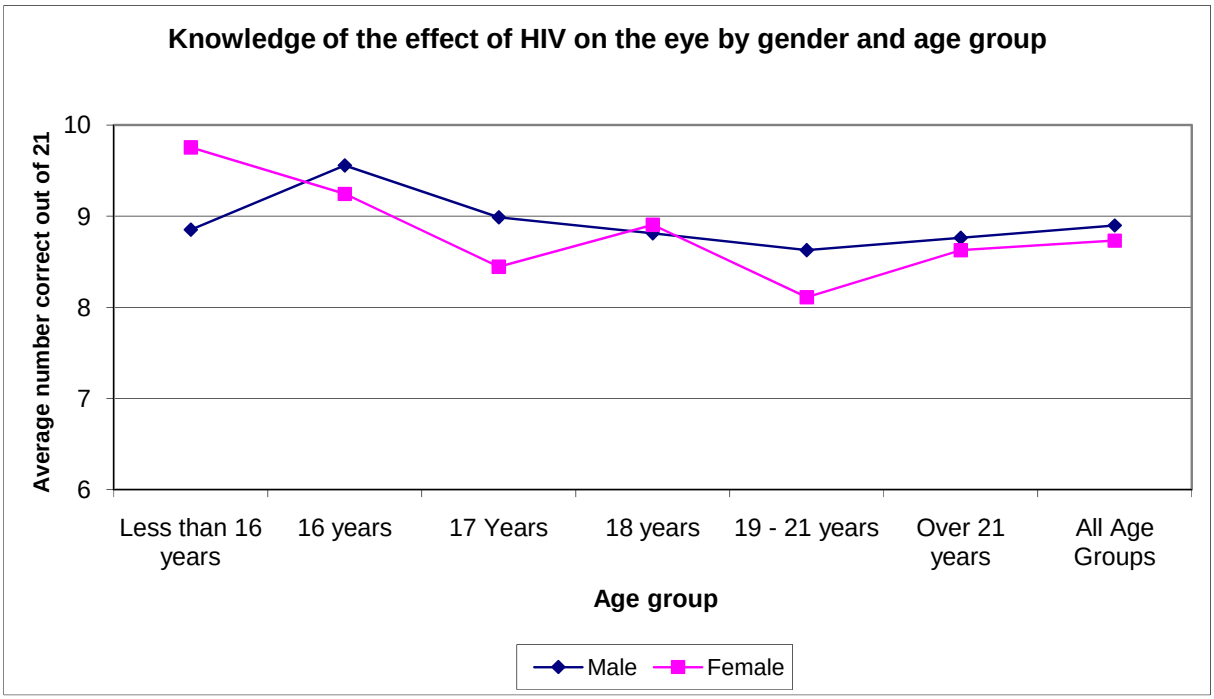

Figure 5: Illustrates the response profile of the learners for both genders in relation to their age groups on the effects of HIV/AIDS on the eye. There was no significant difference between females and males, on each age group.

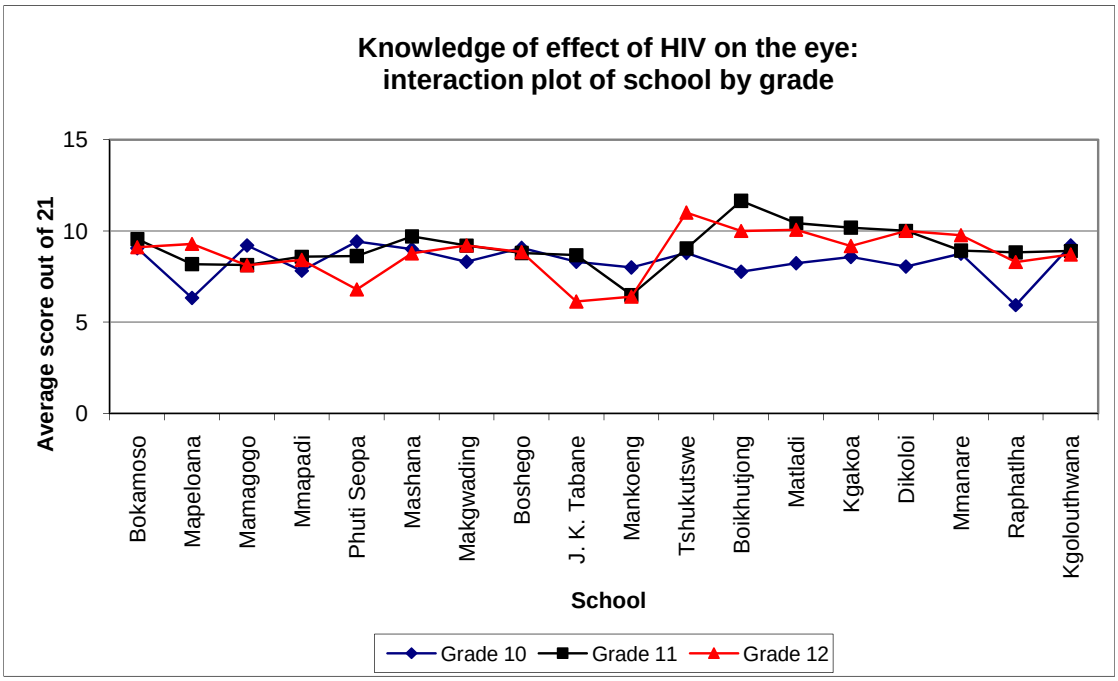

Figure 6: Illustrates the interaction of school by grade on the effects of HIV/AIDS on the eye. The difference among the grades was not uniform across the schools in terms of performance.

Table 59: Showing overall scores of three grades in percentages (%) for 18 selected high schools, on the knowledge of the effects of HIV/AIDS on the eye. Grade 11 learners from Matladi high school were highest (55.4%) and the least (28.3%) were those in grade 10 from Raphatlha high school.

Name of the School	Grade			
	10	11	12	All Grades
Matladi	39.2%	49.7%	**48.0%**	**44.8%**
Mashana	42.9%	46.2%	41.8%	44.3%
Bokamoso	43.1%	45.5%	43.4%	43.8%
Tshukutswe	41.9%	43.0%	52.4%	43.8%
Kgakoa	40.8%	48.5%	43.7%	43.8%
Boikhutjong	37.0%	**55.4%**	47.6%	43.3%
Dikoloi	38.3%	47.7%	47.6%	43.3%
Kgolouthwana	43.8%	42.4%	41.5%	42.9%
Mmanare	41.7%	42.5%	46.5%	42.9%
Boshego	43.2%	41.9%	42.1%	42.4%
Makgwading	39.6%	43.9%	43.9%	41.9%
Phuti Seopa	**44.8%**	41.0%	32.4%	40.5%
Mamagogo	43.8%	38.7%	38.7%	40.0%
Mmapadi	37.2%	41.0%	40.0%	39.0%
J. K. Tabane	39.6%	41.3%	29.2%	39.0%
Mapeloana	30.1%	39.0%	44.2%	38.1%
Raphatlha	28.3%	42.0%	39.5%	36.7%
Mankoeng	38.1%	31.0%	30.5%	34.3%
All Schools	40.3%	43.5%	42.2%	41.9%

Table 60: Showing the analysis of the covariance table for modeling the effects of HIV/AIDS on the eye. There was a significant interaction between school and grade ($p < 0.05$). $P > 0.05$, where gender was considered (no significant difference in response between males and females).

Source	Type III Sum of Squares	Degree (D) Freedom (f)	Mean Square	F-value	*p*-value
Corrected Model	3,291.245	108	30.474	2.245	0.000
Age in Years	285.075	1	285.075	20.997	0.000
School	1,058.654	17	62.274	4.587	0.000
Grade	367.207	2	183.604	13.523	0.000
Gender	25.597	1	25.597	1.885	0.170
School by Grade	1,112.428	34	32.718	2.410	0.000
School by Gender	210.437	17	12.379	0.912	0.560
Grade by Gender	40.196	2	20.098	1.480	0.228
School by Grade, by Gender	464.596	34	13.665	1.006	0.458
Error	33,521.263	2,469	13.577		
Corrected Total	36,812.508	2,577			

CHAPTER FIVE

5. DISCUSSIONS

The results of this study are discussed in this chapter. The results of the two components of the survey: basic knowledge of the HIV/AIDS and the effects of HIV/AIDS on the eye are discussed separately. The results are discussed as profiles of the study participants, knowledge on the basics of HIV/AIDS, knowledge on the effect HIV/AIDS on the eye and overall knowledge of the participants.

5.1 PROFILE OF THE PARTICIPANTS

The participants that took part in this study were 2659 high school learners in the Capricon district of the Limpopo Province (South Africa), comprised of 1234 (46.4%) females and 1412 (53.1%) males. The greater number of females in the sample seems to be a reflection of the national trend in which 52% of the population is female (STATSA, 2008).

Majority of the high schools (17) (94%) were rurally-located and one was a semi-urban high school. The proportion of the learners in the schools was relatively related to the location of the school. The schools that were closer to Polokwane (Provincial capital) had more learners compared to those which were located deep in a rural area (e.g. Bokamoso high school, Seshego which is close to Polokwane and Raphatlha high school, farther from town) (Table 1).

Generally, one would expect the ages of learners from grade 10 to 12 to be between 15 and 18 years, therefore those who were 14 years of age probably started school earlier and those who were over 18 years of age must have started school late, have repeated some classes or have taken some time off for some reasons (Table 2). It is common for learners in the high school, especially those in the rural areas to take some time off due to conditions such as pregnancy and delivery of the baby. The ages of the participants in this study was almost similar to that of the participants in the study by Peltzer and Promtussananon (2005), where the age range of the learners from grade 8 to 10 was 13 to 24 years. Grade 10 had the most (41.0%) of the participants while the least (25.0%) were in grade 12 (Fig 2).

5.2 KNOWLEDGE OF THE PARTICIPANTS ON THE BASICS OF HIV/AIDS

HIV is the acronym for Human Immunodeficiency Virus (Stephenson, 1996). This study found that 63.6% of the participants knew what the acronym HIV stands for. This value is higher than the reported findings by Lal *et al.* (2008) in Delhi (India), in which less than a fifth (19.9%) of the respondents knew what HIV stands for. This knowledge of the participants in this study might have been acquired via the outcomes-based (OBE) system of education and or the HIV/AIDS awareness campaigns (including TV, radio, news papers and magazines) in the country. With regard to age, the greatest knowledge was recorded among those less than 16 years of age in which 72.3% gave correct responses (Table 3). Many (67.8%) of those who were in grade 12 knew what the acronym HIV stands for (Table 5). There was no consistent greater knowledge with age and level of the study.

AIDS is an acronym for Acquired Immunodeficiency Syndrome (Stephenson, 1996). Again, many of the respondents (66.1%) knew what the acronym AIDS stands for. Also this value is greater than what was found in Delhi, India by Lal *et al*. (2008) where 51.4% knew the abbreviation of AIDS. A large percentage (72.3%) of those who were less than 16 years of age and many (76.2%) of those who were in grade 12 answered correctly (Table, 6 and 8). Ages and grade levels of the learners were of statistical significance in relation to knowledge ($p < 0.05$) (see Table 52). Although many knew what the acronym HIV and AIDS stood for, these findings are deemed to be unsatisfactory and disappointing because one would expect all learners to have known both acronyms; because they have seen and heard about them on TV, radio, news papers, magazines or fliers and billboards.

Unprotected sexual contact was documented as one of the three common modes of HIV transmission in 2006 by United Nations Educational, Scientific and Cultural Organization (UNESCO). The South African Department of Health took an initiative of distributing condoms all over the country, to the places where they would be easily accessible to the public at large and also educating the public on how to use them; and this was also adopted by the NGOs (that deal with HIV/AIDS awareness campaigns). This was necessary to teach the public on how to practice safe sex,

which subsequently will help in decreasing the prevalence of HIV/AIDS in the country. In the Sonagachi district of Calcutta, India, a project to empower sex workers and facilitate their access to essential information and health services lowered HIV incidence among targeted sex workers by two thirds, and increased rates of condom use from 5.0% to 90.0% (Basu *et al.*, 2004; Pardasani, 2005), indicating that education of the population can greatly change peoples attitude and reduce HIV.

In the present study, a majority (85.7%) of the learners who agreed that unprotected sex is a mode of transmission of HIV which was greater than the percentage reported by Kyryochenko *et al.* (2006) where 78% knew this mode of transmission. The findings in the present study are also higher that that reported at Delhi (India) in 2008 in which only 48.2% knew this mode of transmission (Lal *et al.*, 2008). However, inspite of the high percentage findings in the present study, one would have expected all learners to have known this mode of transmission of HIV, because the awareness campaigns emphasize the importance of the using a condom as one of the preventive method of transmission of HIV [ABC i.e. Abstinence, Being faithful, Correct and Consistent Condom use (UNAIDS, 2004)].

Schoub (1999) reported that most of mother–to-child transmissions occur at the time of delivery or during the birth process, and estimated that about 23% of transmissions occur the in uterus even as early as the first trimester of pregnancy. The National Department of Health encourages and advocates that all pregnant women should check their HIV status in order to prevent transmission of HIV from mother to the fetus through administration of antiretroviral therapy (ART) prophylaxis [e.g. zidovudine (AZT) (Retrovir®) and nevirapine (NVP) Viramune®] to a pregnant woman (Evian, 2003).

The United Nations Children's Funds (UNICEF) (2008) suggests that lack HIV testing by pregnant women may hinder the efforts to increase prevention coverage for pregnant women in need. Between 2004 and 2006 in South Africa, the coverage of the prevention of mother-to-child transmission increased from 15.0% to 67.0%

(UNAIDS, 2008b), meaning that the number of pregnant women testing for HIV has increased. Mother-to-child transmission, either during pregnancy or birth or postnatal via breast feeding, was another common mode of HIV transmission as was documented by UNESCO in 2006. The percentage of the learners (62.5%) in the present study who knew that HIV can be transmitted from the mother during pregnancy was greater than the reported findings by Magnani *et al*., 2005 in South Africa where only 6% knew this mode of HIV transmission. Also Lal *et al*. (2008) reported only a few 23.4% knew this mode of transmission. The present result could be due to the massive awareness campaign on HIV/AIDS and the integration of HIV/AIDS into the school curriculum in South Africa might. This might have influenced the results of this aspect of the present study.

The World Health Organization (WHO) (2000) reported that about 20-30% of babies who were infected through mother–to–child transmission contract the virus through breast feeding. Also De Cock *et al.* (2000) reported that with prolonged breast feeding the likelihood of HIV infection can be as high as 45.0%. Timely administration of a short course of antiretroviral drugs (ART prophylaxis) significantly reduces the risk of this HIV transmission (Guay *et al*., 1999). Hence it has been suggested that mother–to-child transmission can be prevented if the breast milk is expressed and pasteurized (Prevention of mother-to-child transmission, 2000).

Many (64.3%) of the learners in the present study agreed that a child can get HIV from the mother by breast feeding. With respect to misconceptions of how HIV/AIDS can be transmitted, majority (77.6%) of the learners knew that talking to an HIV infected person is not a mode of HIV transmission. A high percentage (81.5%) of the learners knew that hugging a person infected with HIV cannot transmit HIV. This result is less than the reported finding reported by Jaiswal *et al.* (2005) at Kathmandu Valley in Nepal, in which 93.5% knew that hugging an infected person cannot transmit HIV to another person; and when the same sample was used after a brief educational program a percentage of those who knew this increased to 98.1%. But lower level of knowledge on this aspect was observed at Ukaine by Kyrychenko *et al*. (2006). The Kathmandu Valley study indicated that a proper standardized

educational program, leads to a tremendous improvement on the public knowledge. Also a recent study in rural South Africa found that each additional year of educational attainment reduced the risk of HIV infection by 7.0% (Bärnighausen *et al.*, 2007). However, one would have expected 100% correct responses to these questions, since different modes of transmission of HIV have been clarified by HIV/AIDS awareness campaigns and also this aspect is covered by life orientation aspect of the school curriculum. Different modes of transmission were covered in the curriculum in order to alleviate the discrimination and stigmatization toward HIV infected people (e.g. a person can get HIV by living in the same dwelling with an HIV infected person).

Many countries (75.0%) have reported the existence of programmes designed to educate and raise awareness among people living with HIV of their human rights (UNGASS Country Progress Reports, 2008). Human beings are inherently social animals, and their physical and psychological health is damaged when they are isolated and cut off from their social groups (Jenkins and Sarkar, 2007). Ford *et al*. (2004); Wolfe *et al*. (2006); Ma *et al*. (2007); Pulerwitz and Barker (2008) found that HIV- related stigma and discrimination undermine HIV prevention efforts by making people reluctant to be tested for HIV, and to seek out information about how to protect themselves from infection. And in some cases, people are reluctant to use condoms for fear of being identified with the disease or with marginalized populations that are most heavily affected (Nyblade *et al.*, 2003). South African President Zuma in his address of 29th October 2009 emphasises that there should be no shame, no discriminations and no recriminations towards people living with HIV (South African Broadcasting Coporation, 2009).

The last common mode that was documented by UNESCO in 2006 was a direct contact with infected blood, most often by drug injectors using needles or syringes contaminated with minute quantities of blood containing the HIV. In Karachi, Pakistan, HIV prevalence among injecting drug users rose from less than 1.0% in early 2004 to 26.0% in March 2005 (Emmanuel *et al.*, 2006). In the present study, 64.0% of the learners agreed that sharing needles with drug users is another mode

of HIV transmission. This finding is greater than the reported finding by Magnani *et al*. (2005) in KwaZulu-Natal (South Africa) where only 33.0% knew this mode of HIV transmission. Also Lal *et al*. (2008) in Delhi (India) reported lesser finding (44.4%) of those who knew this mode of transmission. Transfusion of infected blood or blood products is one of the modes of transmission of HIV (Kengeya-Kayondo *et al*., 1995; Mulder *et al*., 1996; Hauri *et al*., 2004; Kiwanuka *et al*., 2004; Schmid *et al*., 2004). A large proportion (70.7%) of the learners in this study agreed that a person can get HIV through blood transfusion. This percentage is greater than the 31.1% reported in Delhi (India) by Lal *et al*. (2008). The proportion of the participants who got this correct, although high, is still considered unsatisfactory because blood transfusion as one of modes of HIV transmission is covered in the school curriculum and awareness campaigns. Again, the responses to these questions were considered poor and knowledge is at unacceptable level.

Window period with regard to HIV infection is the time between HIV infection and the appearance of detectable antibodies to the virus (i.e. when the antibody tests will give a positive result). This period can be from 3 weeks to 6 months. Hence people who are exposed to or who practice high-risk behavior are well advised to arrange for a repeat test after 3-6 months and to practice safer sex while waiting for their results (Van Dyk, 2005).

In the present study only two (0.1%) learners who were in grade 12 knew the definition of window period in HIV testing (Table, 30 and 32). This is lower than what was reported in another study in South Africa by Peltzer and Promtussananon (2005), where 25% or less knew what is meant by window period in HIV testing. The location of high schools in the present study might have influenced the results, because most were rurally located and only one was a semi-urban high school, while in the other study (Peltzer and Promtussananon) most (54.9%) of the participants were from urban high schools and 45.1% were from non-urban high schools. Lack of resources (e.g. library or electricity) in deep rural areas might be the cause of the poor response among the learners on this aspect.

The present study does not show an improvement in knowledge compared to what was reported in 2005 (Peltzer and Promtussananon), therefore this indicates that there is still a lack of knowledge and a high level of ignorance on this aspect. HIV/AIDS awareness campaigns emphasize that people must check their HIV status every three to six month following an initial testing in order to give allowance for the window period. One would expect these learners to know why this period is given for one to check his or her HIV status. Furthermore the VCT (Voluntary Counseling and Testing) centers and other HIV testing centers emphasize that people should come after three months starting from the day one gets his or her HIV results, especially when the results are negative.

Van Dyk (2005) describes the HIV positive result or a positive HIV antibody test as the results that indicate that an individual has been infected with HIV and is able to spread the virus through sex, blood transfusion, during pregnancy, childbirth and breast feeding. While a HIV negative result or a negative HIV antibody test indicates that no antibodies against HIV were found in the blood sample, this means either that the person has not been infected with HIV, or that he or she may have been infected but antibodies have not yet formed (due to window period).

Only about a third (33.2%) of the total participants in this study knew the difference between HIV positive and HIV negative results. These results indicate that there is unacceptable level of ignorance on this aspect of HIV/AIDS because one would expect high school learners in South Africa to know the difference between what HIV positive and HIV negative means. More so, this difference is emphasized by the voluntary counseling and testing (VCT) centers and all facilities where one can check his or her HIV status. This clearly shows that there is a need for active HIV/AIDS campaigns around the areas where the present study was carried out. It would have been of interest to know how many of these participants have had their HIV status tested. According to the South African Department of Health, in 2002, there were 474 voluntary counseling and testing (VCT) public facilities in the country and 171 of these were in Limpopo province (South African Department of Health VCT sites list, 2002).

In 2000, WHO's hope was that people who are seronegative should be motivated to use preventive measures to prevent future infection, and those who are seropositive they should learn to live positively, use care and support services at an earlier stage, learn to prevent transmission to sexual partners, and plan for their own and their families futures (WHO, 2000). Also the President of this country on world AIDS day (1 Decemder 2009) encouraged people to know their HIV status. In the present study, although a vast majority (85.9%) of the learners agreed that it is important for one to know his or her HIV status (Table 36), this proportion is till unsatisfactory because one would have expected all learners to know that this is important. Further, only a small percentage (5.6%) of the learners knew the reason for why one should know his or her HIV status (Table 39). This indicates lack of knowledge and a high level of ignorance on this aspect. Awareness campaigns and school curriculum emphasize that it is important for one to know his or her HIV status.

There are several signs and symptoms of HIV infection. According to Schoub (1997) a seroconversion illness or a primary HIV infection phase is characterized by symptoms sush as sore throat, headache, mild fatigue, swelling of the lymph nodes, gastrointestinal symptoms, rash and (occasionally) oral ulcers and is often mistaken for flu–like viral infection. Wilson and Walker (2001) reported that generally these symptoms occur within 2 to 6 weeks following infection, and the lesions generally resolve spontaneously within 15 days of the onset. Many (61.2%) of the learners in the present study agreed that a person can live many years before showing any sign of developing any physical changes of HIV/AIDS (Table 42). These findings are more than the reported findings by Dadkha *et al.* (2008) in Ardabil, Iran in which 34% of the respondents knew that an infected person can remain healthy for a long period of time, without showing any signs of infection. The difference in knowledge may be due to the educational level in South Africa and the awareness campaigns in the country.

Only about half (50.4%) of the respondents disagreed that the effect of HIV on the body is bleeding nose and ears (Table 42). Also, just over half of the learners (54.9%) agreed that the first effect of HIV on the body is to suppress the immune

system (Table 42). These findings show a serious lack of relevant knowledge which may improperly classify a person with bleeding nose as being HIV infected. These suggest a need for serious awareness campaigns on HIV/AIDS.

Coker and Miller (1997) and UNAIDS (2000) estimated that 50% or more of HIV positive people in Africa are co-infected with TB, and the greatest impact of HIV on TB has been in sub-Saharan Africa where up to 70% of TB patients are also infected with HIV (UNAIDS, 2004). Also Williams and Maher (2007) reported that HIV infection increases the risk of tuberculosis, and in countries such as South Africa, it is not surprising that even full implementation of the directly observed therapy, short-course (DOTS) strategy is unable to reduce the tuberculosis incidence more quickly because HIV drives it upwards. Wood *et al*. (2007) suggested that the epidemic of tuberculosis in HIV-positive people also fuels tuberculosis in those who are HIV-negative, and slower progress of tuberculosis in HIV-positive people meaning that intensified case-finding is an important addition to the DOTS strategy for tuberculosis control, even where the prevalence of HIV is high.

Unfortunately, 46.0% of the learners in the present study disagreed that due to HIV infection and a depressed immune system, HIV patients develop TB (Table 42), which is of great concern. A study by Edhonu-Elyetu (1997) in Botswana found that the most common symptoms in individual who tested HIV positive on the ELISA (enzyme-linked immunosorbent assay) test were weight loss (47.0%), persistent cough (30.0%), prolonged fever (23.0%), chronic diarrhea (21.0%), TB (16.%), herpes zoster (13.0%), and oral candidiasis (11.0%).

On symptoms of HIV, many (60.2%) of the learners in the present study agreed that HIV/AIDS could cause continuous diarrhea (Table 42). This value is higher than the reported finding by Singh *et al.* (2005) at Chitwan District (Nepal), in which only 41.2% knew diarrhea as a symptom for HIV/AIDS. This better knowledge about this aspect among South African respondents could be due to the information that awareness campaigns imparted to the nation and the integration of HIV/AIDS into the school curriculum. However, only less than a third (29.9%) of respondents in

this study agreed that HIV/AIDS could cause continuous nausea, indicating a poor knowledge on this aspect (Table 42). Also, only half (50.1%) of the learners agreed that HIV/AIDS could cause continuous vomiting (Table 42). Many (62.3%) of the learners knew that HIV/AIDS could not cause continuous weight gain (Table 42). All these suggest a need for education in these areas.

A person with immune suppression due to HIV infection are at a risk of developing cancer and most notably virus-related cancers are Kaposi's sarcoma, non-Hodgkin's lymphoma and anogenital carcinomas [due to human papillomavirus (HPV)] (Engels *et al.*, 2006 and Frisch *et al.*, 2001). Only 47.0% of the learners agreed that HIV/AIDS could cause skin cancer to HIV patients and (39.9%) agreed that HIV/AIDS could cause pneumonia (Table 42). All these suggest a need for education in these areas. Also, only 49.0% of learners agreed that headache can be a symptom when the HIV status of a person changes from negative to positive (Table 45). Also a small percentage (38.6%) of the learners agreed that sore throat could be a symptom when the HIV status of a person changes from negative to positive (Table 45). This knowledge level is considered poor for the high school learners.

In terms of hair colour a few (26.4%) knew that hair colour does not change to grey when the HIV status of a person changes from negative to positive (Table 45). However, 73.0% of the learners agreed that tiredness could be a symptom when the HIV status of a person changes from negative to positive (Table 45). Many (60.8%) of the learners agreed that rash could be a symptom when the status of a person changes from negative to positive (Table 45). About the same proportion (59.5%) of the learners agreed that pain in the joints could be a sign when the HIV status of a person changes from negative to positive (Table 45). Further, many (63.5%) of the learners disagreed that weight gain can be a symptom when HIV status of a person changes from negative to positive (Table 45). Considering the high prevalence of HIV/AIDS in the country, one would have expected greater knowledge in this area.

Testing for HIV can be done in the following places: (1) in the offices of the General medical practitioners, (2) a local health department, (3) hospital, (4) family planning clinics, (5) sites specifically set up for HIV testing (e.g. New start or Love life in South Africa) and (6) in some communities home-based; always testing should be done where counseling is provided (UNAIDS, 2008a). Just half (51.0%) of the learners knew that one can check his or her HIV status at their family medical practitioner (Table 48). However, an overwhelming proportion (93.4%) of the respondents of the learners knew that one can check his or her HIV status at the hospital (Table 48). One would have expected more of the learners to know that, just as with other health conditions, the family medical practitioner has enough knowledge to deal with HIV/AIDS diagnosis whether directly or indirectly.

It is however, not surprising that a vast majority (93.4%) knew that this could be done at the hospital level because, hospital is the most common place for health issues in rural areas. Also, lack or shortage of general or family medical practitioners in rural areas might have influenced the result.

Only a few (34.2%) knew that one can check his or her HIV status at the family general practitioner and also at the hospital (Table 48). This finding is a manifestation the poor knowledge of the learners on the role of the family general practitioner with regard to HIV/AIDS tests. Many (66.3%) of the learners knew that one cannot check his or her HIV status at the traditional healer (Table 48). This findings is encouraging as a majority of those in the rural areas consult the traditional healers for most of their ailments, and also a series of studies found that many South African patients consult traditional healers as a first effort to remedy various ailments (Louw and Pretorius, 1995; Peltzer, 2000). Also, a large proportion (78.1%) of the learners knew that one cannot check his or her HIV status at school (Table 48). These results are considered impressive because many learners knew that traditional healer have no means of testing a person for HIV.

5.3 KNOWLEDGE OF THE EFFECTS OF HIV/AIDS ON THE EYE

Numerous reports (Jabs and Quinn, 1996) have described the spectrum and natural history of HIV-associated eye disorders, which affect 70-80% of all patients at some point during their illness. Only a few (27.8%) respondents in this study knew that HIV/AIDS infection does affect the eye (see Table 42). For symptoms of HIV/AIDS on the eye a patient, can seek eye care from (1) a general medical practitioner, (2) an optometrist (eventually will refer the patient to an ophthalmologist or general practitioner if necessary) and (3) an ophthalmologist.

Many (65.6%) of the participants correctly reported that an eye specialist or optometrist could be consulted for signs and symptoms in the eye that are related to HIV/AIDS (Table 53). Just about half (50.6%) of the learners knew that an ear specialist could not be consulted for signs and symptoms in the eye that are related to HIV/AIDS (Table 53). Also, Just over half (56.9%) of the learners knew that a traditional healer could not be consulted for signs and symptoms in the eye that are related to HIV/AIDS (Table 53). Also, a larger proportion (71.6%) of the learners disagreed that the school principal should be consulted for signs and symptoms in the eye that are related to HIV/AIDS. All of the above responses are shown in Table 53.

These results are impressive because more than 50.0% had knowledge on who to consult for ocular complications of HIV/AIDS although this information was not included in the school curriculum and HIV/AIDS awareness campaigns. Although the rate of correct responses on these aspects can be considered poor, this is expected as both the curriculum and the HIV/AIDS awareness campaigns do not include eye and eye care issues. It is therefore recommended that this should be included in awareness campaigns.

According to Cano-Parra *et al.* (1999) both tears and soft contact lenses are potential sources of HIV infection, but Centers for Disease Control (CDC) has excluded tears from all body fluids that are classified as potentially infectious,

because the quantity of virus found in tears of HIV patient is considered small and would be unlikely to serve as an inoculum to spread the disease.

According to the study by Amin *et al*. (1991) most of the lens care regimens tested were capable of achieving at least a 10 log reduction in infectious HIV-1 on the contaminated soft lens. These results suggest that when performed properly, the routine cleaning and disinfecting of contact lenses would virtually eliminate any chance of the lens serving as a vector for HIV-1 transmission. Only a few (46.9%) of the learners in this study reported that a person could not be infected with HIV by exchanging contact lenses (Table 56). Since adolescents are engaged in very risk behaviors (exchanging coloured contact lenses), it is necessary for both the awareness campaign and school curriculum to emphasis the need for proper contact lens care regimens for all contact lens wearers.

Also only a minority (40.3%) of the learners knew that HIV/AIDS cannot decrease the risk of eye infections (Table 56). Even though the proportion of those who gave the correct answer here was relatively low, it is impressive because, neither the school curriculum nor the HIV/AIDS awareness campaigns touches this area of HIV/AIDS education. A patient infected with HIV may complain of photophobia and red eye, which may be due to iridocyclitis (Lima, 2004), and according to Sarraf and Ernest (1996) a thorough ocular examination is required in order to rule out anterior or posterior segment infections. A small proportion (31.4%) of the learners agreed that HIV/AIDS related infections can change the colour of the white part of the eye of an HIV patient to red.

Kaposi's sarcoma is a highly vascularized, painless mesenchymal tumor affecting the skin and mucous membrane that appears as multiple purple-to-red nodules in up to 25% of HIV-positive patients (Tschachler *et al.*, 1996), and can affect the eyelid or conjunctiva (Dugel *et al.*, 1990b). Conjunctival squamous cell dysplasia and neoplasia have been associated with HIV infection and AIDS (Bhatia, 2002) and Fogla *et al.* (2000) reported the development of conjunctival dysplasia on the nasal side and squamous cell carcinoma on the temporal bulbar conjunctiva.

According to Wiafe (2003), herpes zoster ophthalmicus can cause blepharitis, and this can lead to secondary bacterial infection of the eyelids, eyelids scarring, marginal notching, loss of eyelashes, trichiases and cicatricial entropion. Only a small proportion (31.5%) of the learners in this study agreed that HIV/AIDS related infections can cause cancer of the eyelids, even a lesser proportion (28.3%) agreed that HIV/AIDS related infections can affect eye-lashes of the HIV patients (Table 56).

Some of HIV-infected and AIDS patients complain of a chronic, mildly irritated "red eye"that is resistant to treatment (allergic conjunctivitis), also AIDS patients with microsporidal conjunctivitis (infection caused by an obligate, intracellular protozoan parasite of the phylum microspora (Didier *et al*., 1991) complain of tearing, photophobia, foreign body sensation and redness (Chronister, 1996). Only a small proportion (38.1%) agreed that tumours can develop on an eye ball due to HIV/AIDS related diseases (Table 56); just over half (52.0%) of the participating learners agreed that HIV/AIDS infection can cause swollen lids, discharge on eyelids margins and lids, while only a few (19.9%) of the learners agreed that HIV/AIDS could cause a persistent gritty (sandy) sensation in the eye (Table 56). Again, in spite of the poor performance in these aspects, the correct responses are considered impressive due to the fact that the learners might not have directly received information from their schools and non-governmental organization about the ocular manifestation of HIV/AIDS.

Patients with HIV diseases have been shown to have symptoms with clinical signs of dry eye (keratoconjunctivitis sicca) (Chronister, 1996), which is probably related to HIV-mediated inflammation and destruction of the primary and secondary lacrimal glands (Cunningham and Margolis, 1998). Only a few (27.8%) of the learners in this study agreed that HIV/AIDS related infections can cause dry eye (Table 56). Also 26.0% of the learners agreed that HIV/AIDS can cause itching and burning sensation in the eye (Table 56). Corneal infection (infectious keratitis) can result in permanent blindness and this occurs in less than 5% of HIV-infected patients (Akduman and Pepose, 1995). Herpes zoster ophthalmicus (HZO) can involve the

corneal epithelium or stromal and occur in approximately 20% of HIV patients (Margolis *et al*, 1998). According to Pavan-Langston (2002) corneal complications occur in approximately 65% of cases with herpes zoster ophthalmicus and this can result in significant visual loss (Wiafe, 2003). Because corneal involvement is common and complex with HZO, ranging from mold epithelial involvement to complete opacification and even melting of the entire cornea with perforation and loss of the eye (Kenstelyn, 2001). Only a few learners (26.2%) in the present study agreed that the cornea of an HIV patient can change from transparent colour to white due to HIV related infections (Table 56).

HIV/AIDS has the potential to be associated with serious eye infections, some of which may lead to blindness (Kenstelyn and Cunningham, 2001). Ocular disease which affect both eyes include cytomegalovirus retinitis (CMV), HIV retinopathy, ocular syphilis, ocular tuberculosis, cryptococcal meningitis but herpes zoater ophthalmicus, ocular toxoplasmosis, Kaposi'sarcoma of the adnexae and conjunctival neoplasias affect one eye (Kenstelyn and Cunningham, 2001). Before effective treatment e.g. HAART, cytomegalovirus (CMV) retinitis was associated with devastating visual loss from retinal necrosis and retinal detachment, as well as significant mortality (Holbrook *et al.*, 2003; Ballinger, 1995) and CMV retinitis occurs in 90% of immune-compromised HIV-positive population (Bowen *et al.*, 1996). Also, patients who experience immune reconstitution with HAART are at risk for immune recovery uveitis (IRU), an inflammatory condition that can cause vision loss in the eyes with CMV retinitis (Karavellas *et al.,* 1998 and Robinson *et al.*, 2000).

HIV-associated retinal microvasculopathy is typically asymptomatic and transient but may play a part in progressive optic-nerve atrophy, with loss of colour vision, contrast sensitivity and visual field defects (Mueller *et al.*, 1997). Delays in the diagnosis of uveitis in patients with syphilis can lead to irreversible loss of vision (Ross *et al.*, 1994). Also, Non Hodgkin's lymphomas can cause cortical visual loss (Vrabec, 2004). Many (65.1%) of the learners in the present study correctly disagreed that HIV/AIDS can enhance vision, while less than half (46.0%) agreed that HIV/AIDS can cause visual impairment (blindness) (Table 56). The difference in

the percentages for the correct responses in these two questions might be because learners were guessing since this information is not included in the school curriculum and the awareness campaigns.

Herpes zoster ophthalmicus affects the ophthalmic distribution of the trigeminal nerve (Karbassi *et al.*, 1992) and causes a severe pain (Cunningham and Margolis, 1998). Characteristic prodomal symptoms of herpes zoster ophthalmicus include headache, generalized malaise and fever (Wang *et al.*, 2000). Also headache is one of the common initial symptoms of central nervous system toxoplasmosis (Kenstelyn, 2001). In this study, less than half (42.9%) of the learners agreed that HIV/AIDS-related infections can cause painful eyes and over half (58.6%) of the learners agreed that HIV/AIDS-related infection can cause severe headache (Table 56). These levels of responses are low and are considered to be as a result of lack of information in those aspects.

5.4 THE OVERALL PERFORMANCE OF THE PARTICIPANTS ON HIV/AIDS

This present study found that there was a fairly good general knowledge of HIV/AIDS but certain important aspects of HIV/AIDS which one would have expected the learners to know were not known. For instance, as shown in Table 30 only two learners (0.1%) from the total population sample knew the meaning of window period. However, knowledge of the ocular effects of HIV/AIDS was generally poor.

The relative better performance on the general knowledge compared to the knowledge on the eye could be due to the implementation of outcomes-based system of education (OBE) in 1998, as curriculum 2005 (launched in 1997), and also the HIV/AIDS awareness campaigns in the country. Outcomes-based system of education (OBE) curriculum includes life skills and life orientation subjects which include information on HIV/AIDS. Since HIV/AIDS education has been integrated into the school curriculum, one would expect a good general knowledge, therefore the performance of the learners was considered unsatisfactory. The ocular aspect of HIV/AIDS was not included under HIV/AIDS in the school curriculum and also the

awareness campaigns on HIV/AIDS do not contain information on the ocular manifestations. These might be reasons for the poor performance of the learners on the knowledge of ocular effect of HIV/AIDS.

Gender did not have much influence on the findings for both components of the survey (basic knowledge of the HIV/AIDS and basic knowledge of the effects of HIV/AIDS on the eye) ($p > 0.05$) (Fig. 3 and 5; Table, 52 and 60) suggesting that the females did not have better knowledge than males and vice versa.

Ages of the learners and grade of study had statistically significant effect on the knowledge in both the general and ocular components in certain aspects ($p < 0.05$) (Fig. 3 and 5). However, age was inversely related with the general knowledge of HIV/AIDS and the knowledge of the effect of HIV/AIDS on the eye. The young (16 years) learners seemed to have more knowledge than the older (age) ones, and this agrees with the findings by Peltzer and Promtussananon (2005) who reported that young learners were more knowledgeable than the older ones. A possible explanation is that the young learners obtained the knowledge from the OBE curriculum or have more interest in the aspect than the older learners. Many of the older ones may not have taken part in the OBE curriculum. For most components of the survey there was no consistent pattern on the knowledge of the learners in relation to their ages and grades of study. (see Table, 51 and 59; Fig. 4 and 6).

5.5 RECOMMENDATIONS

The following recommendations will be made:

i. There is a need for greater awareness campaigns on HIV/AIDS in the rural areas of South Africa, as many of the respondents in the present study were from the rural areas.

ii. It is recommended that ocular effects of HIV/AIDS be integrated into the HIV/AIDS awareness campaigns in the form of peer education programs, television programs, radio programs, newspapers, magazines and billboard.

Mahat *et al*. (2008) showed a significant improvement in knowledge of HIV/AIDS on peer education programs for the grade nine learners. Media should provide a slot for HIV/AIDS programs; by so doing the information about HIV/AIDS will reach the society easier and quickly.

iii. General information on HIV/AIDS has been integrated into secondary and primary schools (UNAIDS 2008b). There is a need for integration of basic ocular effect of HIV/AIDS into the school curriculum as early as primary school level.

iv. Training of primary school and high school educators who are teaching the subjects on HIV/AIDS should be expanded to include information about the eyes.

v. Introduction of the continuing education units CEU (measure used in the continuing education programs monitoring) by South African council for educators (SACE) and South African Department of Education is necessary in order to keep educators up to date with the knowledge of HIV/AIDS.

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7. APPENDICES:

7.1 APPENDIX A

Questionnaire	

KNOWLEDGE OF BASICS AND OCULAR MANIFESTATIONS OF HIV/AIDS AMONG HIGH SCHOOL LEARNERS IN THE CAPRICORN DISTRICT OF THE LIMPOPO PROVINCE, SOUTH AFRICA.

Dear Student,

This survey is being conducted in the various high schools in the Capricorn district of the Limpopo Province of South Africa, to establish the basic knowledge of high school learners regarding the effects of HIV/AIDS on the eye.

Please, complete the questionnaire sincerely and to the best of your knowledge. Mark your answer with a cross (X) in the box on the right side of the table or complete as directed.

SECTION A				
1	Name of your school:			
2	Location of school:	Urban	Semi-urban	Rural
3	Age (years) last birthday			
4	Gender:	Male	Female	
5	Race:	Black	White	Asian	Coloured
6.	Level of study: Grade	10	11	12

SECTION B

HIV stands for:
8. AIDS stands for:

9. By which of the following methods can a person get HIV?

9.1 Unprotected sex.	Yes	No	don't know
9.2 Mother to a child during pregnancy.	Yes	No	don't know
9.3 Talking to an HIV infected person.	Yes	No	don't know
9.4 Mother to a child by breast feeding.	Yes	No	don't know
9.5 Sharing needle by drug users.	Yes	No	don't know
9.6 Blood transfusion.	Yes	No	don't know
9.7 Hugging a person infected with HIV.	Yes	No	don't know

10. Can a patient live many years before showing any signs or developing any physical changes of HIV/AIDS?

Yes	No	don't know

11. The first effect of HIV on the body is

11.1 Bleeding nose and ears.	Yes	No	don't know
11.2 Suppresses the immune system.	Yes	No	don't know

12. Where can one go to check his or her HIV status?

12.1 Family medical practitioner.	Yes	No	don't know
12.2 Hospital.	Yes	No	don't know
12.3 Only 12.1 and 12.2.	Yes	No	don't know
12.4 Traditional Healer.	Yes	No	don't know
12.5 At School.	Yes	No	don't know
12.6 All of the above.	Yes	No	don't know

13. What is meant by the window period in HIV testing?

14. What is the difference between HIV positive & negative results?

15. Is it important to know your HIV status?

Yes	No	don't know

If yes, Why?

16. When the HIV status of person changes from negative to positive, will he or she have these symptoms & signs:

	Yes	No	don't know
16.1 headaches.			
16.2 sore throat.			
16.3 hair colour changes to grey.			
16.4 tiredness.			
16.5 rash.			
16.6 pain in the joints.			
16.7 weight gain.			

17. Due to HIV infection & depressed immune system, HIV patient cannot develop tuberculosis (TB).

T	F	don't know

18. HIV/AIDS can cause continuous

18.1 diarrhoea.	T	F	don't know
18.2 nausea.	T	F	don't know
18.3 vomiting.	T	F	don't know
18.4 weight gain.	T	F	don't know

19. HIV/AIDS can cause skin cancers to HIV patients?

T	F	don't know

20. HIV/AIDS can cause pneumonia?

T	F	don't know

SECTION C

21. Does HIV/AIDS affect the eyes?

Yes	No	don't know

22. Who should be consulted for signs or symptoms in the eye that are related to HIV/AIDS?

22.1 Eye specialist/Optometrist.	Yes	No	don't know
22.2 Ear specialist.	Yes	No	don't know
22.3 Traditional healer.	Yes	No	don't know
22.4 School principal.	Yes	No	don't know
22.5 Both 22.1 and 22.2	Yes	No	Don't know

23. Can a person be infected with HIV by exchanging contact lenses with HIV infected patient?

Yes	No	don't know

24. Can HIV/AIDS infection decrease the risk of eye infections?

Yes	No	don't know

25. Can HIV/AIDS related infections change the colour of the white part of the eye of an HIV patient to red?

Yes	No	don't know

26. Can HIV/AIDS related infections cause cancer of the eyelids?

Yes	No	don't know

27. Can HIV/AIDS related infections affect eye-lashes of HIV patient?

Yes	No	don't know

28. Can HIV/AIDS related infections cause dry eyes?

Yes	No	don't know

29. Cornea of HIV patient can change from transparent colour to white due to HIV related infections?

Yes	No	don't know

30. Tumour (cancer) can develop on an eye ball due HIV/AIDS related diseases?

Yes	No	don't know

31. HIV/AIDS infection cause swollen lids, discharge on eyelids margin and lids?

Yes	No	don't know

32. Can HIV/AIDS cause a persistent gritty (sandy) sensation in the eye?

Yes	No	don't know

33. Can HIV/AIDS cause an itching and burning sensation in the eye?

Yes	No	don't know

34. Can HIV/AIDS infection cause good vision?

Yes	No	don't know

35. HIV/AIDS can cause loss of vision (blindness)?

Yes	No	don't know

36. Can HIV/AIDS related infections cause painful eyes?

Yes	No	don't know

37. Can HIV/AIDS-related infection cause severe headache?

Yes	No	don't know

THANK YOU

7.2 APPENDIX B

APPLICATION FORM FOR PROPOSED RESEARCH PROJECT UNIVERSITY OF LIMPOPO

MEDUNSA CAMPUS RESEARCH ETHICS COMMITTEE

A. PARTICULARS OF APPLICANT/CHIEF RESEARCHER

Title: **Ms** First name: **Irene** Surname: **Melwa**

Department: Optometry Tel: **0823328391**

School: Health Sciences

B. DETAILS OF RESEARCH PROJECT
(Tick appropriate block(s) with a 'x'

1.a	New project		or : Continuation of project	
1.b	Independent research :		or : Contract research:	
	Post-graduate research:	**x**	or : Undergraduate research :	

Degree (specify) Masters degree in Optometry

At which university is the degree registered? **University of Limpopo, Turfloop Campus**

2. a. Title of project: Knowledge of basics of HIV/AIDS and its ocular manifestations among high learners in Capricorn district of the Limpopo Province, South Africa.

b. Co-workers (Not for post-graduate research. See Guidelines)

Name	Department/Institution	Signature
Not applicable (N/A)		

Research Co-ordinator (In the case of independent or contract research)

Name	Department/Institution	Signature
Not applicable (N/A)		

d. Supervisor (In the case of post-graduate research)

Name	Department/Institution	Signature
Prof AO Oduntan	Optometry, University of Limpopo (Turfloop Campus)	

e. Co-supervisor (In the case of post-graduate research)

Name	Department/Institution	Signature
None		

Hospital Superintendent/Health Care Manager

Name	Department/Institution	Signature

N/A		

g. Other involved departmental heads

Name	Department/Institution	Signature
N/A		

C. SPECIAL REQUIREMENTS

Will the research involve the following?

	Yes	No		Yes	No
Experimental animals		X	Approval from Animal ethics Committee attached (separate application form required)		
Special apparatus		**X**	Is it available at Medunsa?		
Special drugs (medicaments)		**X**	Explanation of who will supply the drugs attached		
Radio isotopes		**X**	Completed radio Isotopes form attached (Appendix 4)		
Special laboratory facilities		**X**	Is it available at Medunsa? If no, attach a statement of requirements		
Electron microscopy		**X**	Completed Electron microscope form attached (Appendix 3)		
Health care services		**X**	Signature of health care manager attached		

Statistical analysis	**X**		Has a statistician been consulted? If yes, attach form. (Appendix D) If no explain.	**X**	

D. ETHICAL ISSUES

1. Indemnity

If a hospital (human, dental or veterinary) will be involved, please attach the written approval of the Superintendent. Should the use of the service laboratories be required, attached a letter of consent of the hospital management that this is in order.

2. Consent

Learners will form part of the survey. Appendix C is an attached university of the Limpopo consent form.

E. BUDGET

Who will finance this project? (Tick appropriate block with a "x")

University of Limpopo (Medunsa Campus)		Health Department		Self	**X**	Other (specify)	

Please indicate the institutions where application has been made for financial support or where it is intended to apply for financial support.

MRC		NRF		CSD		Other (specify)	

NB: Approval of the research project does **NOT** imply that the requested funds will be made available to the applicant.

G. DECLARATION BY RESEARCHER(S)

Should this project be approved, I fully understand the conditions under which I am authorized to carry out the above-mentioned research. I guarantee to ensure compliance with these approved conditions. Furthermore, I undertake **not to change the procedure as detailed in the protocol but will submit a further application to the Research Committee if changes become necessary**

SIGNATURE: _____ DATE: _____

CHIEF RESEARCHER:

SIGNATURE: _____DATE:_____

HEAD OF DEPARTMENT

SIGNATURE: _____DATE:_____

DIRECTOR OF SCHOOL

7.3 APPENDIX C

UNIVERSITY OF LIMPOPO CONSENT FORM

Statement concerning participation in a Research Project.

Name of Project: **Knowledge of basics and ocular manifestations of HIV/AIDS among high school learners in the Capricorn district of the Limpopo Province, South Africa.**

I have read the information on the aims and objectives of the proposed study and was provided the opportunity to ask questions and given adequate time to rethink the issue. The aim and objectives of the study are sufficiently clear to me. I have not been pressurized in any way to allow my child to participate in the study.

I understand that participation in this Project is completely voluntary and that my child may withdraw from it at any time and without supplying reasons.

I know that this Project has been approved by the Research, Ethics and Publications of Faculty Committee of Medicine, University of Limpopo. I am fully aware that the results of this Project will be used for scientific purposes and may be published. I agree to this, provided my privacy is guaranteed.

I hereby give consent to participate in this Project.

Name of learner.....

Signature of parent or guardian……
Signature of the child……

Place. Date. Witness

_____

_____

Statement by the Researcher

I provided verbal and written information regarding this Project

I agree to answer any future questions concerning the Project as best as I am able.

I will adhere to the approved protocol.

....

.....

Name of Researcher Signature Date

Place

7.4 APPENDIX D

STATISTICAL ANALYSES

The Chairperson,
Medunsa Campus Research Ethics Committee
Box 163
UNIVERSITY OF LIMPOPO
Medunsa Campus

Dear Sir/Madam

STATISTICAL ANALYSES

I have studied the research protocol of

_____

titled:

_____

and I agree/do not agree * to assist with the statistical analyses.

Yours sincerely,

_____

Signature: Statistician

_____

Name in block letters

_____

Date

* Please delete which is not applicable. If you do not agree to assist with the statistical analyses, please provide reasons on a separate sheet.

7.5 APPENDIX E

LETTER TO THE PARENT OR GUARDIAN

Date:……..

Dear Parent/ Guardian,

A research project is being conducted in high schools in the Limpopo Province of South Africa. The title of the project is: **Knowledge of basics and ocular manifestations of HIV/AIDS among high school learners in the Capricorn district, Limpopo Province**. The aim of the study is to establish the basic knowledge of the effects of HIV/AIDS on the eye among high school learners in the Capricorn district of the Limpopo Province. The objective is to collect data which can be used to establish the learner's knowledge on the effects of HIV/AIDS on the eye. Findings will enable us to recommend awareness campaign on the effects of HIV/AIDS on the eye.

Your child has been identified as one of those who will take part in the project. He/ she will be required to complete a questionnaire on HIV/AIDS and its effects on the eye.

The purpose of this letter is to seek your permission for your child to take part in the study. If you agree, please read the consent form carefully and sign. Your signature confirms your agreement that your child can participate in the study. Your child is also required to append his/her signature below yours to confirm that he/she assents to completion of the questionnaire. For any question regarding this research project, please contact me on my cell phone number 0823328391.

Your assistance in this regard will be highly appreciated.

Yours faithfully

Ms I.T Melwa