



Acknowledgement

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List of abbreviations

<i>AIDS</i>	<i>Acquired Immune Deficiency Syndrome</i>
<i>ART</i>	<i>Antiretroviral Therapy or Treatment</i>
<i>ARV</i>	<i>Antiretroviral</i>
<i>BCM</i>	<i>Body Cell Mass</i>
<i>CDC</i>	<i>Center for Disease Control</i>
<i>CMV</i>	<i>Cytomengalo virus</i>
<i>CSA</i>	<i>Central Statistics Agency</i>
<i>DOTS</i>	<i>Directly Observed Therapy Short Course</i>
<i>EDHS</i>	<i>Ethiopian Demographic and Health Survey</i>
<i>ELISA</i>	<i>Enzyme Linked Immune Sorbent Assay</i>
<i>EPHI</i>	<i>Ethiopian Public Health Institute</i>
<i>FDA</i>	<i>Food and Drug Administration</i>
<i>FGAE</i>	<i>Family Guidance Association of Ethiopia</i>
<i>FHAPCO</i>	<i>Federal HIV/AIDS Prevention and Control Office</i>
<i>FMOH</i>	<i>Federal Ministry of Health</i>
<i>GI</i>	<i>Gastro Intestinal</i>
<i>HAPCO</i>	<i>HIV/AIDS Prevention and Control Office</i>
<i>HAART</i>	<i>Highly Active Antiretroviral Therapy</i>
<i>HBC</i>	<i>Home Based Care</i>
<i>HCT</i>	<i>HIV Counseling and Testing</i>
<i>HIV</i>	<i>Human Immunodeficiency Virus</i>
<i>HSV</i>	<i>Herpes simplex virus</i>
<i>IEC</i>	<i>Information Education Communication</i>
<i>IGAs</i>	<i>Income Generating Activities</i>

<i>KS</i>	<i>Kaposi's Sarcoma</i>
<i>LTR</i>	<i>Long Terminal Repeats</i>
<i>MAC</i>	<i>Mycobacterium avium complex</i>
<i>MTCT</i>	<i>Mother to child transmission</i>
<i>MSM</i>	<i>Men who have sex with men</i>
<i>NAAT</i>	<i>Nucleic Acid Amplification Testing</i>
<i>NGO</i>	<i>Non Governmental Organization</i>
<i>NHL</i>	<i>Non Hodgkin's Lymphoma</i>
<i>nPEP</i>	<i>Non occupational Exposure Prophylaxes</i>
<i>NIAID</i>	<i>National Institute of Allergy and Infectious Diseases</i>
<i>OIs</i>	<i>Opportunistic Infections</i>
<i>OVC</i>	<i>Orphans and Vulnerable Children</i>
<i>PCP</i>	<i>Pneumocystis Carinii Pneumonia</i>
<i>PIHCT</i>	<i>Personally Initiated HIV/AIDS Counseling and Testing</i>
<i>PLWHA</i>	<i>People Living With HIV and AIDS</i>
<i>PMTCT</i>	<i>Prevention of mother to child transmission</i>
<i>SSA</i>	<i>Sub Saharan Africa</i>
<i>STI</i>	<i>Sexually Transmitted Infections</i>
<i>TB</i>	<i>Tuberculosis</i>
<i>UNAID</i>	<i>United Nations Agency for International Development</i>
<i>UNAIDS</i>	<i>Joint United Nations Program on HIV/AIDS</i>
<i>VCT</i>	<i>Voluntary Counseling and Testing</i>
<i>WHO</i>	<i>World Health Organization</i>
<i>ZFN</i>	<i>Zinc Finger Nucleases</i>

Abstract

The aim of this study was to assess the HIV prevalence rate of the selected hospitals and health centers in Arsi zone, Oromiya region, Ethiopia. Out of the 25 woredas found in the zone, 14 of them (56%) were selected by purposive or convenience sampling method. 17 Health institutions, three Hospitals (out of the five Hospitals found in the zone) and fourteen Health centers were used for sampling. All the data was collected by tally method from the “Voluntary Counseling and Testing Registration Log Book” and from the “monthly reporting format” of the health institutions taken as a sample and analyzed using SPSS version 20. A total number of 269,398 individuals were tested for HIV in 14 woredas of the zone (Asella, Tiyo, Digelu and Tijo, Lemu and Bilbilo, Robe, Lode Hetosa, Dodota, Diksis, Jeju, Shirka, Ziway Dugda, Munesa, Hetosa and Sire). A 10 (ten) years annual clinical data record from Asella Hospital, 3 years annual clinical data record from Rehoboth hospital, 8 years annual clinical data record from the Family Guidance Association of Ethiopia (FGAE) - Asella branch clinic and a one to nine years data from each of the other 13 woredas was collected to show the average annual HIV prevalence rate in the areas. The assessment of the retrospective clinical data record showed HIV/AIDS to be about 1.74% average annual prevalence. The data record also showed that HIV prevalence decreased from 11.14% in 2006 to 1.74% as compared to that of 2015. Furthermore, HIV prevalence among sexes showed 2.75% of the HIV positive individuals were females and 1.79% was males. According to the study, 38.94% of the HIV positive individuals were males and 61.06% were females. The data also showed that the disease is more prevalent in the age groups of 15-49 years of age. Furthermore, the recent decrease in the prevalence of the disease seems to be promising but there is still a need to further enhance disclosure and condom use and using different mechanisms like mass health education and face to face counseling and the need to take the control of the disease more seriously in the community.

Keywords: - AIDS, Arsi zone, HIV, prevalence, woreda

INTRODUCTION

1. Background of the study

HIV, the virus that causes AIDS “Acquired immune deficiency syndrome” has become one of the most serious health and development challenges (*UNAIDS,2013a*).The first cases of AIDS were reported in the United States in 1981. Since that time it has spread all over the world with devastating impacts on the quality of life of people. Nowadays, HIV/AIDS has become the world’s most serious development crises (*Reid, E., 1992*). As to WHO acknowledge conservative estimates, the HIV infection is increasing exponentially and the global rate of new HIV infection seems to be doubling every 12 to 18 months (*FMOE, 2003*).

1.1 The Global HIV/AIDS Epidemic

HIV/AIDS is a global problem and infects people all over the world, but certain regions have much higher infection rates. HIV/AIDS related deaths have climbed over 20 million lives over recent decades, and an estimated 40 million people are living with the virus around the world (*Manjula et al., 2007*).

No part of the world is spared from HIV/AIDS epidemic. Currently, around 35 million people are living with the virus which killed tens of millions of people since the beginning of the epidemic (*UNAIDS 2012a, 2013b and www.avert.org.hiv-around-world*).

HIV continues to be a major global public health issue. Since 2000, 38.1 million people become infected with HIV and 25.3 million people have died of AIDS related illnesses. In 2014, an estimated 36.9 million people were living with HIV (including 2.6 million children) –a global HIV prevalence rate of 0.8 %. The vast majorities of this number live in low and middle income countries (*HAPCO, 2014*).

While new cases have been reported in all regions of the world, 95% of new infections occurs in individuals that reside in low and middle income countries particularly in the sub Saharan African (*UNAIDS, 2013b*). Sub Saharan Africa (SSA), with only 10% of the total world population, is carrying the burden of 80 percent of the world’s HIV infection and AIDS cases (*FMOH, 2005*). Most people living with HIV or at risk of HIV do not have access to prevention, care, and treatment, and there is still no cure (*WHO/UNAIDS/ UNICEF, 2013*).

HIV not only affects the health of individuals, its impact is also manifested on the house hold, communities, development and economic growth of nations. Many of the countries hardest hit by HIV also suffer from other infectious disease, food insecurity, and other problems. HIV primarily affects those in their most productive years; about half of new infections are among under the age of 25 (*UNAIDS, 2013b*). In 2013, 35.5 million people were living with HIV worldwide including 3.3 million children. The global prevalence rate (the percent of people aged 15-49 who are infected) has leveled since 2001 and was 0.8% in 2012. 1.6 million People died of

AIDS in the same year, a 30% decrease since 2005. Still there were about 2.3 million new infections in 2012 or more than 6,300 new infections per day. Deaths have declined due to in part anti- retroviral treatment (ART) scale up. HIV is the leading cause of death worldwide and the number one cause of death in Africa (*UNAIDS, 2012a, 2013b*).

Table 1. HIV prevalence and incidence by region

Region	Total number (%) Living with HIV.	Newly infected	Adult Prevalence Rate
Global total	35.3 million (100%)	2.3 million	0.8%
Sub Saharan Africa	25.0 million (71%)	1.6 million	4.7%
South/south-east Asia	4.0 million (11%)	270,000	0.3%
Latin America	1.5 million (4%)	86,000	0.4%
Eastern Europe/central Asia	1.3 million (4%)	130,000	0.7%
East Asia	880,000 (2%)	81,000	<0.1%
Western/Central Europe	860,000 (2%)	29,000	0.2%
Middle East/North Africa	260,000 (0.7%)	32,000	0.1%
Caribbean	250,000 (0.7%)	12,000	1%
Oceania	51,000 (0.1%)	2,100	0.2%
North America	1.3 million (4%)	48,000	0.5%

(Source: *Fact sheet, October 2013b*)

According to the UNAIDS report on the global AIDS epidemic, 2013b, HIV is a leading cause of death among women of reproductive age. Gender inequalities, differential access to service, and sexual violence increase woman's vulnerability to HIV and women, especially younger women, are biologically more susceptible to HIV. Younger people aged 15-24 account for approximately 39% of new HIV infections.

Since the beginning of the epidemic more than 75 million people have been infected with HIV; approximately 36 million people have died of AIDS related illness. It is estimated that each day 6,300 individuals worldwide are infected with HIV (*UNAIDS, 2013b*). Although the testing capacity has increased overtime, the majority of people with HIV are still unaware that they are infected. As the majority of people infected with HIV are unaware of their status, it is reasonable to expect that there may be significant cases of under-reporting and inaccuracies in certain listed statistics. Estimates may vary widely between sources or between years as old information is discarded and new information is acquired.

1.2. HIV/AIDS epidemic in Africa

The HIV pandemic created unprecedented burden on the economies and health care systems of affected countries, particularly in the Sub-Saharan Africa, where prevalence is highest. Sub-Saharan Africa (SSA), the hardest hit region, is home to 71% of people living with HIV but only about 12 % of the world's population (*UNAIDS 2013a*). 88% of the world's children with HIV live in this region, where the epidemic has orphaned more than 14 million children. Almost all the region's nations have a generalized HIV epidemic, that is, their national prevalence rate is greater than 1%.

This region continues to be the most affected by HIV. More than two third (70 percent/25 million) of all People Living with HIV/AIDS (PLWHA) live in Sub Saharan Africa-including 88 percent of the world's HIV children. An estimated 1.6 million people in the region became newly infected and an estimated 1.2 million adults and children died of AIDS, accounting for 75 percent of the world's AIDS deaths in 2012.

Women comprise 59% of PLWHA in this region. In eight countries, 10% or more of adults are estimated to be HIV positive. South Africa has the highest number of PLWHA in the world (4.3 million). Swaziland has the highest prevalence rate in the world (24.8%). Recent data offer promising signs, with national HIV prevalence and/or incidence stabilizing or even declining in many countries in the region. Many of the countries hardest hit by HIV also suffer from other serious issues, for example, infectious diseases, poverty, and food insecurity (*UNAIDS, 2013c*).

1.3. HIV/AIDS in Ethiopia

Ethiopia is one of the Sub-Saharan African countries hard hit by HIV/AIDS. In Ethiopia, the first confirmed case of HIV were detected in 1984 and the first hospitalized AIDS patients were reported in 1986 (*Lister, F.T., 1988*). Initially the epidemic was localized in urban areas, along with the major commercial routs among certain occupational groups. By 1988, high rates of HIV prevalence (17%) were detected among the main trading roads and distance truck drivers (13%) were detected. Since then the epidemic has expanded throughout the country into rural areas, especially in areas along road sides (*FMOH, 2008*).

It is estimated that in 2014, a total of 0.72 million [0.56-0.99 million] were living with HIV in Ethiopia. The HIV estimates shows that the region of Oromia has the largest HIV population living with 204,000[150,400 – 293,600]. In 2014, the three regions of Ethiopia (Oromia, Amhara and Addis Ababa) accounted for close to 70% of the people living with HIV in Ethiopia (*Ethiopian Public Health Institute, EPHI, 2015*).

Table 2: Estimated number of people living with HIV in 2014

Region	HIV Adults + Children			HIV Adults (15+)			HIV Children (0-14)		
	Estimate	Low	High	Estimate	Low	High	Estimate	Low	High
ADDIS ABABA	116800	96900	154000	110800	91800	146800	6000	5200	6900
AFFAR	11400	8000	18500	9900	6900	16200	1500	1000	2100
AMHARA	181500	147300	231000	158500	128600	202400	23100	18700	28500
BENISHAN GUL GUMZ	5100	3700	7700	4400	3100	6700	700	600	1000
DIRE DAWA	9700	7300	13300	8700	6600	12100	900	700	1200
GAMBELA	14500	11000	18100	12300	9400	15400	2200	1600	2800
HARARI	4700	3100	6200	4200	2700	5600	500	400	600
OROMIA	204000	150400	293600	172300	127300	250900	31700	23600	40100
SNNP	88700	69100	119300	78000	60400	105200	10700	8500	13800
SOMALI	31100	18700	49900	27100	16300	43500	4000	2400	6200
TIGRAY	56900	43400	77000	49400	37700	67100	7400	5700	9600
National Total	724400	558900	988600	635600	490800	871900	88700	68400	112800

(Source: The Ethiopian Public Health Institute, 2015).

Gender inequality, poverty, and harmful socio-cultural norms such as widow inheritance, pre-marital and extra-marital sex were cited as major vulnerability factors that drive the epidemic. Major risk factors to HIV infection also include: multiple sexual partnership, early initiation of sex, low condom use and intergenerational and transactional sex. Mobility of people, especially of young people to large scale development schemes such as mechanized farms, construction of dams and transportation routes and factories were becoming hotspots with the potential of creating massive epidemic and causing further spread to the general population (HAPCO, 2014). Age is another important demographic variable which has its effect on the prevalence of HIV epidemic. The prevalence of the epidemic is not the same in different age groups. Some groups are more vulnerable to the epidemic than others. In the context of Ethiopia, for women, HIV prevalence peaks at age 30-34. For men, the HIV prevalence peaks at age 35-39 (Central Statistical Agency, 2011). According to 2005 Ethiopian Demographic and Health Survey (EDHS) report, the HIV prevalence among adults age 15-49 was 1.4 percent. In parallel to this approximately 60 percent of new HIV infection affects the young age group globally (Da Ros and Da Silva Schmitt, 2008).

Similar studies have revealed much higher levels of infection among girls than boys. This is due to the fact that at young age, boys have sex with girls of similar age, whereas girls have sexual relations with older men, who are more likely to be infected (Hallett, et al., 2007). Poverty drives many girls to have sex with ‘sugar daddies’. On the other hand, a study conducted by S Afr, 2007 reveals that, the occurrence of HIV among females peaked in the 20-29 year age group at a level

six times higher than the incidence found in 20-29 year old males. In the age group 15-24 years, females contribute 90 percent HIV infections. Not using a condom among youth and widowed were the socio behavioral factors attributable to the highest HIV infection rates. Parallel to the above study (*Fontanet, et al., 1998*) conducted a study on age and sex specific HIV prevalence in the urban community setting of Addis Ababa, Ethiopia showed that the HIV prevalence by age and sex specific is significant. The result of *Fontanet, et al.*, showed that a total of 3,853 individuals were included in the analysis and the prevalence of HIV in adults was 6.0 percent for men and 6.9 percent for women. In this study the highest prevalence was observed in the 25-29 years age group. Moreover, a big difference in HIV prevalence rate was observed among men and women at the age 15-24 years, where women are four times more likely infected with HIV than men.

One of the crucial determinants on the prevalence of HIV epidemic is socio-economic factors. Poverty is one of the socio-economic variables, which has an effect on the spread of the epidemic through different channels, including migration of people from one place to another (urban to rural or rural to urban), limited media exposure, access to health education, nutrition, sexual exploitation and gender inequality (*Casale & Whiteside, 2006*). There is strong negative association between HIV and poverty at regional level in Africa (*Bloom, et al., 2002*). On the other hand, different scholars have hypothesized that high HIV prevalence is a result of poverty especially in Sub-Saharan Africa societies (*Gillies, et al., 1996*).

A study conducted by *Bradley, et al., 2007*, on educational attainment and HIV status among Ethiopian voluntary counseling and testing clients in order to examine the association between HIV infection and education attainment level among VCT clients showed that HIV prevalence decreases significantly with each increase in education level for both men and women.

People migration from rural to urban is more pronounced in the least developed countries. Different scholars revealed a high STD incidence and a high rate of HIV transmission in urban areas compared to rural areas. The reason for this could be long working hours exercised in urban areas and the fact that individuals are isolated from their family. According to *Vylder & Stefan, 1993*, high HIV infection rates are exhibited in urban areas, but the transmission of the epidemic is today frequent among the poor, hence increasingly also in rural areas.

World Bank in 2004 reported that AIDS now exists in all regions of Ethiopia. By 2003, HIV had infected about 1.5 million people in the country and 96,000 of them were children (*AIDS in Ethiopia, fifth edition, 2004 [draft]*). The number of AIDS cases in this year was estimated at 98,000 and 25,000 among adults and children respectively. The national adult prevalence of HIV infection was estimated at 4.4%, urban 12.6% and rural 2.6% (*FMOH, 2005*). According to the calibrated single point estimate, from 2005 sentinel surveillance and the Ethiopian Demographic

and Health Survey (*EDHS, 2005*) data, prevalence of adult infection is 2.1% (urban 7.7% and rural 0.9%).

In Ethiopia, the total number of people who have died due to HIV/AIDS in 2006 alone was 88,997 and in 2007, it is estimated that 71,902 people will die. In this year, there are an estimated 898,350 children who will have lost one or both parents by the epidemic (AIDS orphans) (*FMOH, 2007*).

According to the study results from HAPCO (*January, 2014*), HIV prevalence level shows a drastic fall in Ethiopia. There is a stable low HIV prevalence of 0.6% in rural areas but substantial decline from 7.7% to 4.2% in urban areas (*www.hapco.gov.et*). The HIV/AIDS Prevention and Control Office (HAPCO) said that adult HIV prevalence level has fallen from 2.1% in 2011 to 1.3% in 2013 owing to the sound strategic plans designed and implemented over the years, strong leadership commitment and program ownership.

Anti retroviral treatment (ART) coverage reached 62.3%, which is above the sub-Saharan Africa (SSA) regional coverage (53%). However prevention of mother to child (MTC) transmission of HIV coverage was only 9.3%. Out of the 14,000 HIV-positive births in 2010, only 34% received prophylaxes in the same year. In addition, major programs were implemented for care and support of orphans and vulnerable children (OVC) these consisted of education programs, food and shelter, and guidance and that there are about 3000 health institutions at national level that provide HIV/AIDS counseling and testing services and 2044 health centers across the nation which give services for the prevention of mother to child transmission of HIV. There are 897 sites that provide anti-HIV/AIDS treatment services. During 2005 budget year close to 11 (eleven) million people have received HIV/AIDS counseling and treatment services. Close to 300,000 patients have received drugs for HIV/AIDS and other related diseases. The MOH is introducing new equipment and training professionals to identify and provide new medicines to those who have been on ART for a long time and who might have developed training on income generating activities (*MOH, 2010*).

Several key informants also agreed that the focus should be on economic strengthening and empowerment of PLWHA and their families through the creation of income generation projects, provision of vocational training, and support for those who discontinue school, or support at workplace so that they will be competitive and productive. Trend analysis of national prevalence rate from 1989-2000 show a continual gradual rise and then a steady decline in the years after 2000 from 6.6 in 2001 to 2.3 in 2010 (*MOH, 2010*). HIV prevalence was higher among women (1.9%) than men (0.9%). With regard to sex differences HIV prevalence level rises with age both for men and women. HIV prevalence is higher in urban (5.5%) than in rural population (0.7%) (*CSA, 2005*).

Furthermore, the 2005 Ethiopian Demographic & Health Survey (EDHS) came up with wide variations in the HIV prevalence across regions. Highest prevalence rates were reported in Gambella (6%) and Addis Ababa (4.7%) (CSA, 2005).

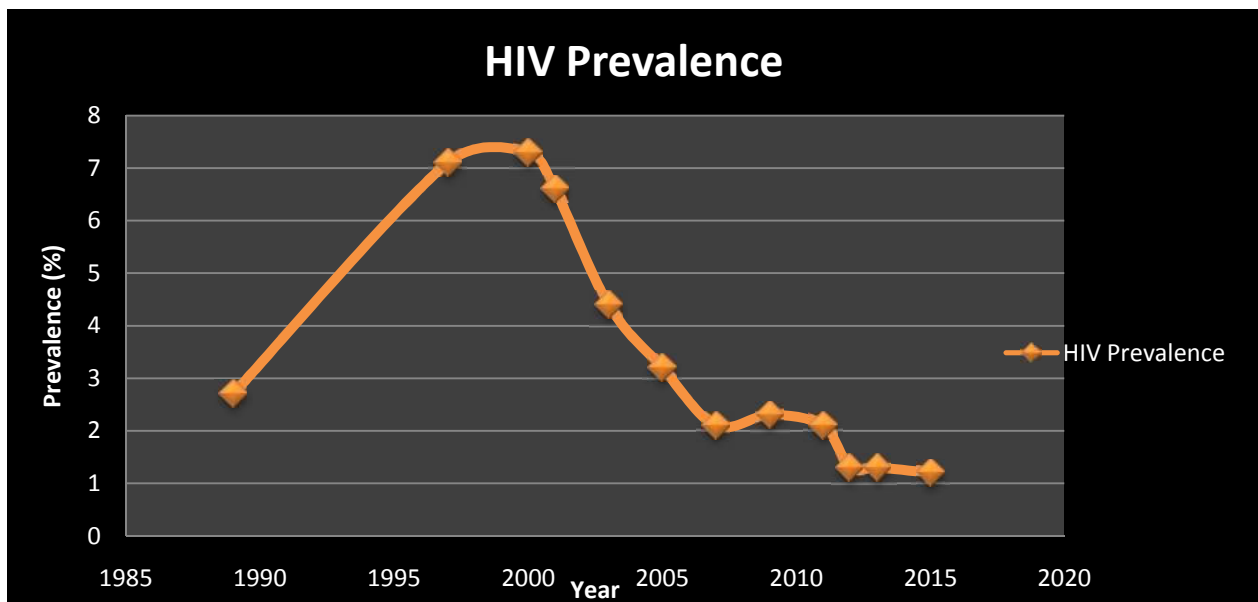
The trends of HIV prevalence in the adult population of the country from 1989 to 2015 is indicated in table 3 and figure 1.

Table 3 Trends of HIV prevalence in the adult population of Ethiopia (1989-2015).

Y EAR	HIV prevalence
1989	2.7
1997	7.1
2000	7.3
2001	6.6
2003	4.4
2005	3.2
2007	2.1
2009	2.3
2011	2.1
2012	1.3
2013	1.3
2015	1.2

(Source: Guideline to Implement HIV and AIDS Policy and Strategy in the Education Sector, January 2010 and HAPCO, 2014).

Figure 1 Trends of HIV prevalence in the adult population of Ethiopia.



1.4. Projections for the main HIV estimates

A projection for the main HIV estimates from 2015 to 2019 for each region as well as over all national estimates is indicated in table 4.

Table 4 Major HIV Indicators, Ethiopia

Ethiopia	2015	2016	2017	2018	2019
HIV-pos population (All Ages)					
Total	741,478	748,933	757,917	766,399	775,733
Males	291,414	293,962	297,000	299,561	302,397
Females	450,064	454,971	460,917	466,838	473,336
New HIV infections (All Ages)					
Total	24,050	21,567	21,378	21,330	21,397
Males	9,395	8,373	8,299	8,274	8,296
Females	14,655	13,194	13,079	13,056	13,101
Annual AIDS deaths (All Ages)					
Total	16,865	12,978	10,928	9,553	8,554
Males	6,850	5,454	4,731	4,278	3,928
Females	10,015	7,524	6,197	5,275	4,626
ART needs (All Ages)					
Total	636,556	646,880	660,301	674,073	687,055

Adult 15+ years

Adult Prevalence (15+years) in percent	1.22%	1.20%	1.19%	1.17%	1.16%
HIV Positive Population					
Total	657,261	670,099	683,282	697,019	711,218
Males	248,487	253,671	258,768	263,930	269,184
Females	408,774	416,428	424,514	433,089	442,034

(Sourceh: The Ethiopian Public Health Institute. HIV Related Estimates and Projections for Ethiopia, 2015).

Note: - HIV prevalence is calculated by dividing the total population of adults aged 15+ living with HIV by the total population aged 15+ for a given year.

2. Literature Review

HIV/AIDS is one of the most destructive diseases humankind has ever faced. It brings with it profound social, economic and public health consequences. Human immune deficiency virus (HIV) infection is a chronic viral infection, that, when untreated, causes a progressive destruction of the immune system resulting in AIDS (*FMOH, 2005*).

The key component of the immune deficiency associated with untreated HIV replication is a marked reduction in cluster of differentiation (CD4) T-cells. AIDS is the presence of HIV infection with a CD4 cell count less than 200 cells /mm³ and /or it is defined as the presence of an AIDS defining clinical condition, which includes any number of opportunistic infections, malignancies or other clinical syndromes as defined by the Centers for Disease Control and prevention (*CDC, 1992*). Because of the immune deficiency status, the person is vulnerable to other opportunistic infections (OIs). Opportunistic infections include: Pneumonia, recurrent infection of the skin, mouth and throat, other skin diseases, unexplained fever, meningitis, cancers such as Kaposi's sarcoma and chronic diarrhea with weight loss (*WHO, 1993*).

2.1. Common Opportunistic Infections

HIV causes progressive depletion of the CD4 T-cells resulting in conditions known as Opportunistic Infections and Malignancies. Opportunistic Infections (OIs) are the predominant causes of morbidity and mortality among HIV infected patients. Main areas affected are the nervous system, gastrointestinal and respiratory systems, and the skin. The level of immunity determines the occurrence and type of opportunistic infections. In general, minor infections such as Herpes zoster and other skin infections, occur early. Whereas life threatening infections such as CNS toxoplasmosis and cryptococcal meningitis occur later with severe immunity. Some life threatening infections such as pneumonia and TB may occur early as well as later. When TB occurs later, it is typical, more disseminated and more extra pulmonary (*Daniel, EMJ, 2002*). Concurrent infections and non infectious conditions such as diabetes, hypertension and bronchial asthma, sometimes occur with OIs. Non opportunistic pathogens such as *M.tuberculosis*, *Entamoeba histolitica* or *Strongloids stercoralis*, etc are frequent and recurrent among patients with HIV disease (*HAPCO, 2007*).

2.1.1. Opportunistic Infections of the Respiratory System

Patients with HIV infection are vulnerable to respiratory diseases from early to advanced stage of AIDS. Upper respiratory tract and lower respiratory tract infections are common but lower respiratory tract infections are life-threatening. Upper respiratory tract infections include pharyngitis (inflammation of pharyngeal mucosa), tonsillitis, rhinitis, sinusitis, and otitis media (inflammation of the middle ear). They occur relatively early, before advanced immune deficiency develops (*FMOH, 2007*).

Symptoms related to upper respiratory tract diseases include nasal discharge, sneezing, facial pain, stridor and tracheal pain. The common organisms are *streptococcus pneumonia*, *staphylococcus aureus* or *H.influenza*. *Candida albicans* is also a recognized cause of pharyngitis (FMOH, 2007).

Diseases of the lower respiratory tract infections include TB, bacterial pneumonia, and PCP (*Pneumocystis Carinii Pneumonia*).The principal symptoms of respiratory diseases include cough, sputum production, chest pain, dyspnea (labored or difficulty in breathing due to pulmonary diseases, vigorous physical activity, anemia or cardiac disease), wheezing and haemoptysis (the coughing up of blood) but it is difficult to differentiate these by history and physical examination alone. Typical mycobacterium infections among HIV infected individuals are uncommon in Ethiopia. In one study only two cases of *Mycobacterium avium complex* (MAC) were reported among patients with pulmonary TB and HIV infection in Ethiopia (FMOH, 2007).

2.1.2. Gastrointestinal Opportunistic Infections

The gastrointestinal (GI) mucosa is uniquely susceptible to human immunodeficiency virus (HIV)-1 infection (Nelson et al, 1988). Experimental results show that there is a significant and preferential depletion of mucosal CD4 T-cells compared with the peripheral blood CD4 T-cells during primary HIV-1 infection (The Rockefeller University Press, 2004). The gastrointestinal mucosa harbors the majority of the body's lymphocytes compared with the peripheral blood, which contains only 2-5% of all lymphocytes (Cerf-Ben Sussan N, et al., 1991).

In addition to representing the largest lymphoid organ, certain characteristics of the mucosal compartment render it extremely permissive to HIV-1 replication. Compared with circulating lymphocytes, a greater percentage of these mucosal CD4 lymphocytes express the CCR-5, chemokine co-receptor (Veazey, R.S, et al., 2000).

Due to its proximity to the external environment and of food and microbial antigens, a predominant number of GI mucosal CD4 T-cell are activated (Kim, S.K., et al, 1997). The GI mucosa is also maintained in a state of physiological inflammation characterized by a high percentage of pro-inflammatory, HIV-1 stimulatory cytokines (McGowan, I.M., 2004).

Gastrointestinal and hepatobiliary disorders are among the most frequent complaints in patients with HIV disease. Advances in antiretroviral therapy are changing the nature of HIV disease and affecting many of the gastrointestinal manifestations. Before combination antiretroviral therapy, the best estimates suggested that 50 to 93% of all patients with HIV disease had marked GI symptoms during the course of their illness (Malenbranche R, et al., 1983).

Gastrointestinal (GI) manifestations of HIV disease include diarrhea, dysphagia (difficulty in swallowing), and odynophagia (pain full swallowing), nausea, vomiting, weight loss, abdominal pain, anorexial disease, jaundice and hepatomegaly (enlargement of liver), GI bleeding,

interactions of HIV and hepatotropic viruses, and GI tumors (Kaposi's sarcoma and non-Hodgkin's lymphoma) (Gazzard BG, 1988; Raufman, 1988). The evaluation of specific gastrointestinal complaints must be based on an assessment of the degree of immune suppression. Progressive immune compromise is associated with increasing prevalence of GI symptoms (May GR, et al., 1993) and remains the common endpoint for most individuals infected with HIV.

2.1.2.1. Diarrhea

Diarrhea is the most common GI symptom in patients with HIV. In outpatient studies, the prevalence of diarrhea ranged from 0.9 to 14% (Wilcox CM, et al., 1996). Prevalence was increased in homosexual men and individuals with lower CD4 cell counts. In hospitalized individuals with advanced HIV, 50% of all patients had diarrhea (Dworkin B, et al., 1985). Furthermore, there is considerable geographic variation in the frequency of diarrhea and the spectrum of enteric pathogens.

Some pathogens, like *Mycobacterium avium*-complex (MAC), are unique to HIV disease. Others, like *Cryptosporidium*, cause self-limited diarrheal illness in healthy hosts but chronic diarrhea in immune suppressed patients (Janoff EN, and Smith PD, 1988). The degree of immunodeficiency as expressed by the CD4 cell count is an important determinant of enteric pathogens. *Mycobacterium Avium Complex* (MAC) and *Cytomengalo Virus* (CMV) infections are not observed in patients with CD4 cell count $> 100/\text{mm}^3$ (Gallant JE, et al., 1992).

In patients with "early" HIV disease, medications are a common cause of diarrhea, especially protease inhibitors, including Nelfinavir and Saquinavir. The diarrhea is often self-limited, lasting less than 2 to 4 weeks from initiation of medication use. Chronic/uncontrollable diarrhea, however, does occur in spite of improved CD4 cell count and decreased viral load. Other etiologies of diarrhea include idiopathic colitis, enteropathogenic *Escherichia coli*, and small bowel bacterial overgrowth (Steuerwald MH, et al., 1997). Intestinal disturbances common in patients with HIV, including gastric hypoacidity, impaired intestinal immunity, or impaired intestinal motility are known to predispose to bacterial overgrowth (Valdovinos M.A et al., 1993, Pgnata C, et al., 1990).

Reported evidence suggests that HIV itself may be an indirect diarrheal pathogen because viral proteins have been found in the gut. HIV has been identified in histologic specimens from the GI tract tissue in up to 40% of patients. (Ullrich, R and Fox CH, 1989; Nelson JA, et al., 1988). Symptoms of cramps, bloating, and nausea suggest gastric or small-bowel involvement, or both, raising the possibility of infection with *Cryptosporidium*, *Microsporidium*, *Isospora belli*, or *Giardia* organisms. Hematochezia (passage of bloody stool) and tenesmus (ineffectual pain full effort in bladder and bowel evacuation) imply large-bowel inflammation resulting from CMV, *Shigella*, *Campylobacter*, or *Clostridium difficile* infections. Tenesmus can occur as a result of herpes, *Shigella*, or *Campylobacter* infections. Enteric HIV infection may lead to mucosal

atrophy (decrease in size of tissue or wasting), which in turn impairs small-bowel absorption, causing diarrhea and weight loss. (Ulrich R, et al., 1992; Reicken, et al., 1990).

2.1.2.2. Weight loss

In the setting of progressive weight loss, death is inevitable once body weight falls below roughly 66% of ideal body weight (Kotler DP, et al., 1989). Weight loss above 5 to 10% from usual weight predicts mortality, independent of CD4 count (Gilbert C, 1995). Body cell mass (BCM), the metabolically active body component, is an earlier and more specific predictor of mortality (Kotler DP, et al., 1989).

Caloric deficit is one cause of weight loss that may be due to odynophagia, dysphagia, anorexia (loss of appetite), altered sense of taste, early satiety, nausea, vomiting, diarrhea, fever, fatigue, apathy and/or depression. Pharmacologic side effects, opportunistic infections that result in lesions in the mouth or esophagus, and mal-absorption of nutrients can be the underlying causes of reported symptoms (Casey K, et al., 1997). To prevent weight loss and malnutrition, protein requirements should be at least 1.0 to 1.2 g/kg in the absence of secondary infection (Babameto G and Kotler DP, 1997). Appetite stimulants are often effective in treating anorexia, a major cause of involuntary weight loss.

2.1.2.3. Dysphagia and odynophagia

Dysphagia (difficulty in deglutition, can be due to spasm of pharyngoesophageal musculature, stricture, neoplasm, paralysis), odynophagia, or both, due to esophagitis are very common among patients with advanced HIV disease. Both were recognized as prominent symptoms in early reports of HIV disease (Masur H, et al., 1981).

The majority of patients with dysphagia or odynophagia have candidal esophagitis alone or in association with other infectious pathogens, (Laine L. et al., 1992, Wilcox CM, et al., 1996) including *cytomegalovirus* (CMV), *herpes simplex virus* (HSV), idiopathic (nonspecific) ulceration, and *Mycobacterium avium-intracellulare*. Malignancies, such as Kaposi's sarcoma (KS) and lymphoma, and non-HIV-related disorders, such as acid-reflux esophagitis, can also occur. Heartburn and regurgitation are usually indicative of esophageal reflux disease. As with infections in other parts of the intestinal tract, the CD4 count can be used to direct the evaluation. *Candida* and Herpes simplex virus (HSV) esophagitis are predominantly identified in patients with CD4 cell count less than 200 cells/mm³. CMV and idiopathic ulcers are noted almost exclusively below a CD4 cell count of 100 cells/mm³.

2.1.2.4. Abdominal Pain

Abdominal pain is common in patients with HIV infection, and it may portend a catastrophic complication. Infectious enteritis may lead to dull, intermittent abdominal pain in the absence of obstruction.

This is particularly true of infection by *Cryptosporidium* and *Mycobacterium avium-intracellulare complex* (MAC) but may also occur in infections from other protozoa, as well as from enteric bacteria including *Salmonella*, *Shigella*, and *Campylobacter* (Ullrich R, et al., 1992).

2.1.3. Dermatologic manifestations in HIV disease

2.1.3.1. Epidemiology of skin diseases in HIV/AIDS

Skin disorders are commonly encountered in HIV-infected patients, and they may be the first manifestation of HIV disease. Up to 90% of HIV-infected persons suffer from skin diseases during their course of illness (Pennys, 1995). In a local cross-sectional study of 186 HIV positive patients, 175 (94%) suffered from one or more cutaneous disorders (Ho KM, et al., 2001). The most common skin disorder identified was fungal infection, followed by eczema and seborrhoeic dermatitis. The spectrum of skin disorders depends on: (a) Immunologic stage, as reflected by CD4 count, (b) Concurrent use of HAART, (c) Pattern of endemic infections.

In general, declining immunity is associated with increased number and severity of skin disorders (Raju PV, et al., 2005). Skin lesions are more likely to have unusual appearance in advanced HIV infection.

The advent of HAART has changed the spectrum of skin disorders by improving host immunity, which in turn reduces the occurrence of Kaposi's sarcoma and some of the skin infections (Chen TM, and Cockerell CJ. 2003). However, the restoration of immunity may cause flare-up of herpes zoster (Ward HA, et al., 2002). HIV-infected patients are more likely than the general population to suffer from adverse drug reactions. HAART, with no exception, carries the risk in causing muco cutaneous adverse reactions (Kong HH, and Myers SA., 2005).

One of the commonly encountered problems in HAART era is the protease inhibitor (PI)-induced lipodystrophy which is characterized by loss of buccal fat, thinning of extremities and buttocks, central adiposity ("crix-belly"), dorsocervical fat pad ("buffalo hump") and gynaecomastia (abnormally large mammary tissue in male often secreting milk).

According to Chen TM. and Cockerell CJ. (2003), Skin diseases are rarely life-threatening, but many of them are life-ruining. While the life span is prolonged by the use of HAART, many HIV-infected patients are troubled by drug-induced facial lipoatrophy. Not only can there be cosmetic disfigurement, the intense pruritus (itching) due to eosinophilic folliculitis may severely impair the patients' quality-of-life. Therefore, management of these apparently minor conditions should not be overlooked. In most cases, treatment modality of skin diseases in HIV-positive ends a catastrophic complication.

2.1.3.2. Kaposi's sarcoma

Kaposi's sarcoma (KS) has been the most common neoplasm associated with HIV infection affecting predominantly homosexual men. Between 1987 and 1994, the prevalence has declined from 55% to 5% in the United States (*Franceschi S, et al., 1997*).

GI involvement by KS is frequent in patients with advanced HIV disease. Most clinical series probably underestimate the overall incidence of luminal GI involvement with KS, since intestinal lesions rarely lead to symptoms. In a prospective endoscopic evaluation of 50 homosexual men with AIDS and KS of the skin or lymph node, 20 patients (40%) had evidence of gastrointestinal KS within the range of the flexible sigmoidoscope or upper endoscope (*Freidman S, et al., 1985*).

GI Kaposi's Sarcoma is often widely disseminated yet rarely leads to symptoms. KS lesions are usually small and multiple but may occasionally be bulky masses. (*Freidman S, et al., 1985*). Several autopsy series have failed to demonstrate a single instance of death due primarily to a GI KS lesion (*Mobley K. et al., 1985*).

Rare clinical consequences of Gastrointestinal (GI) KS lesions have been reported before and since the AIDS epidemic. GI bleeding has been attributed to ulcerated KS lesions (*Potter DA, et al., 1984*). Intestinal KS has also occurred in association with protein-losing enteropathy, (*Perrone V, et al., 1981*) and mal absorption (*Bryk D, et al., 1978*). Reports also describe hepatobiliary KS. In fact, KS has been found in almost every solid organ. Lesions in the liver are predominantly periportal and are usually asymptomatic, (*Ziegler JL, et al., 1984*) but conceivably they could cause biliary obstruction if located in the distal common bile duct or lymph nodes near the hepatic hilus. Pancreatic KS lesions also occur (*Freidman S, et al., 1985*) but have not been shown to cause pancreatitis.

A striking increase in Non Hodgkin's Lymphoma (NHL), often accompanied by GI involvement, has occurred in persons with advanced HIV disease. Almost all the tumors are of B cell origin (Ziegler JL, et al., 1984). Most are high grade, with sheets of large cells displaying cellular pleomorphism and nuclear distortion. GI or hepatobiliary involvement occurs in 27 to 74% of all HIV-infected patients with NHL; it is not uncommon for the gastroenterologist to make the initial diagnosis. The tumor may develop at any stage of HIV disease, and the prognosis generally correlates with the extent of underlying immune compromise and Karnofsky performance score rather than characteristics of the lymphoma itself (Ziegler JL, et al., 1984; Kaplan LD, et al., 1989).

2.1.4. HIV and Hepatitis-B (HBV) Co-infection

That co-infection with HBV and HIV is common is not surprising given their similar modes of acquisition. The prevalence of seropositivity for past or present infection with HBV approaches 90% in HIV-infected homosexuals (Dove L, et al., 1997). Similarly high rates of co-infection have been seen in injection drug users (Rogers M, et al., 1983). The prevalence of HBV seropositivity among HIV-infected patients, however, is no higher than that seen in control patients without HIV, suggesting that co-infection likely reflects lifestyle practices that

predispose to both infections (*Krogsgaard K, et al., 1987*).

In patients with past or present HBV infection, HIV infection leads to alterations in HBV serology and viral replication. Following acute HBV infection, the virus is cleared in 95% of immune competent patients. In contrast, 50% of HIV co-infected patients will develop chronic infection (*Lazizi Y, et al., 1988*). More patients with HIV and HBV co-infection are in the chronic HBV carrier state, with highly infectious serum and body fluids, as compared with those who are not infected with HIV (*Bodsworth N, et al., 1989*).

The impact of HIV on the severity of chronic HBV infection is less clear. Several case series have suggested that HIV co-infected patients have milder clinical disease, with reduced severity on histologic examination and less pronounced elevations of serum aspartate aminotransferase (AST) and alanine amino transferase (*Scharschmidt B, and Housset C, 1992*). Corroborating these results, *Scharschmidt et al.* found no difference in survival up to 48 months between 35 patients with HIV/HBV co-infection and 70 patients infected with HIV alone, regardless of whether progression to overt acquired immunodeficiency syndrome (AIDS) occurred (*Scharschmidt B, et al., 1992*). In a similar study, however, *Housset et al.* (1992), obtained contradictory results, with significantly shorter survival among HIV/HBV co-infected patients compared with those infected with HIV alone. Furthermore, liver disease was the most common cause of death among these patients.

Vaccination against HBV has been recommended for all patients infected with HIV. Unfortunately, HIV infection reduces the efficacy of vaccination in these patients. Several studies have demonstrated suboptimal response to plasma-derived vaccine in both magnitude and duration of the antibody response (*Mannucci M, 1989; Carnie C, et al., 1987 and Collier A., 1988*).

Historically, there has been little enthusiasm or rationale to treat HBV infection in HIV co-infected individuals since the latter disease rather than the former had been the major determinant of life expectancy for most patients. This situation is changing rapidly; however, as therapies for HIV improve and patients live longer, developing greater risk for decompensated liver disease (*Wong D, et al., 1993*). Newer antiviral drugs such as lamivudine, which directly inhibit HBV replication rather than modulating the immune response, may hold more promise for effective treatment of these patients in the future.

2.1.5. TB and HIV co-infection

HIV is the strongest risk factor for the development of TB. One third of people living with HIV/AIDS (PLWHA) are co-infected with latent TB. People co-infected with TB are 21-34 times more likely to develop active TB disease than people living without HIV. *Mycobacterium tuberculosis* is the leading cause of morbidity & mortality among people living with HIV/AIDS (PLWHA) worldwide. In Ethiopia the co-infection rate is 20-50% creating a dual epidemic of symptomatic of HIV infection and tuberculosis. PLWHA are more likely than others to become

sick with TB. An estimate of 6% to 10% of all TB cases among people aged 25-44 occurred among people who were HIV positive (*CDC, 1993*).

Without treatment, as with other opportunistic infections, HIV and TB can work together to shorten lifespan. Someone with untreated latent TB infection and HIV infection is much more likely to develop TB diseases during his or her life time than someone without HIV infection (*Raviglione, et al., 1999*). Among people with latent TB infection, HIV infection is the strongest known risk factor for progressing to TB disease. A person who has both HIV infection and TB disease has an AIDS- defining condition. A person infected with HIV who also has either latent TB infection or TB disease can be effectively treated. The first step is to ensure that people living with HIV are tested for TB infection. If found to have TB infection, further tests are needed to rule out the TB disease. The next step is to start treatment for latent TB infection or TB disease based on test results. Untreated latent TB infection can quickly progress to TB disease in PLWHA since the immune system is already weakened and without treatment, TB disease can progress from sickness to death (*FMOH, 2007*).

According to the guideline for ART in adults and adolescents (Part II) (*FMOH, 2007*), approximately 20-50% of patients with TB are co-infected with HIV, and many patients eligible for Antiretroviral treatment (ART) will have active TB. Hence, TB diagnosis is an important entry point for a significant percentage of persons eligible for ART. ART is recommended for all TB patients at WHO clinical stage III with CD4 counts less than 350 cells/mm³ and TB patients with WHO clinical stage IV defining conditions irrespective of CD4 count. If CD4 count is not possible, all TB patients are eligible for ART. Any patient with suspected TB should be assessed with three sputum smears and chest x-ray, and be offered HIV testing if status is unknown and reasonable time has elapsed since the last negative test results.

The major issue in clinical management of patients with HIV and active TB are when to start ART, possibly of high pill burden, risk of drug interactions, and drug toxicity. However, in HIV infected patients who present with TB, priority must be given to initiate DOTS (Directly Observed Therapy Short course). The HIV epidemic is a main reason for the reversal of steep decline in the prevalence of TB in places with effective functioning TB control program (*Shafer and Edlin, 1996*).

TB continues to be an important public problem worldwide in terms of both mortality among the adult population and the appearance of micro epidemics of TB due to the multi drug resistance strain (*Raviglione, et al., 1999*). Worldwide infection with *M. tuberculosis* is estimated at 1.7 billion at any given time and the global TB burden to be 9 million new cases in 1995 (*Porter and Mc Adam, 1994*).

Ethiopia has a high rate of TB infection and the disease is one of the major public health problems in the country. Studies from hospital based records indicate the disease to be among the leading causes of death (*WHO, 1997*). Although there are as yet no reliable national prevalence

figure the annual incidence of new cases is estimated to be 169/100,000 and prevalence 0338/10,000 (*Demissie M., et al., 1997*).

The HIV epidemic is a main reason for the reversal of steep decline in the prevalence of TB in places with effective functioning TB control program (*Pablos-Mendes, et al.1998*).

2.1.6. HIV and non-communicable diseases

Additional linkage between HIV and other health risks are becoming important as more people with HIV receive ART and have longer survival times. Depending on their specific drug regimen, they might face higher risks of some non communicable diseases than the general population, and there are indications that some ARV drugs might increase the risk of heart diseases and diabetes (*Rabkin M. et al., 2012*).

HIV infection is also associated with increased risk of some types of cancer, including cervical cancer (*Huchco MJ. et al., 2011 and UNAIDS, 2011*). HIV services integrated with other health services have been found to be more cost effective and have the potential to achieve significant economic and health benefits (*Sweeney S. et al., 2012*).

2.2. Vulnerable communities and populations at high risk of HIV infection

In 2013, woman represented approximately 57% of all adults living with HIV worldwide. Women are biologically more susceptible to HIV. In addition to suffering from gender inequalities, discrimination and violence can also increase their vulnerability to infection. People who use drugs, men who have sex with men (MSM) and sex workers are also at high risk (*UN AIDS, 2013b*).

Globally, young women are twice more likely to become infected with HIV than their male counter parts (*UNAIDS, 2012b*). Biological (physiological) factors which make women more susceptible to Sexually Transmitted Diseases (STD) particularly to HIV infection include:

- **Large mucosa membrane surface area of the vagina:** - This favors easy deposition of an infected semen and sperm, and penetrations of the virus in the body.
- **Cervical ectopy:**-This is evisceration (coming out wards) of the cervical mucous, which increase easily penetrable surface area by microorganisms. Particularly at risk are adolescent girls whose cervical mucous eviscerates the most.
- **Sex during menses:**-During menstruation, the uterine surface area sloughs off leaving traumatized and easily penetrable mucosa by disease causing microbes.
- **Abortion:**-Two factors are associated with it. The first one is the fact that the uterine mucosa is already sloughed off as a result of separation of the placenta from the uterine wall. The other is, the instruments used are unsterile and could have been used for similar abortion earlier increasing the chance of cross infection.

- **Receptive sex:** - Females by nature are receptive during sexual intercourse. This means they receive the semen, which could be infected already, from the male partner.
- **Traumatic sex (where there is damage to the genitalia):**-Traumatic sex increases the chance of epithelial and capillary breakage and thereby favors easy entry of microorganisms to the body (*FMOE, 1998*).

2.2.1. Factors which affect the prevalence of HIV/AIDS

2.2.1.1. Socioeconomic factors: - The impact of these factors on the prevalence of HIV/AIDS is mostly related to the building of the attitude of the individual and to creating a healthy environment through education and level of income (*Beegle, K. and D. de Walque, 2009*).

i. Poverty: Poverty enhance the vulnerability of contracting HIV through different channels, including increased movement of people from one place to another (urban to rural or rural to urban), limited media exposure, limited access to health education, sexual exploitation and gender inequality. Poverty exposes people to food insecurity and fails to fulfill other basic needs. This problem facilitates sexual risk behaviors by forcing them to engage in commercial sex practices. Women's economic dependence on their partner may also expose them to their partner insisting on unsafe sex. Poverty is also related to the biological problems of human beings through food insecurity and malnourishment. Malnutrition will expose individuals to the disease through weakening of their immune system.

ii. Education: In lots of research, education is one of the most focused socio-economic factors which are put forward in relation to the prevalence of the AIDS epidemic (*de Walque D., 2009*). The benefit of education in relation to diminishing the prevalence of the epidemic can be classified in short and long terms. In the short run, education will benefit individuals through raising awareness, accessing and perceiving different information through reading and experience how to protect themselves from the epidemic. Hence, more educated individuals have a tendency of preventing the diseases by applying safety methods in the short run. In the long run, education may benefit individuals by eradicating poverty and other related risk factors through discovering a new knowledge and increasing the level of income of individuals which in turn diminishes the prevalence rate of the epidemic. On the other hand individuals who are less educated experience a higher rate of HIV infection due to their low income, decrease autonomy and limited access to information concerning the way the disease is transmitted and its prevention method. However, contrary to the above argument, studies show that, in the early stage of the epidemic in many countries, groups of people who are economically strong with better education have a higher rate of partner change due to greater personal autonomy and spatial migration. However, in the later stage of the epidemic due to the accessibility and exposure of information the prevalence rate diminishes in these groups through building their awareness about the epidemic.

iii. Occupation: The mobility of individuals mainly depends on the profession in which they engaged. Since most migrant workers are forced to stay in their work places for extended periods

separated from their families and marriage partners, there will be a tendency of having new sexual partners during their migration period. Hence, they will have a wider range of sexual networking than non migrant workers. Thus, this will in turn accelerate the transmission of the HIV/AIDS epidemic. The transmission of HIV epidemic due to mobility of individuals is also determined by the structure and the conditions of the migration process. Individuals who are engaged in professions which make them migrate, may experience separation from their present socio cultural norm to a new society and socio-cultural norms. This spatial migration will lead them to adapt the new culture of the society which may have some contribution to the prevalence of the epidemic. Some studies argue that there is empirical evidence for the link between human mobility and HIV transmission. In Sub-Saharan Africa countries the probability of HIV infection has been found be higher near roads, for individuals who have been experiencing migration and for individuals who have sexual partners who are migrants. Migrant labor is highly correlated with high risk sexual behavior, thus migrants and migrant workers are at higher potential risk of HIV infection. Due to a high level of mobility, activities which are associated with agricultural marketing, military and transportation service have a significant contribution to the transmission of the disease.

iv. Employment status: Employment status is linked to the prevalence of the epidemic through generating income and migration to other places in order to look for jobs. This income difference and migration will affect the likelihood of individuals affected by the epidemic as stated in the above theories of poverty and education subsection.

v. Place of residence: Place of residence of individuals may affect the prevalence rate of the epidemic through socio-cultural and socio-economic variation. For example, rate of STD transmission tends to be higher in rural areas due to un standardized access to STD treatment.

In addition to this the level of knowledge about HIV/AIDS is also lower in these areas. On the other hand, because of the limited scope for sexual networking in isolated communities and the highest influence of traditional values the prevalence level in rural areas is very low.

2.2.1.2. Demographic factors: - In purely heterosexual sex, HIV prevalence level is higher among women than men. This is because of women are biologically more susceptible to infection due to larger genital tract surface area, which may be also torn during sexual activity, which leads to higher risk of HIV transmission. The other demographic factor is age, which also affects the prevalence of the epidemic as follows. Most young people are rushing to sex and practicing unsafe sex due to their puberty age. Their economic status and knowledge about the epidemic also contributes to the prevalence level of HIV infection. For example, youth are more attracted to money specially if they are poor and have inadequate information about the disease. The third demographic factor which was identified in the conceptual framework was marital status of individuals. Marital status will affect the transmission of epidemic through acquiring new sexual partners and less autonomy.

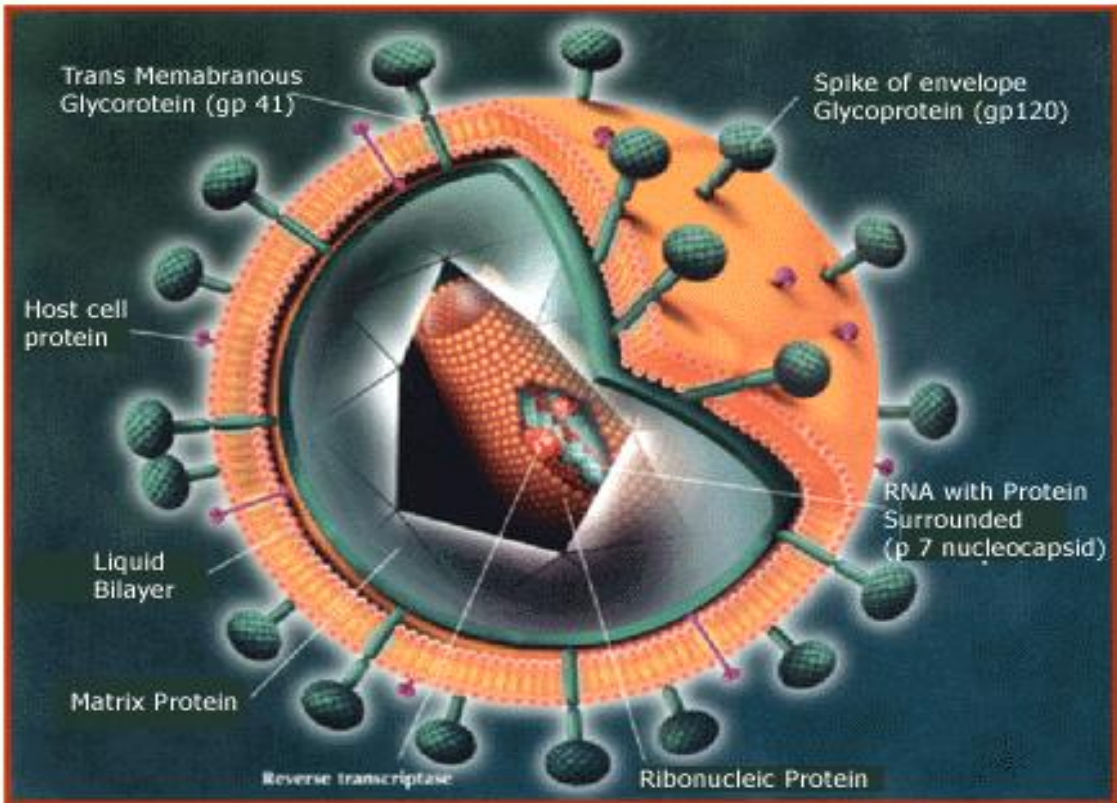
2.2.1.3. Cultural factors: Cultural practices, values and traditions have strong influences on the visible aspects of individual behaviors which in turn influence their vulnerability to disease. In the case of women, they are exposed to the disease through traditional practices such as husband sharing, early marriage, female genital mutilation and condoning of gender based violence. Early marriage refers to any form of marriage that takes place before a child has reached 18 years. Early marriage severely increases young girls' vulnerability to HIV as they are most likely to be forced into having sexual intercourse with their (usually much older) husband. Moreover, these very young girls have softer vaginal membranes which are more prone to tear, making them susceptible to HIV infection. In addition to this, their older husband is more likely to be sexually experienced and HIV infected. The severity of multiple sexual partners relates to the fact that if one person in a circle of partners gets infected with HIV, there is a very high likelihood that all persons involved will be infected.

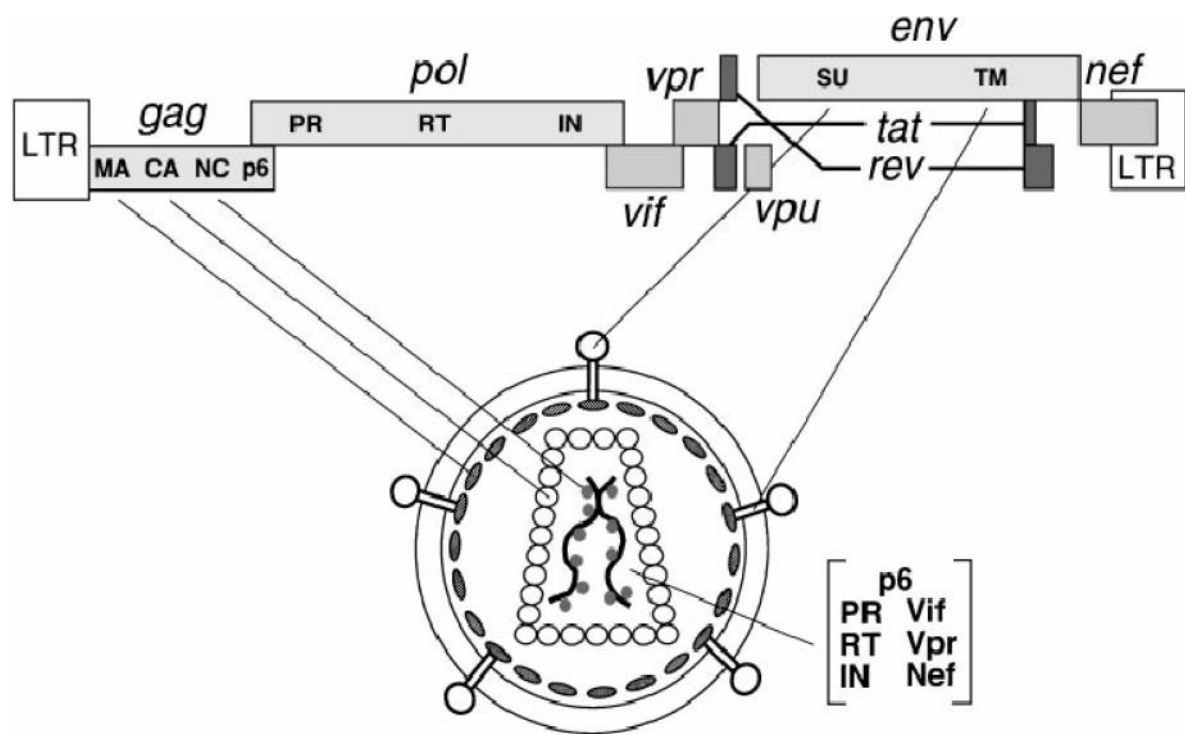
Female genital cutting places girls and women at increased risk of HIV infection through several routes. In the first place, instruments such as razors or knives, which are used for genital mutilation, may not be sterilized. In the second place, female genital mutilation renders the female genital more likely to tear during intercourse. In males, the foreskin's inner mucosal surface is more susceptible to HIV because it has more immune cells that are vulnerable to HIV infection. The presence of the fore skin acts as a physical barrier, trapping HIV next to the surface of the penis for long periods. In this moist environment, the HIV virus can survive longer. After circumcision the penile shaft becomes less susceptible to viral infection.

2.3. The disease and its epidemiology

2.3.1. Etiologic Agent

Human immunodeficiency virus (HIV) is a retrovirus. It has RNA as its genetic material. This is reverse transcribed into DNA by the enzyme reverse transcriptase, which HIV contains together with the RNA. HIV targets cells that form part of the immune system. It has spikes on its surface; the heads of which are made from three glycoprotein molecules known as gp120 attached to another molecule called gp41. This binds with CD4, a protein that protrudes from various types of human cell. Its main target is a type of cell called CD4 T-lymphocyte (Figure 2). Once the virus has attached to a cell, it can go on to the next stage and merge with the host cell (*Steve P, 2010*).





2.3.3. HIV-1 genes and the virus life cycle

The HIV-1 genome encodes nine open reading frames (Figure 3). Three of these encode the Gag, Pol, and Env poly proteins, which are subsequently proteolysed into individual proteins common to all retroviruses. The four Gag proteins, MA (matrix), CA (capsid), NC (nucleocapsid), and p6, and the two Env proteins, SU (surface or gp120) and TM (trans membrane or gp41), are structural components that make up the core of the virion and outer membrane envelope. The three Pol proteins, PR (protease), RT (reverse transcriptase), and IN (integrase), provide essential enzymatic functions and are also encapsulated within the particle. HIV-1 encodes six additional proteins, often called accessory proteins, three of which (Vif, Vpr, and Nef) are found in the viral particle. Two other accessory proteins, Tat and Rev, provide essential gene regulatory functions, and the last protein, Vpu, indirectly assists in assembly of the virion. (Zhou QA and Sharp PA.1996). The retroviral genome is encoded by 9-kb RNA, and two genomic-length RNA molecules are also packaged in the particle. Thus, in simplistic terms, HIV-1 may be considered as a molecular entity consisting of 15 proteins and one RNA (Frankel AD. and Young JA., 1998).

2.3.4. What is HIV-2?

According to the National Institute of Allergy and Infectious Diseases (NIAID, Updated January 14, 2016), three years after the emergence of the first cases of AIDS in the U.S., three scientists, Robert Gallo, Luc Montagnier and Françoise Barre-Sinoussi, discovered the virus which caused this mysterious immune deficiency syndrome, HIV. Several years later, a new strain was found in a man living in Africa, which has genetic variations far different than the one isolated in Europe and North America. As a result, the original virus was named HIV-1 while the new strain was called HIV-2.

Genetic strain varies mostly in geographic distribution and disease progression. In biology, a strain is simply a genetic variation of an organism that makes it entirely unique. Similarities can exist but they are ultimately independent organisms. Demographically speaking, HIV-2 is a less common form of HIV with some subtle yet distinctive differences.

2.3.5. How are HIV-1 and HIV-2 similar?

Despite differences in their genetic profile, HIV-1 and HIV-2 share the following similarities (Nyamweya S. et al., 2013):

- The modes of transmission are the same (sexual contact, blood-to-blood contact, mother-to-child transmission).
- People infected with HIV-2 are subject to the same opportunistic infections as those infected with HIV-1.
- HIV-1 and HIV-2 are treated with the same antiretroviral medications.

- The same CD4 testing can be used to monitor HIV-1 and HIV-2 disease progression.

2.3.6. How are HIV-1 and HIV-2 different?

There are also a number of differences between HIV-1 and HIV-2. They include:

- HIV-2 appears to be less virulent, generally depleting the immune system a slower rate than HIV-1.
- People with HIV-2 tend to be less infectious in the early stage of the disease compared to those with HIV-1.
- However, HIV-2 seems to be more infectious in the later stages of the disease when the CD4 count had dropped below 200 cells /ml.
- HIV-2 is typically constrained to certain parts of the world when compared to HIV-1 (although international travel has allowed for widening global distribution).
- The viral load test used for HIV-1 is not as reliable for people with HIV-2 infection.

Some antiretroviral drugs may work less effectively for people with HIV-2, although this is more related to older-generation drugs than newer ones. Newer-generation combination tests (including the Alere Determine Combo) were released into the market, able to test not only for HIV-1 and HIV-2 but for HIV antibodies and antigens, as well.

2.3.7. Where in the world is HIV-2 most common?

HIV-2 is highly concentrated in West African countries such as Senegal, Nigeria, Ghana, and the Ivory Coast. In the past, few cases have been reported outside of these areas, but those numbers are quickly changing, particularly in HIV-2-prevalent countries popular with international travelers or those with a high influx of immigrants from HIV-2-prevalent countries (*De Cock, K et al., 1993*).

2.3.8. Viral replication

Like all viruses, human immunodeficiency virus (HIV) is comprised of only genetic material, a few proteins, and a protective envelope. Its genetic material, carried by single-stranded RNA molecules, contains all the information necessary to make more viruses. HIV cannot reproduce itself outside of a cell, but when HIV invades a living cell, it turns the cell into a factory for making more HIV.

HIV binds to specific receptors on the cell surface. These receptors are found on only a few types of cells, including certain white blood cells, intestinal cells, and brain cells.

HIV penetrates the cell membrane and releases its contents into the host cell, T- cell.

A viral protein, the enzyme reverse transcriptase, converts single strands of RNA into double-stranded DNA.

Another viral protein, the enzyme integrase, splices the viral DNA into the DNA in the host cell's nucleus. The cell becomes unable to distinguish viral DNA from its own genetic material.

The host cell carries out the instructions encoded in the viral DNA, making copies of the viral RNA and viral proteins.

A third viral protein, the enzyme protease, cleaves the viral proteins into functional enzymes. The viral proteins and RNA come together in the cell to facilitate the production of a new virus.

The viral proteins and RNA are packaged into a newly formed HIV, which buds from the host cell and is soon ready to infect other cells (Figure 4).

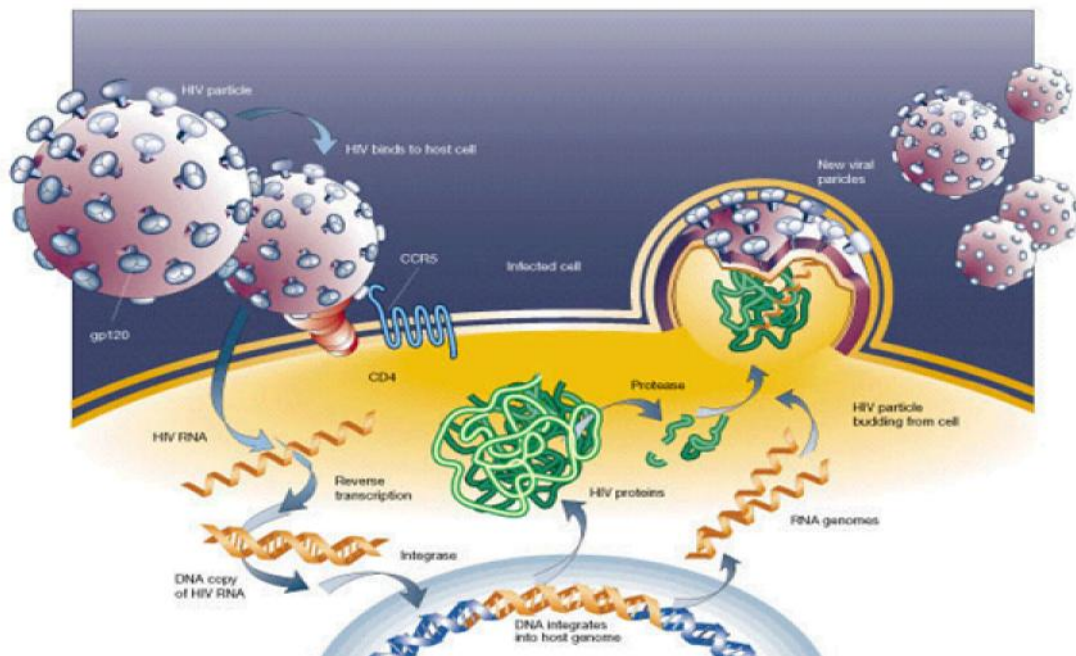


Figure 4. Infectivity cycle of HIV inside the CD4 cell.

2.4. HIV/AIDS infection and treatment

For more than three decades since the discovery of HIV-1, AIDS remains a major public health problem affecting greater than 35.3 million people worldwide (UNAIDS, 2012b). Current antiretroviral therapy has failed to eradicate HIV-1, partly due to the persistence of viral reservoirs. Current therapy for controlling HIV-1 infection and impeding AIDS development (highly active antiretroviral therapy; HAART) includes a mixture of compounds that suppress various steps of the viral life cycle (*Taylor BS, et al., 2013*). HAART profoundly reduces viral replication in cells that support HIV-1 infection and reduces plasma viremia to a minimal level but neither suppresses low-level viral genome expression and replication in tissues nor targets the latently infected cells that serve as a reservoir for HIV-1, including brain macrophages, microglia, and astrocytes, gut-associated lymphoid cells, and others (*Eisele E, Siliciano RF, 2012 and Chun, T.W. 1997*).

HIV-1 persists in ~10⁶ cells per patient during HAART, and is linked to co morbidities including heart and renal diseases, osteopenia, and neurological disorders (*Chun TW, and Fauci AS, 2012*). Because current therapies are unable to suppress viral gene transcription from integrated pro-viral DNA or eliminate the transcriptionally silent pro-viral genomes, low-level viral protein production by latently infected cells may contribute to multiple illnesses in the aging HIV-1 infected patient population. Supporting this notion, pathogenic viral proteins including transactivator of transcription (Tat) are present in the cerebrospinal fluid of HIV-1-positive patients receiving HAART (*Johnson TP, 2013*). To prevent viral protein expression and viral reactivation in latently infected host cells, new strategies are thus needed to permanently disable the HIV-1 genome by eradicating large segments of integrated proviral DNA.

Advances in the engineered nucleases including zinc finger nuclease (ZFN), transcription activator-like effectors nuclease (TALEN), and clustered regularly interspaced short palindromic repeats (CRISPR) associated 9 (Cas9) that can disrupt target genes have raised prospects of selectively deleting HIV-1 proviral DNA integrated into the host genome (*Zhang J, and Crumacker C, 2013*). These approaches have been used to disrupt HIV-1 entry co receptors C-C chemokine receptor 5 (CCR5) or C-C-C chemokine receptor 4 (CCCR4) and proviral DNA-encoding viral proteins (*Stone D, et al., 2013*). CCR5 gene-targeting ZFNs are in phase II clinical trials for HIV-1/AIDS treatment (*Hofer U, 2013*). Also, various gene editing technologies have recently been shown to remove the proviral HIV-1 DNA from the host cell genome by targeting its highly conserved 5' and 3' long terminal repeats (LTRs) (*Ebina H, et al., 2013*). However, introduction of nucleases into cells via these nuclease-based genomic editing approaches remains inefficient and partially selective to remove the entire HIV-1 genome. Thus, the key barrier to their clinical translation is insufficient gene specificity to prevent potential off-target effects (toxicities) (*Qu X, 2013*). To achieve highly specific HIV-1 genome editing, different approaches are combined to identify HIV-1 targets while circumventing host off-target effects. The resulting highly specific Cas9-based method proved capable of eradicating integrated HIV-1 DNA with high efficiency from latently infected human "reservoir" cell types, and prevented their infection by HIV-1.

2.4.1. Post-exposure Prophylaxis (PEP)

All potentially exposed contacts should be offered and encouraged to have a test for HIV. Individuals with known recent exposure to HIV should be tested as soon as possible with standard and nucleic acid amplification testing (NAAT) and antibody testing should be repeated at 6 weeks, 3 months, and 6 months after the last exposure (<http://www.cdc.gov/mmer/preview/>). Health care personnel have been exposed to a source person who either has or may have HIV infection. The recommendations are based on the risk for HIV infection after different types of exposure and on limited data regarding efficacy and toxicity of PEP.

Because the majority of occupational HIV exposures do not result in transmission of HIV, potential toxicity must be considered when prescribing PEP. PEP should be initiated as soon as possible, preferably within hours rather than days of exposure, and is generally not recommended if more than 72 hours have passed since the exposure.

2.4.2. Non occupational Exposure Prophylaxis (nPEP)

Because persons who are infected with HIV might not be aware they are infected, baseline HIV testing should be performed on all persons seeking evaluation for potential non occupational HIV exposure. If possible, this should be done with an Food and Drug Administration (FDA)-approved rapid test kit (with results available within an hour). If rapid tests are not available, an initial treatment decision should be made based on the assumption that the potentially exposed patient is not infected, pending HIV test results. Because nPEP is less likely to be effective if initiated >72 hours after HIV exposure, it is generally not recommended more than 72 hours after exposure (<http://www.cdc.gov/mmer/preview/>).

2.4.2.1. Transmission

Most commonly, HIV is contracted through sexual contact with an infected person, sharing needles or syringes with an infected person, or, less commonly, by receiving infected blood products. Babies born to HIV positive mothers may become infected before or during birth or through breastfeeding. There is currently no vaccine to prevent transmission of HIV and no cure. HIV commandeers the body's immune system by destroying white blood cells called CD4+ T lymphocytes (CD4+ T cells) that are a critical part of the immune system. A healthy, uninfected person usually has between 800 and 1200 CD4+ T cells per cubic milliliter of blood (mm^3). A person's condition is said to have progressed to AIDS when their CD4+ T cell count has fallen below 200 cells per mm^3 of blood, severely hindering the body's ability to ward off infection. Specific "opportunistic infections" thrive in the immune-compromised body. Researchers have created a number of drugs that can suppress HIV in the body and extend lifespan significantly. The category of medications that fight HIV by preventing replication is called antiretroviral. The

Food and Drug Administration (FDA) has approved more than 20 antiretroviral medications or combinations of antiretroviral for HIV treatment that fall into four classes, corresponding to the way the body can fight the virus. Because HIV can become resistant to any one drug, people living with HIV/AIDS typically take a combination of drugs from different classes. This combination treatment is known as highly active antiretroviral therapy, HAART (*CDC, 1998*).

2.4.2.2. Symptoms

Most people who have become recently infected with HIV will not have any symptoms. They may, however, have a flu-like illness within a month or two after exposure to the virus, with fever, headache, tiredness, and enlarged lymph nodes (glands of the immune system easily felt in the neck and groin). These symptoms usually disappear within a week to a month and are often mistaken for those of other viral infections. During this period, people are very infectious, and HIV is present in large quantities in blood, semen, and vaginal fluids. More severe HIV symptoms—such as profound and unexplained fatigue, rapid weight loss, frequent fevers, or profuse night sweats—may not appear for 10 years or more after HIV first enters the body in adults, or within two years in children born with HIV infection (*NIAID, 2014*).

2.4.2.3. Prevention

Because there is no cure or vaccine to prevent HIV, the only way people can prevent infection from the virus is to avoid high-risk behaviors putting them at risk of infection, such as having unprotected sex or sharing needles. The National Institute of Allergy and Infectious Diseases (NIAID) urges everyone aged 13 to 64 to get tested for HIV as part of their routine health care. Catching HIV in its early stages can make a life saving difference. HIV infection is a chronic viral infection, which when untreated, causes a progressive destruction of the immune system resulting in Acquired immune deficiency syndrome (AIDS). The key component of the immune deficiency associated with untreated HIV replication is a marked reduction in cluster of differentiation 4 (CD4) T-cells. AIDS is defined as the presence of HIV infection with CD4-cell count less than 200 cells/mm³ and /or the presence of an AIDS defining clinical condition, which includes any number of opportunistic infections, OPs (*CDC, 1992*).

If antiretroviral (ARV) drugs are taken consistently, replication of the virus is prevented and viral load decreases, CD4 increases, morbidity and mortality decreases. Despite the significant advances in HIV treatment and prevention, there is still no cure, only treatment. Current treatment of HIV consists of a combination of antiretroviral drugs referred to as Highly Active Antiretroviral Therapy (HAART). The goal of antiretroviral treatment is to indefinitely maintain suppression of plasma HIV-RNA levels (also called viral load) below the detection limits of HIV-RNA assays. The current preferred regimens in treatment–naïve patients consists of two nucleoside analogue reverse transcriptase inhibitors (NNRTI) or one of several boosted protease inhibitors (PIs), or an integrase strand transfer inhibitor (*Hogg RS, et al., 1999*).

2.4.3. Antiretroviral treatment (ART)

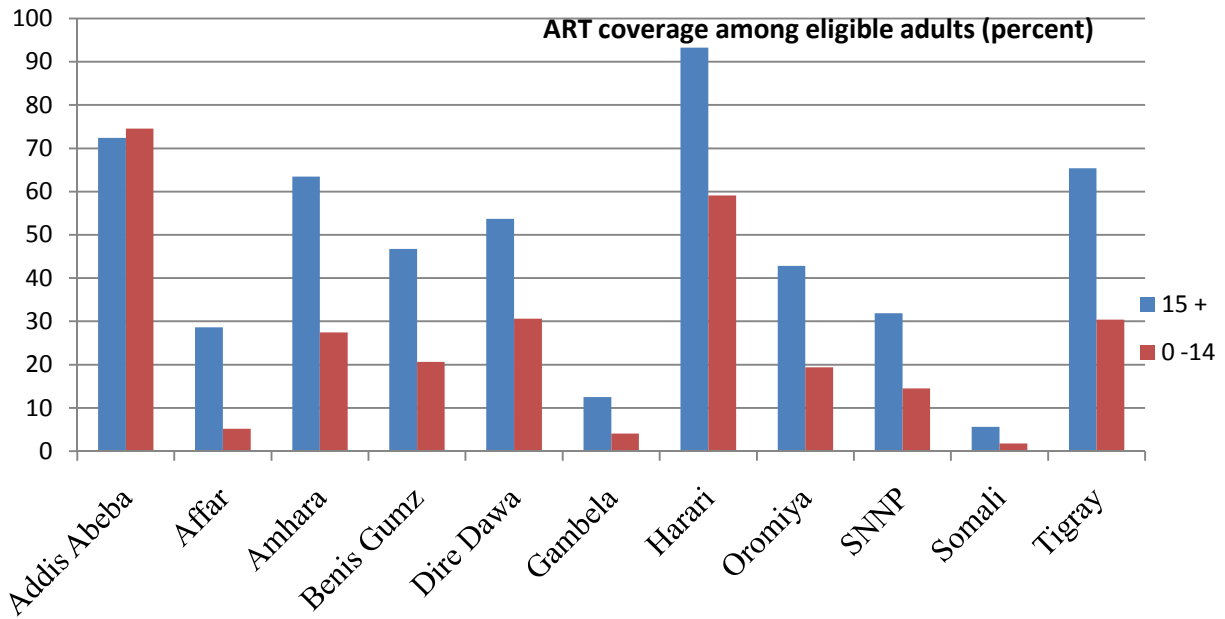
According to the Federal Ministry of Health, 2007, with the advent of ARV drugs, AIDS has become a treatable chronic disease. Even in the third world setting with increasing people with AIDS accessing services, a decline in death rates is clearly visible. ART is a complex health care intervention with a number of challenges; in order to benefit maximally nearly 100% adherence is necessary, therefore the support of family, friends, health care workers and other care providers is mandatory for the patients to achieve this level of adherence (*FMOH, 2007*). Failure to comply with treatment results in the emergence of drug resistant viruses that are usually difficult to manage especially in resource limited settings. That is why it is said, “The first regimen is the best regimen”. In resource limited settings patients accessing ART have a number of non-medical needs including nutrition, shelter, transportation, etc.

The primary goal of ART is for the maximum and durable suppression of viral replication and restoration of immunologic function, resulting in reduction of HIV related morbidity and mortality, and improvement of quality of life and survival of people living with HIV. In addition to this, ART raises the hope of individuals, family and communities, reduces HIV transmission in the population including MTC, reduces the incidence of TB, and decreases the amount of virus (viral load).

2.4.4. Future challenges in the provision of ART in Ethiopia

The feared future challenges in the provision of ART include drug resistance, interruption of donor support including ART drug provision, lack of drugs to treat opportunistic infections, absence of home based care for PLWHA and difficulty in defaulter tracing in the absence of the current volunteers supported by the NGOs. Currently, the main problem of PLWHA in Ethiopia is to have access to adequate food which is required while taking their regular medications (*Aantijes and Jerene, 2010*). Other support needs are socioeconomic support through involvement in income generating activities (IGA), support for school fee and educational material for OVC and psychological support to clients and family members (*Caregivers Action Network, 2013*).

It has also been confirmed that the emphasis in patient needs has now clearly shifted from basic nursing care in the home to livelihood support (*Aantijes and Jerene, 2010*). The need for clinical and health care needs is evidently palpable. The services provided to PLWHA are categorized into clinical and non clinical. Initially, care and support services (non-clinical) in Ethiopia were mainly delivered by NGOs. Later on, the involvement of the government through provision of opportunity for involvement in IGAs and food support by the health offices and healthy facilities at different levels was indicated. Services provided to PLWHA and their families are psychological, economic, materiel and nutritional support services, and clinical care mainly provided by the MOH facilities (Voluntary Counseling and Testing, VCT, for early detection, treatment for opportunistic infection, ART service and prevention of mother to child



part of the body's immune system that help fight infections. HIV can progress to acquired immunodeficiency syndrome (AIDS).

After the original infection, it takes between 2 weeks and 6 months for antibodies to HIV to appear in the blood. The period between becoming infected with HIV and the point at which antibodies to HIV can be detected in the blood is called the seroconversion or "window" period. During this period, an HIV-infected person can still spread the disease, even though a test will not detect any antibodies in his or her blood. Several tests can find antibodies to or genetic material (RNA) of the HIV virus. These tests include:

- **Enzyme-linked immune sorbent assay (ELISA).** This test is usually the first one used to detect infection with HIV. If antibodies to HIV are present (positive), the test is usually repeated to confirm the diagnosis. If ELISA is negative, other tests are not usually needed. This test has a low chance of having a false result after the first few weeks that a person is infected.
 - **Western blot.** This test is more difficult than the ELISA to perform, but it is done to confirm the results of two positive ELISA tests.
- Ñ **Polymerase chain reaction (PCR).** This test finds either the RNA of the HIV virus or the HIV DNA in white blood cells infected with the virus. PCR testing is not done as frequently as antibody testing, because it requires technical skill and expensive equipment. This test may be done in the days or weeks after exposure to the virus. Genetic material may be found even if other tests are negative for the virus. The PCR test is very useful to find a very recent infection, determines if an HIV infection is present when antibody test results were uncertain, and screen blood or organs for HIV before donation.
- Ñ **Indirect fluorescent antibody (IFA).** This test detects HIV antibodies using a special fluorescent dye and a microscope. This test may be used to confirm the results of an ELISA test.

3. Objectives of the study

3.1. General objective

To assess the trend of the epidemic patterns, understand the impact of the disease on the population and generate reliable information on the current level of HIV/AIDS prevalence in Arsi zone and provide credible information to control the epidemic.

3.2. Specific objectives

1. To estimate the HIV/AIDS prevalence in Arsi zone.
2. To identify the most affected groups of the population in the zone.

4. Materials and methods

4.1. Study area

The study was conducted in Arsi zone, Oromia region between September 2015 and May 2016. Arsi is one of the zones in oromia region which is located in the south central Ethiopia about 175km, south of Addis Ababa (Figure 6). Five Hospitals and Ninety six health centers are under Arsi zone health bureau. Chilalo Mountain, which is 2,430 m (7,970 *ft*) above sea level, is found in this zone and it is also the home of the most famous Ethiopian athletes like Haile G/silassie, Derartu Tulu, Kenenisa Bekele, Fatuma Roba, Tirunesh Dibaba, and others. Based on the 2007 census conducted by the CSA (*Central Statistics Agency, 2007*), Arsi zone has a total population of 2,637,657 of which 1,323,424 (50.17%) are men and 1,314,233 (49.83%) women. With an area of 19,825.22 square kilometer, Arsi has a population density of 133.05. While 305,701 (11.59%) are urban inhabitants and 2,331,956 (88.41%) lives in the rural areas with the primary economic activity of subsistence farming and a further 7,098 (0.27%) are pastoralists. The two largest ethnic groups reported are the Oromo (84.15%) and the Amhara (14.3%), all other ethnic groups made up 1.55% of the population. The majority of the inhabitants were Muslim; with 58.1% of the population, 40.01% orthodox Christianity and concerning education, 84% of all eligible children are enrolled in primary school, and 22% in secondary schools.

4.2. Study design

Three hospitals and fourteen health centers were selected as a sample from the total of five hospitals and ninety six health centers found in the zone. The technique of selecting sample for the study was non random sampling using a purposive sampling method (priority area selection). This method was chosen because of proximity of the areas and ease of access and using this method, the necessary documents and enough samples can be collected from the twelve woredas. The study was carried out based on quantitative data collected from the seventeen health institutions in the twelve woredas out of the twenty five woredas. One to ten years retrospective data was collected by tally method from the “voluntary Counseling and Testing Registration Log Book” and from the monthly reporting formats of the health institutions taken as a sample. The collected data was subjected to descriptive statistics, using average values and percentiles (prevalence rate) and analyzed using SPSS version 20.

The study takes in to consideration the sex, age, educational status, marital status, occupation, and the reasons why people make a test for HIV. Some of the reasons for making the HIV test were; to get premarital information, for visa applications and to know one self.

4.3 .Study population

Resident populations aged above six months visiting the seventeen health institutions (three hospitals and fourteen health centers) found in the twelve woredas were subject for the study.

4.4. Map of the Study Area (Arsi zone, Oromia region)

Arsi zone is one of the twenty zones of Oromia region located about 175 kilometers south of Addis Ababa. It is bordered by east shewa, west Harerge , west Arsi and Bale zones. At present it has twenty five woredas (Figure 5).

The following are the selected woredas in the study area; Asella, Tiyo, Digelu and Tijo, Limu and Bilbilo, Shirka , Munesa, Ziway Dugda, Hetosa/Eteya, Lode Hetosa (Huruta), Diksis, Sire, Robe, Jeju, Dodota(Dera).

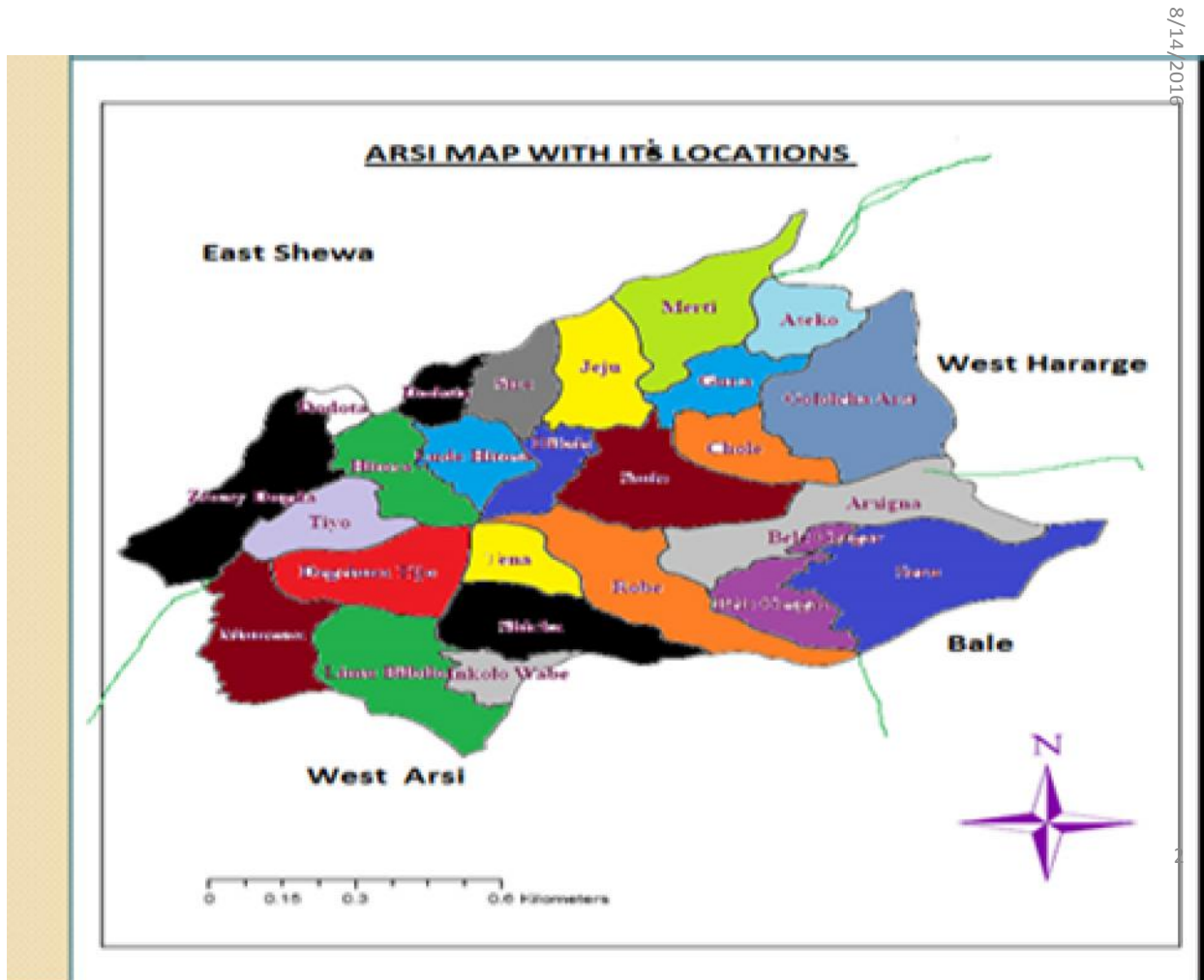


Figure 6 Map showing the study area (Arsi zone, Oromia Region)

Adopted from the Ethiopian GIS Association.

5. Results

5.1. The HIV/AIDS situation in the study area

The annual trends of HIV prevalence in Asella town from the ten years clinical data records of voluntary counseling and testing (VCT) department of Asella hospital (table 5) shows that an average number of 5401.4 individuals were screened (2857.5 males and 2543.9 females) and 306.8 (119.5 males and 187.3 females) of them were tested positive. The prevalence of the disease decreased from 11.14% in 2006 to 4.69% in 2015 and the average annual prevalence rate is 5.68%.

Table 5. Annual data of HIV tested and HIV- positive individuals (2006-2015) in Asella hospital.

Year	Total number of screened individuals			Number of HIV positive individuals		Percent of HIV positive	Total No of HIV positive	Prevalence (Percentage)
2006	M	1736	3276	M	146	4.45	365	11.14
	F	1540		F	219	6.69		
2007	M	3514	6736	M	213	3.16	541	8.06
	F	3222		F	328	5.02		
2008	M	4342	8711	M	186	2.14	534	6.13
	F	4369		F	348	3.99		
2009	M	4479	8003	M	168	2.10	429	5.36
	F	3524		F	261	3.26		
2010	M	4522	8055	M	110	1.37	297	3.69
	F	3533		F	187	2.32		
2011	M	2878	5551	M	91	1.63	228	4.11
	F	2673		F	137	2.47		
2012	M	1970	3800	M	94	2.47	207	5.45
	F	1830		F	113	2.95		
2013	M	1915	3670	M	76	2.07	213	5.80
	F	1755		F	137	3.73		
2014	M	2214	3995	M	64	1.60	150	3.75
	F	1781		F	86	2.14		
2015	M	1005	2217	M	47	2.12	104	4.69
	F	1212		F	57	2.57		
Average /Mean	M	2857.5	5401.4	M	119.5	2.21	306.8	5.68
	F	2543.9		F	187.3	3.47		

Regarding age, the sexually active individuals aged between 15-49 years are affected most (74.33%) followed by the older people, >50 years old, (14.43%) and the least affected are children aged 0-14 years (Table 6).

Regarding sex, females are affected more than males (Figure 6). The figure also shows a decreasing trend of the epidemic.

Table 6. Number of HIV positive individuals in different age groups in Asella Hospital (2008-2015).

Age	2008		2009		2010		2011		2012		2013		2014		2015		Average
	M	F	M	F	M	F	M	F	M	F	M	F	M	F	M	F	
0-14	12	40	20	41	22	25	18	11	5	11	4	13	4	7	3	7	46.12 (11.24%)
15-49	145	243	138	215	80	125	62	96	65	78	60	96	60	65	38	41	200.87 (74.33%)
>50	29	65	10	5	8	37	11	30	24	24	12	28	0	14	6	9	39.00 (14.43%)
Total	186	348	168	261	110	187	91	263	94	113	76	137	64	86	47	57	286

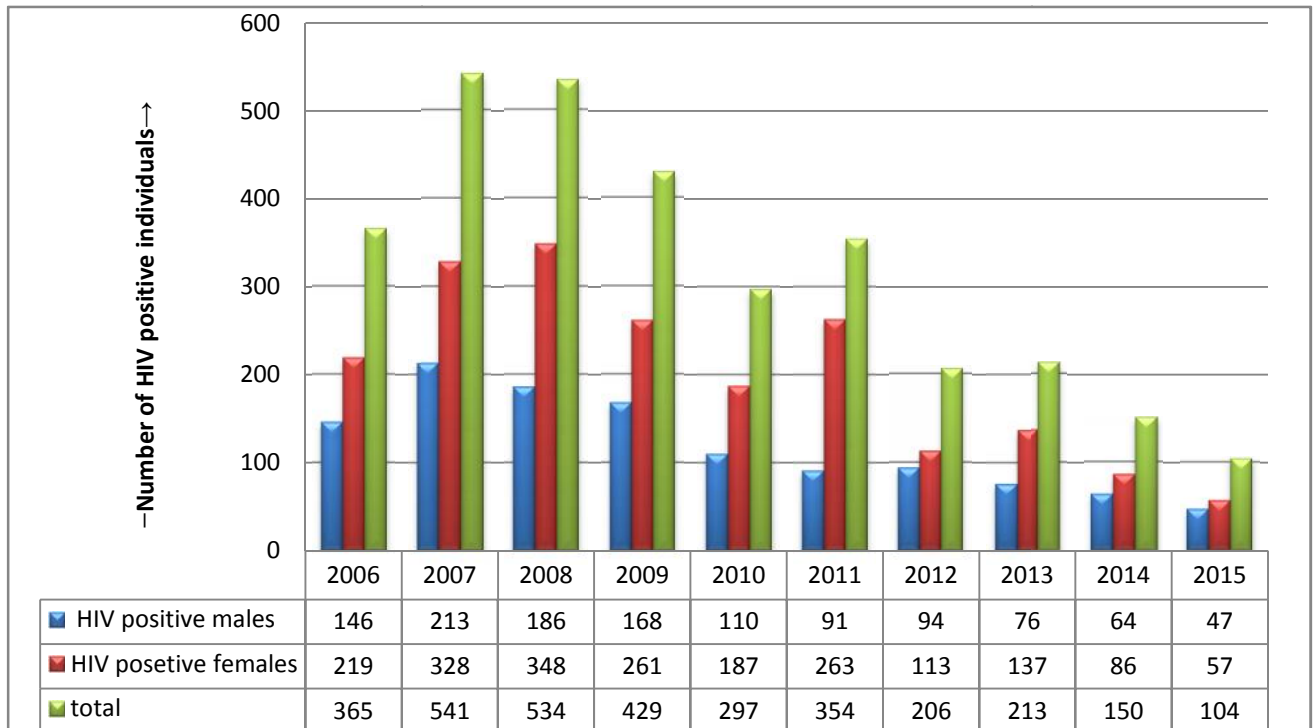


Figure 7 Graph showing the number of HIV positive individuals (2006-2015) based on the data collected from Asella Hospital.

In Family Guidance Association of Ethiopia (FGAE)-Asella branch clinic also, a total of 9,742 individuals (4,357 males and 5,385 females) have been tested for HIV/AIDS within eight years between 2008 and 2015 (Table 7) and only 337 of them were tested positive with an average annual prevalence of 3.46% (Figure 8).

Table 7. *Number of individuals screened for HIV in FGAE-Asella branch clinic (2008-2015).*

Year	Number of screened Individuals		Total
2008	M	39	90
	F	51	
2009	M	527	1212
	F	685	
2010	M	411	1056
	F	645	
2011	M	520	1230
	F	710	
2012	M	1022	2350
	F	1328	
2013	M	612	1368
	F	756	
2014	M	588	1232
	F	644	
2015	M	597	1144
	F	547	
Total	M	4357	9742
	F	5385	
Average	M	544.6	1217.8
	F	673.1	

Figure 8 below also shows the number of HIV positive individuals based on the data collected from the Family Guidance Association of Ethiopia (FGAE)-Asella branch clinic. This graph shows that females are affected more than males.

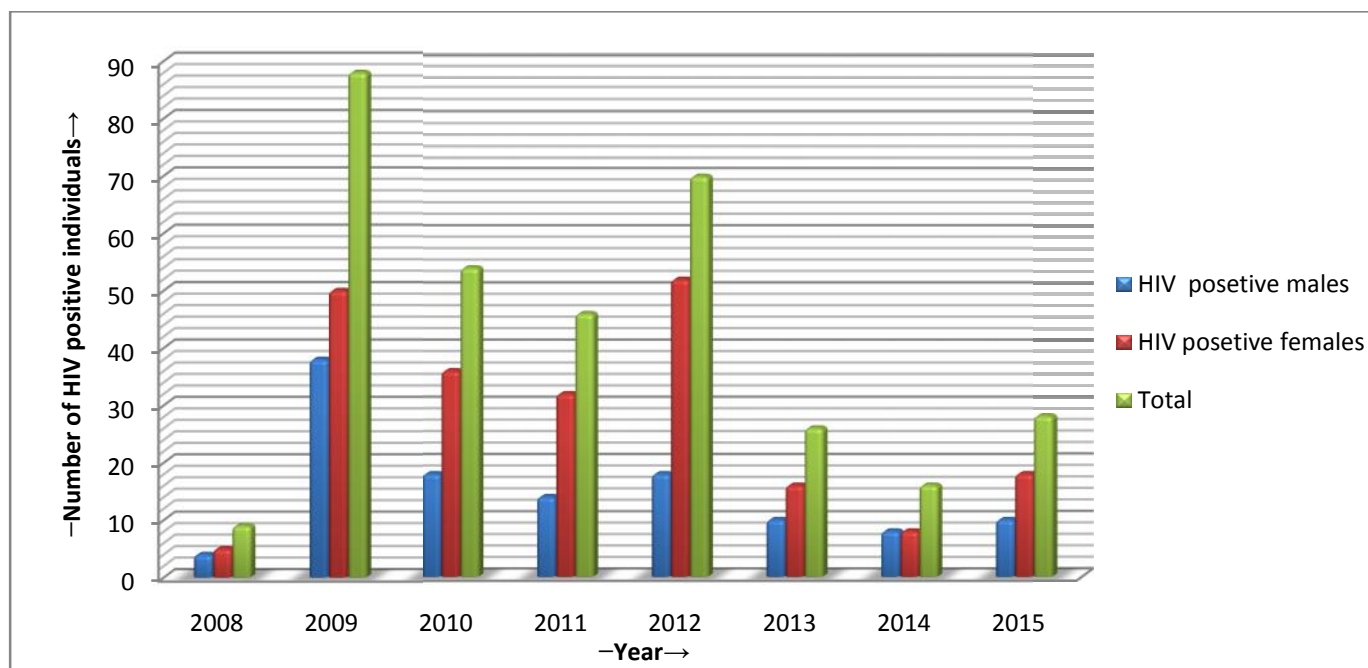


Figure 8. Graph showing the number of HIV positive individuals based on the data collected from the FGAE-Asella branch clinic (2008-2015).

Table 8. Number of individuals screened for HIV in different age groups in Family Guidance Association of Ethiopia (FGAE)-Asella branch Clinic.

Age	2008		2009		2010		2011		2012		2013		2014		2015	
	M	F	M	F	M	F	M	F	M	F	M	F	M	F	M	F
0-14	3	7	14	32	12	25	33	41	47	23	55	32	43	61	8	9
15-49	31	41	402	544	360	552	433	607	878	1220	510	653	444	489	555	499
>50	5	3	111	109	39	68	54	62	97	85	47	71	101	94	34	39
Total	39	51	527	685	411	645	520	710	1022	1328	612	756	588	644	597	547

Rehoboth Hospital is a privately owned hospital located in Asella town and was founded recently three years ago. Within these years about 7,382 individuals were tested for HIV and only 160 (2.17%) of them were HIV positive out of which 81 of them were males and 79 of them were females. The data from this hospital shows that the disease is more prevalent in males (3.07%) than in females (1.67%). The percentage of HIV positives fluctuates from 3.81% to 1.19% and then to 3.22% between 2013 and 2015 (Table 9).

Table 9. Number of individuals tested positive for HIV (2013-2015) in Rehoboth Hospital (Asella).

Year	Total Number of screened individuals			Number of HIV positive individuals.		Percent of HIV positive	Total	Total Percentage (%)
	M	F		M	F			
2013	M	780	1,491	M	23	2.95	45	3.01
	F	711		F	22	3.09		
2014	M	1,321	3,691	M	22	1.67	44	1.19
	F	2,370		F	22	0.91		
2015	M	541	2,200	M	36	6.65	71	3.22
	F	1,659		F	35	2.11		
Total	M	2,642	7,382	M	81	3.07	160	2.17
	F	4,740		F	79	1.67		
Average	M	880	2460.7	M	21	2.39	53.33	2.17
	F	1580		F	26.3	1.65		

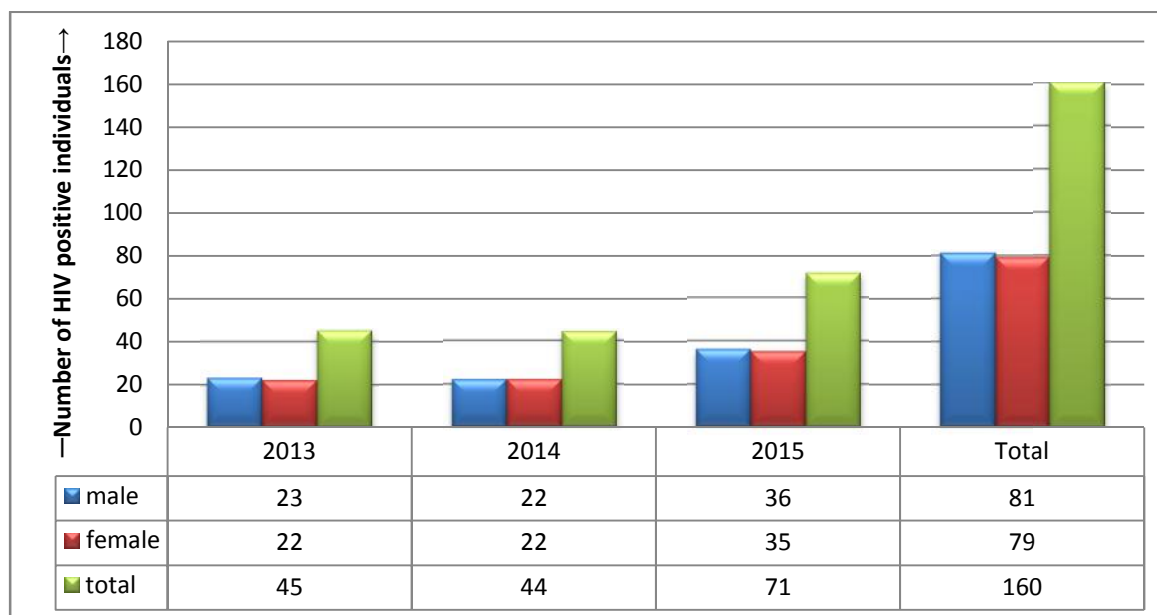


Figure 9. Number of HIV positive individuals in Rehoboth Hospital (2013-2015)

The HIV positive individuals from Rehoboth Hospital were grouped into three age categories. It is indicated that the sexually active age groups (15-49) are affected most (78.75%) indicating the disease is transmitted mainly through sexual contact while children and old people are less affected, 8.75% and 12.5% respectively (Table 10).

Munessa woreda, Kersa Health Center, is found about 60 kilometers south west of Asella. Five years clinical data was collected and 6,462 individuals tested (3,931 males and 2,531 females) of which 170 of them were HIV positive. The positivity rate is higher in females (3.28%) and relatively lower in males (2.21%) with an average annual prevalence of 2.63% (Table 13 and Table 14).

Table 13. *Number of individuals tested for HIV in Munesa woreda, Kersa health center (2011-2015).*

Year	Male				Female			
	0-14yrs	15-49yrs	>50yrs	Total	0-14yrs	15-49yrs	>50yrs	Total
2011	12	254	162	428	10	206	146	362
2012	18	342	196	556	9	255	190	454
2013	14	542	324	880	6	266	316	588
2014	22	564	396	982	8	301	214	523
2015	19	652	414	1085	13	408	183	604
Total	85	2354	1492	3931	56	1436	1049	2531
Average	17	470.8	298.4	786.2	11.2	287.2	209.8	506.2

Table 14. *Number of individuals tested positive for HIV in Munesa woreda, Kersa health center (2011-2015).*

Age	2011		2012		2013		2014		2015		Total			Average	
	M	F	M	F	M	F	M	F	M	F	M	F	T	M	F
0-14	0	0	1	1	0	0	1	0	0	0	2	1	3	0.4	0.2
15-49	6	2	14	9	12	14	22	17	16	18	70	60	130	14	26
>50	1	0	3	6	6	8	3	5	2	3	15	22	37	3	4.4
<i>Total</i>	7	2	18	16	18	22	26	22	18	21	87	83	170	17.4	16.6

A seven years annual clinical data from Robe woreda, Robe health center was collected and analyzed. The prevalence rate shows a decreasing trend from 2.23% in 2010 to 0.78% in 2015 with an average prevalence rate of 1.35%. In this woreda also females are more affected (1.74%) than males (1.05%) (Table 15).

Table 15. Number of individuals screened for HIV and the number of HIV positive individuals in Robe woreda, Robe Health Center (2009-2015).

Year	Total number of screened individuals			Number of HIV positive individuals		Percent of HIV positive	Total No of HIV positive	Prevalence (Percentage)
	M	F	Total	M	F			
2009	M	957	2,004	M	7	0.73	19	0.95
	F	1,047		F	12	1.15		
2010	M	2,805	4,657	M	43	1.53	104	2.23
	F	1,852		F	61	3.29		
2011	M	2,119	3,720	M	10	0.47	27	0.73
	F	1,601		F	17	1.06		
2012	M	1,152	1,881	M	18	1.56	40	2.13
	F	729		F	22	3.02		
2013	M	810	1,386	M	9	1.11	20	1.44
	F	576		F	11	1.91		
2014	M	1,030	1,720	M	14	1.36	24	1.39
	F	690		F	10	1.45		
2015	M	2,231	4,485	M	16	0.72	35	0.78
	F	2,254		F	19	0.84		
Average	M	1586.3	2836.1	M	16.7	1.05	38.43	1.35
	F	1249.9		F	21.7	1.74		

About 5,535 individuals (3,051 males and 2484 females) were screened for HIV in Shirka woreda, Gobessa Health Center and 270 of them were tested positive for HIV (90 males and 180 females).

Table 16. Number of individuals tested for HIV and the number of HIV positive individuals in Shirka woreda, Gobesa health center (2012-2015).

Year	Number of individuals screened		Total	Number of HIV Positive individuals		Total number of HIV positive	% of HIV positive	Total Percentage (%)
	M	F		M	F			
2012	M	927	1700	M	23	64	2.48	3.76
	F	773		F	41		5.30	
2013	M	981	1653	M	28	90	2.85	5.44
	F	672		F	62		9.23	
2014	M	632	1213	M	22	68	3.48	5.61
	F	581		F	46		7.92	
2015	M	511	969	M	17	48	3.33	4.95
	F	458		F	31		6.77	
Total	M	3051	5535	M	90	270		
	F	2484		F	180			
Mean	M	762.75	1383.75		22.5	67.5	2.95	4.88
	F	621			45		7.25	

The nine years data from Dera Health Center, Dodota woreda shows that females are affected more than males. For example, out of the 45,268 individuals tested for HIV 542 of them was females and 328 of them were males and the prevalence rate of the woreda is 1.92% (Table 17).

Table 17. Number of individuals tested for HIV and the number of HIV positive individuals in Dera Health Center, Dodota Woreda (2007-2015).

Year	Number of tested			Number of HIV Positive			Percentage of HIV positive		
	M	F	T	M	F	T	M	F	T
2007	1205	1219	2424	69	106	175	5.73	8.69	7.22
2008	1285	1473	2758	66	103	169	5.14	6.99	6.13
2009	2666	2999	5665	35	84	119	1.13	2.80	2.10
2010	2211	2604	4815	35	75	110	1.58	2.88	2.28
2011	4346	3989	8335	41	67	108	0.94	1.68	1.29
2012	2633	3742	6375	29	44	73	1.10	1.17	1.15
2013	1553	1700	3253	9	10	19	0.60	0.59	0.58
2014	3197	5024	8221	26	40	66	0.81	0.80	0.80
2015	1061	2361	3422	8	13	21	0.75	0.55	0.61
Mean	2239.67	2790.1	5029.78	36.44	60.22	96.67	1.63	2.16	1.92

In Jeju Health Center, Jeju woreda, 1198 individuals were screened within three years between 2013-2015 and only 17 of them were tested positive (3 males and 14 females). The prevalence rate of the woreda is 1.42%. Like all the other woredas, here also females are affected most (Table 18).

Table 18. Annual data of HIV tested and HIV- positive individuals in Jeju Health Center, Jeju Woreda (2013-2015)

Year	Number of tested individuals			Number of HIV positive individuals			Percentage of HIV Positive		
	Male	Female	Total	Male	Female	Total	Male	Female	Total
2013	240	307	547	3	11	14	1.25	3.58	2.56
2014	120	175	295	0	3	3	0.00	1.71	1.02
2015	165	191	356	0	0	0	0.00	0.00	0.00
Total	525	673	1198	3	14	17			
Mean	175	224.33	399.33	1	4.67	5.67	0.57	2.08	1.42

Huruta Health Center, Lode Hitosa woreda, is one of the woredas of Arsi zone. 4,085 individuals were tested for HIV (1,202 males and 2,883 females) between 2014 and 2015. From these only 40 of them were HIV positive (12 males and 28 females) with an average prevalence of 0.98% (Table 19).

Table 19. Annual data of HIV tested and HIV- positive individuals (2014-2015) in Huruta Health Center (Lode Hetosa Woreda).

Year	Number of individuals tested for HIV			Number of HIV positive individuals			Percentage of HIV positive individuals		
	M	F	T	M	F	T	M	F	T
2014	430	1169	1599	6	20	26	1.39	1.71	1.63
2015	772	1714	2486	6	8	14	0.78	0.47	0.56
Total	1202	2883	4085	12	28	40			
Mean	601	1441.5	2042.5	6	14	15	1.00	0.97	0.98

Only one year data was obtained from Hamda Diksis Health Center, Diksis woreda. In this year, 454 individuals were screened and only 7 (seven) of them were HIV positive. And the average HIV prevalence of the woreda is 1.54% (Table 20).

Table 20. Annual data of HIV tested and HIV- positive individuals in Hamda Diksis Health Center (Diksis Woreda).

Year	Number of individuals tested for HIV			Number of individuals tested HIV positive			Percentage of the HIV positive individuals		
	M	F	T	M	F	T	M	F	T
2015	230	224	454	4	3	7	1.74	1.34	1.54

Table 21. Annual data of HIV tested and HIV- positive individuals in Habura Health Center (Ziway dugda Woreda).

Year	Number of individuals tested for HIV			Number of individuals tested HIV positive			Percentage of the HIV positive individuals		
	M	F	T	M	F	T	M	F	T
2014	106	347	453	0	0	0	0	0	0
2015	286	490	776	0	0	0	0	0	0
Mean	196	418.5	614.5	0	0	0	0	0	0

A very large number of individuals were screened for HIV (73,280) between 2010 and 2015 in Tiyo woreda and 884 of them were tested HIV positive (325 males and 559 females). This result shows females are affected more than males and the woreda's HIV prevalence rate is 1.21% (Table 22).

Table 22. Annual data of HIV tested and HIV- positive individuals in Asella Health Center (Tiyo Woreda).

Year	Number of individuals tested			Number of Positive individuals			Percentage of HIV positives		
	M	F	T	M	F	T	M	F	T
2010	8823	6557	15380	46	168	214	0.52	2.56	1.39
2011	5723	5650	11373	84	118	202	1.47	2.09	1.78
2012	8118	7639	15757	76	99	175	0.94	1.23	1.11
2013	7667	5996	13663	51	73	124	0.66	1.21	0.90
2014	6381	7333	13714	48	72	120	0.75	0.98	0.87
2015	1842	1551	3393	20	29	49	1.08	1.86	0.44
Total	38,554	34,726	73,280	325	559	884			
Mean	6425.67	5787.67	12213.35	54.17	93.17	147.33	0.84	1.61	1.21

Bokoji Health Center (Limu and Bilbilo Woreda) is about 60 kilometers south of Asella. Two years annual clinical data (2014-2015) was collected and 4,469 individuals tested (1,645 males and 2,824 females). Thirteen of the clients were HIV positive and the woreda's average annual prevalence rate is 0.29%.

Table 23. Annual data of HIV tested and HIV- positive individuals in Bokoji Health Center (Limu and Bilbilo Woreda).

Year	Clients receiving HIV test results at PIHCT			Clients Testing positive for HIV			Percentage of HIV Positives		
	M	F	T	M	F	T	M	F	T
2014	615	1193	1808	3	4	7	0.49	0.34	0.39
2015	1030	1631	2661	3	3	6	0.29	0.18	0.23
Total	1645	2824	4469	6	7	13			
Average	822.25	1412	2234.5	3	3.5	6.5	0.36	0.25	0.29

Bokoji Hospital is a new hospital and only one year data was collected. 3534 clients (830 males and 2704 females) received HIV test and only 13 of them were HIV positive. The percentage of HIV positives was 0.72% for males and 0.26% for females (Table 24).

Table 24. Annual data of HIV tested and HIV- positive individuals in Bokoji Hospital (Limu and Bilbilo Woreda).

Year	Clients receiving test results at PIHCT			Clients Testing positive for HIV			Percentage of HIV Positives		
	M	F	T	M	F	T	M	F	T
2015	830	2704	3534	6	7	13	0.72	0.26	0.37

The overall results of the fourteen woredas are summarized as follows. Three health institutions found in Asella town are grouped together (Asella Hospital, Rehoboth Hospital and FGAE-Asella branch Clinic). In these health institutions a total of 71,138 individuals were screened and 3,575 of them tested positive with 5.03% average HIV prevalence of the town. Similarly, Bokoji Hospital and Bokoji Health Center are found in Bokoji town and the average HIV prevalence rate of the woreda is 0.32%. Two woredas, Hetosa (Eteya) and Sire, were not included in the study because they were unwilling to provide the necessary data.

Generally, in the twelve woredas a total of 269,398 individuals were tested (133,482 males and 135,916 females) and 6,123 of them were HIV positive (2,384 males and 3,739 females) and the average annual HIV prevalence rate of the zone is 2.27% (Table 25).

Table 25. Table showing summary of individuals tested for HIV and HIV positive individuals in the fourteen woredas of Arsi zone between the times 2006-2015.

Woreda/ Health institution	Number of screened individuals		Total	Number of HIV positive individuals		Total number of HIV positive	Percent of HIV positive
Asella (Asella hospital + Rehoboth + FGAE)	M	35,574	71,138	M	1,406	3,575	5.03
	F	35,564		F	2,169		
Tiyo	M	38554	73,280	M	325	884	1.21
	F	34726		F	559		
Digelu and Tijo (Sagure)	M	16291	32,891	M	10	25	0.08
	F	16606		F	15		
Robe	M	11104	19,853	M	117	269	1.35
	F	8749		F	152		
Shirka/Gobesa	M	3051	5,535	M	90	270	4.88
	F	2484		F	180		
Jeju	M	525	1,198	M	3	17	1.42
	F	673		F	14		
Munesa/Kersa	M	3931	6,462	M	87	170	2.63
	F	2531		F	83		
Lode Hetosa	M	1202	4,085	M	12	30	0.73
	F	2883		F	28		
Diksis	M	230	454	M	4	7	1.54
	F	224		F	3		
Ziway Dugda	M	392	1,229	M	0	0	0.00
	F	837		F	0		
Dodota/Dera	M	20153	45,268	M	318	860	1.90
	F	25111		F	542		
Bekoji Hopital & Bokoji Health center	M	2475	8003	M	12	26	0.32
	F	5528		F	14		
Eteya	M	---	---	M	---	---	---
	F	---		F	---		
Sire	M	---	---	M	---	---	---
	F	---		F	---		
Total	M	133,482	269,398	M	2,384	6,143	1.74
	F	135,916		F	3,759		
Average	M	11123.5	22449.83	M	198.67	511.92	1.74
	F	11326.33		F	313.15		

Key:* Data not collected because the health centers were unwilling to provide the necessary information.

Report

	Screened females	Screened males	Total no of screened	HIV Positive males	HIV Positive females	Total no of HIV positive	Percent of HIV positives
Mean	11326.33	11123.50	22449.68	198.67	313.23	511.15	1.7431
N	13	13	13	13	13	13	13

5.2. Testing the hypothesis using the Student's t-test

$$T_{cal} = X - \mu / s / \sqrt{n}$$

$$T_{tab} = \frac{\alpha}{2(n-1)}$$

Where μ = hypothesis mean

S = standard deviation

N = number of samples

X = mean

α = confidence interval

n-i = degree of freedom

If $T_{cal} \geq T_{tab}$, reject else accepted.

T-Test

T-TEST

```

/TESTVAL=1.5
/MISSING=ANALYSIS
/VARIABLES=percent of HIV positive
/CRITERIA= CI (.95).

```

[DataSet1] C:\Users\User\Desktop\spss data.sav

One-Sample Statistics

	N	Mean	Std. Deviation	Std. Error Mean
Percent of HIV pos	13	1.7431	1.61928	.44911

One-Sample Test

	Test Value = 1.5					
	t	df	Sig. (2-tailed)	Mean Difference	95% Confidence Interval of the Difference	
					Lower	Upper
Percent of HIV pos	.541	12	.598	.24308	-.7354	1.2216

At 95% level of confidence there is no evidence to reject the hypothesis that the percentage of HIV positive individuals in the study area is 1.74%. Because the value of $t_{\text{calculated}}$ is less than the value of $t_{\text{tabulated}}$ (i.e. 0.596 is greater than 0.541).

The total number of individuals tested for HIV in the twelve woredas of Arsi zone is also summarized as follows. As it is indicated in the figure, Tiyo, Asella, Dodota and Digelu and Tijo (Bokoji) have the highest population of HIV tested because they are relatively bigger towns (Figure 10).

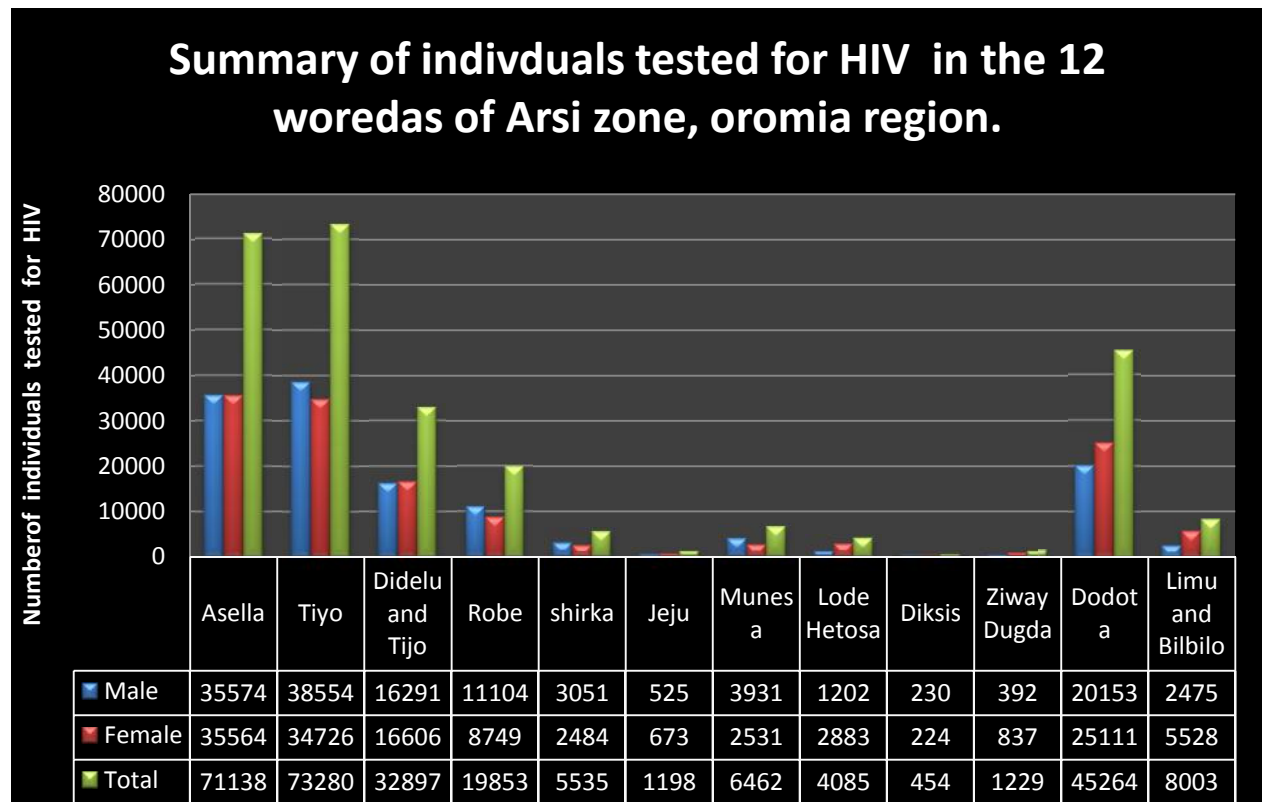
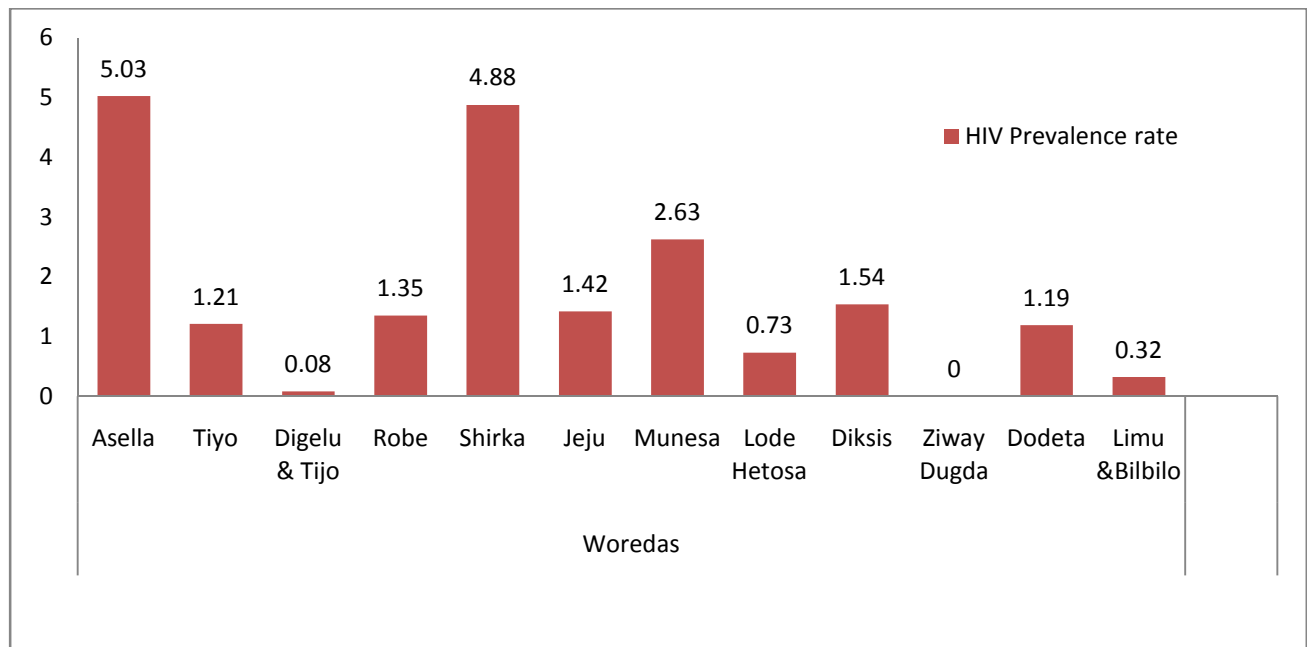


Figure 10. Summary of individuals screened for HIV in the study areas (in the twelve woredas).



Year	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	Total
Number of individuals using ART	720	852	710	634	529	387	434	444	295	206	5211

6. Discussion

The ten years quantitative data (2006-2015) collected from Asella Hospital VCT center showed that out of the 54,014 individuals tested for HIV, only 3,068 of them were HIV positive. This shows that:-

-there is a continuous reduction in the percentage of positivity rate of HIV every year; that is from 11.4% in 2006 to 4.69 in 2015 with an average prevalence rate of 5.68%. This reduction of the positivity rate could be because the level of awareness of the population has increased through time and the number of HIV positive individuals was at its peak in the years between 2007 and 2008.

-the HIV prevalence rate is relatively low. This may be also due to increased level of awareness of the community.

The result of the study also shows that females are affected more than males. Because in all of the years; the percentage of HIV positive females is almost twice of the males.

According to this study, individuals of 15-49 of age groups are affected most (70.24%) because age affects the prevalence of the epidemic as most young people are rushing to sex and practicing unsafe sex due to their puberty age. Their economic status and knowledge about the epidemic also contributes to the higher prevalence level of HIV infection. For example, youth are more attracted to money specially if they are poor and have inadequate information about the disease.

The disease was more prevalent in the divorced and widowed individuals. So, marital status also affects the transmission of the epidemic through acquiring new sexual partners and less autonomy. For example, married girls have higher levels of sexual activity than their sexually active unmarried peers, and they have also limited ability to negotiate condom use and have low power to refuse sex with their partner.

Individuals of all ages were tested for HIV in the Family Guidance Association of Ethiopia Asella branch clinic but the number of females screened is greater in all years. The reason for this could be the frequency of visiting health institutions is much greater in females than are males because this health institution is mainly concerned with sexual reproductive health (SRH) issues of females (Table 7 and Figure 8). Eight years quantitative data (2008-2015) was collected and analyzed. An average number of 1217.8 individuals have been screened per year and only 42.12 of them were HIV positive in each year (i.e. only 3.46%). This result also shows that:-

-the HIV prevalence rate is low.

-there is substantial reduction of prevalence each year (from 10% in 2008 to 2.45% in 2015).

-females are more affected than males (64.40% females and 35.60% males)

Individuals who made test for HIV in Rehoboth Hospital came from the other woredas around the main town (Asella) because this hospital has new and modern medical and laboratory instruments. Out of the 160 HIV positive individuals 42 of them were from Asella town and 118 of them (73.75%) were from the towns found in the main road areas where many track drivers, merchants and passengers pass along. This means the indicated HIV prevalence rates does not necessarily imply the prevalence rate of that particular area since people usually make HIV tests out of their living areas due to fear of discrimination. The three years quantitative data collected from this hospital showed that out of the total of 7,382 individuals screened for HIV only 160 of them (2.17%) were HIV positive (1.67% females and 3.07% males). From the result it can be concluded that HIV prevalence is much greater in urban areas than the rural areas and males are more vulnerable than females.

The results from the other health institutions in the different woredas are analyzed as follows. Asella Health Center, Tiyo woreda, is found in Asella town. In this Health Center, because people come from nearby woredas, a very large number of individuals were screened for HIV. A six years clinical data was collected from Asella Health Center (Tiyo Woreda). A total of 73,280 individuals were tested for HIV between 2010- 2015. Out of these, 884 of them were tested HIV positive (325 males and 559 females) with 0.84% males and 1.6% females and 1.21% annual prevalence rate. This result showed that females are affected almost twice as compared to the males (table 22).

A five years data (2011-2015) was collected from Sagure Health Center. 16,291 males and 16,606 females were tested for HIV and only 10 males (0.06%) and 15 females (0.09%) were tested positive for HIV with the average positivity rate of the woreda about 0.08%. This value seems low but the truth is, people who need HIV test and sick individuals of this woreda usually go to Asella for medical treatment because it near, only 25 Kilometers, and also specialized doctors are found there.

A five years annual clinical data from 2011 to 2015 was also gathered from Kersa Health Center, Munesa woreda. An average number of 786.2 males and 506.2 females were tested for HIV in these years and 17.4 males and 16.6 females were tested positive with a 2.21% and 3.28% prevalence rate respectively and the woreda's prevalence rate of 2.63%. In this woreda also females are affected more than males by the epidemic.

An average number of 2,836.1 individuals were tested annually for HIV in Robe woreda and only 38.43 of them were tested positive. The HIV prevalence rate in males is 1.05% and that of females is 1.74% and the average prevalence rate of the woreda is 1.35%. The disease is less prevalent in males and there is a decreasing trend of HIV especially from 2012 to 2015.

The HIV prevalence rate of shirka woreda, Gobessa health center was also determined. 5,535 clients were tested for HIV and 270 of them were HIV positive (90 males and 180 females). The prevalence rate for the males is 2.95% and that of the females is 7.25% with the woreda's

average prevalence rate of 4.88%. In this woreda the prevalence rate is high next to Asella town (table 16).

From Dodota woreda, Dera Health Center a nine years clinical data (2007- 2015) was collected. About 45,268 individuals were tested (20,157 males and 25,111 females). Out of these, 870 of them were HIV positive with 1.63% and 2.16% prevalence rate of males and females respectively. Annually, about 96.67 infections occurred in the woreda. The prevalence rate decreased from 7.22% in 2007 to 0.61 in 2015 and the average annual prevalence of the woreda is 1.92%.

A three years data from Jeju Health Center, two years data from Huruta Health Center, and a one year data from Diksis Health Center was also collected and analyzed and the average annual HIV prevalence rate is 1.42%, 0.73%, and 1.54% respectively.

In Habura Health Center, Ziway Dugda woreda, the two years annual clinical data shows that none of the individuals were HIV positive. But this result seems unreal because in the current trend, no part of the country is expected to be 100% free from the HIV/AIDS epidemic and the researcher believes that there may be a data management problem in the woreda or a problem in the accuracy of HIV testing kit/chemicals or experienced technician (Table 21).

Data was also gathered from Bokoji Hospital and Bokoji Health Center (Limu and Bilbilo woreda). About 8003 individuals were screened from both health institutions between 2014 and 2015. 12 males and 14 females were tested positive with a total HIV positivity rate of 0.32%. This rate seems very low because this woreda is near to Asella and therefore many residents of the town usually go to Asella for medical treatment (Table 23 and 24). There are currently 13 individuals (6 males and 7 females) on ART in Bokoji Hospital.

In the twelve woredas, a total of 269,398 individuals were tested (133,482 males and 135,916 females) and 6,123 of them were HIV positive (2,384 males and 3,739 females) and the average annual HIV prevalence rate of the zone is 1.74% (Table 25).

Generally, in almost all of the woredas discussed above, the prevalence rate of females is greater than the males. A comparison between the twelve woredas also showed that the disease is more prevalent in Asella (5.03%) followed by Shirka (4.88%) and Kersa (2.63%) and least in Ziway Dugda, Sagure, Bokoji and Lode Hitosa with a prevalence rate of less than 1%.

7. Conclusion

The following may be concluded from the study:

1. HIV/AIDS is one of the major health problems in the zone.
2. The result of the retrospective data record revealed a decreasing trend of HIV prevalence rate in the study area.
3. The estimated HIV prevalence rate in the study area 1.74% which is relatively higher than the country's average prevalence rate. The reason for such a relatively high prevalence is because most people have more sexual partners due to religious and cultural reasons and the level of awareness of the population is low especially in the rural areas.
4. Students, youth, divorced people and mobile workers are among the most vulnerable groups in the study area.
5. Females are affected most than males and people of age 15-49 are most affected by HIV. Out of the 6,123 HIV positive individuals, 3739 of them were females (61.06%) and 2384 of them were males (38.94 %).
6. The educational status of the most affected people in the study area was from elementary to high school. The likelihood of being HIV positive is higher for less educated individuals than more educated individuals.
7. The likelihood of infection is higher for urban than for rural residents. For example, in Asella the prevalence rate is 5.03% and in the remote woredas it is less than 1%.
8. Economically poor individuals have higher likelihood of acquiring HIV/AIDS than economically rich individuals.
9. Although people of age 15-49 are affected most, younger age groups are more vulnerable to HIV infection than older ones.
10. The most affected individuals were single, divorced, and widowed and a few of them were married. This problem is still a major issue because sexual activity often starts at a relatively young age, people often have more than one sexual partner, and although there is access of health care services, people infected with STIs/STDs do not visit these local health centers because of fear of stigma and discrimination.

8. Recommendations

From the results of the retrospective quantitative data analysis, I would like to suggest the following points.

1. Even though the trend of HIV prevalence in the study area shows that it is decreasing, efforts must be made to further decrease its prevalence through health education about the transmission, prevention and control of the disease.
2. Strengthening School anti AIDS clubs is necessary. This is because more than 24% of the country's population is found in the education sector as students, teachers, and non staff (*Education sector Annual Abstract, 2008*). This large number of sectoral community represents a strategic avenue to the national response to HIV prevention, treatment, care and support as well as reduction of stigma and discrimination. Furthermore, at least 75% of learners are within the reproductive age group and thus at high risk of HIV infection.
3. HIV/AIDS education which is already incorporated with certain subjects should be given attention and be included in all subjects in the school curriculum. This helps to raise the knowledge and awareness level of the students and hence their families.
4. Educating the public (students, office workers, drivers, merchants, farmers, etc.) to prevent themselves and their families from the danger of HIV and AIDS is also very important. Because educating people increases their level of awareness by perceiving different information through reading. Educated people are also capable of applying safety methods. On the other hand uneducated people have limited access to information concerning the way the disease is transmitted and its preventive methods.
5. Strengthening governmental and Nongovernmental Organizations (NGOs) which are involved in health related sectors by fulfilling all necessary medications and equipments is important.
6. Because poverty enhances the vulnerability of contracting HIV through increased movement of people from one place to another searching for job, it would be good if all stakeholders create job opportunity or create income generating activities at/around the living areas to increase the level of income of the community. Because, migrant workers are at high risk of HIV infection because they stay away from their families and this increases the chance of establishing new relationships with others (to have many sexual partners).
7. Combat harmful cultural practices, values and traditions which have strong influences on the visible aspects of individual behaviors which in turn influence their vulnerability to disease. In the case of women, they are exposed to the disease through traditional practices such as female genital mutilation, husband sharing, early marriage, and condoning of gender based violence.
8. Combat all unsafe traditional practices (such as female circumcision, tattooing, ear and skin piercing) that aggravate the transmission of HIV/AIDS within the community

9. All public and private institutions should be responsible for establishing effective professional counseling services with the view of strengthening the psychological and physical wellbeing of orphans and vulnerable children (OVC).

In general, local communities, religious leaders, parents, care givers, guardians and other stakeholders need to mobilize support through financial, human and material resources. This will contribute to the successful implementation of HIV/AIDS prevention response activities.

9. Limitations

1. Persons who are infected with HIV might not be aware they are infected. Therefore, in many cases, testing is not done. On the other hand, although some people suspect that they might be infected, they do not make checkups because of fear, stigma and discrimination, other psychological factors, lack of resources to provide testing or inadequate voluntary HIV testing and counseling services.
2. The data collected for the study was limited to only three hospitals and fourteen health centers found in the zone. If its coverage was wider than this the result would have been changed and a more accurate result would have been obtained.
3. There is also limited access of HIV testing kit in most of the health institutions. Because of this HIV test is not given especially in the remote areas of the zone.
4. Some health institutions were unwilling to provide me with the necessary information or data and in others there is no sufficient document or have poor method of documentation.

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11. Appendices and Glossaries

11.1 Appendix

Appendix A

ADDIS ABABA UNIVERSITY

FACULTY OF NATURAL SCIENCES

SCHOOL OF GRADUATE STUDIES

Data collecting format

Region: OROMIYA

Name of health institution _____

Zone: ARSI

Woreda: _____

Date of data collection: _____

The purpose of this data collecting format is to gather information on the HIV/AIDS prevalence in Arsi zone, oromia region and assess the trends of the epidemic patterns, understand the burden of the disease, generate reliable information, and draw recommendations that may assist to improve the service and control the epidemic. This data is used to write a master's thesis in biology in AAU. Therefore, you are kindly requested to fill this format with the correct information. Your accurate and reliable information are appreciated for the achievement of the objectives of the research.

Year	Total number of individuals screened						Number of individuals tested positive						Remark		
	Male			Female			Total	Male			Female			Total	
	0-14 yrs	15-49 Yrs	50 & above	0-14 Yrs	15-49 yrs	50 & above		0-14 yrs	15-49 Yrs	50 & above	0-14 yrs	15-49 yrs			50 yrs & above

Appendix B

ADAMA SCIENCE AND TECHNOLOGY UNIVERSITY

Monthly Survey Reporting Form

Facility Type _____

N ^o	Clients receiving HIV test results at VCT	Total number
	15-19 years: males	
	:females	
	20-24 years: males	
	:females	
	25-49 years: males	
	:females	
	>=50 years: males	
	:females	
	Clients testing positive for HIV at VCT	
	15-19 years: males	
	:females	
	20-24 years: males	
	:females	
	25-49 years: males	
	:females	
	>=50 years:males	
	:females	

Completed by _____

Signature _____

Date _____

Note that Asella Hospital is under Adama Science and Technology University.

Appendix C

HEALTH CENTER/CLINIC/HOSPITAL MONTHLY SERVICE DELIVERY REPORT FORM

Woreda _____

Health center/Hospital _____

Year _____ Quarter _____

	HIV/AIDS VCT Clients receiving pre test counseling				
	0-14 years: Males				
	Females				
	15-24 years: Males				
	Females				
	>=25 years: Males				
	Females				
	Clients receiving HIV test				
	0-14 years: Males				
	Females				
	15-24 years: Males				
	Females				
	>=25 years: Males				
	Females				
	Clients testing positive for HIV				
	0-14 years: Males				
	Females				
	15-24 years: Males				
	Females				
	>=25 years: Males				
	Females				
	PIHCT Clients receiving PIHCT Counseling				
	0-14 years: Males				
	Females				

Cont'd....

15-24 years: Males				
Females				
≥25 years: Males				
Females				
Clients receiving HIV test				
0-14 years: Males				
Females				
15-24 years: Males				
Females				
≥25 years: Males				
Females				
Clients testing positive for HIV				
0-14 years: Males				
Females				
15-24 years: Males				
Females				
≥25 years: Males				
Females				

Completed by _____

Signature _____

Date _____

11.2 Glossary

Acquired immunodeficiency syndrome (AIDS) - Is a disease that occurs when the immune system is weakened by HIV to the point where a person is susceptible to any number of opportunistic infections or diseases.

Antiretroviral (ARV) - Refers to the type of drug that works by interfering the replication of HIV.

Cryptococcal Meningitis- is a fungal infection of the membranes surrounding the brain and spinal cord.

Cytomegalovirus (CMV) is a herpes virus that can cause infections in most organs of the body although PLWHA are more susceptible to CMC retinitis, which can lead to blindness.

Diarrhea- Is the passing of more than four loose or watery stools per day for more than three days.

Dysphagia - Difficulty in swallowing.

Dyspnea- Labored or difficulty in breathing due to pulmonary diseases, vigorous physical activity, anemia or cardiac diseases.

Epidemic- Is the appearance of a disease in a high proportion not expected for a community in a geographical area.

Highly active antiretroviral therapy (HAART) - Is a modality of ART that involves the use of three or more ARVs in a single regimen. This therapy helps to slow the growth of HIV in the body by interfering with the ability of the virus to replicate, which allows the body's immune system to maintain or recover its ability to produce the white blood cells necessary to respond to opportunistic infections.

Human immunodeficiency virus (HIV) - Is the virus that causes AIDS.

Incidence- refers to the number of people in a population who developed a certain disease in a specific time. It is the number of new cases arising and is an indicator of the spread of a disease.

Odynophagia - Painful swallowing.

Opportunistic Infections (OPs) –Are illnesses caused by organisms that do not usually cause diseases in persons with healthy, functioning immune system.

Pandemic - Worldwide epidemic distribution of a disease such as HIV/AIDS.

Post Exposure Prophylaxes (PEP) - Is a short term Anti retroviral treatment that reduces the risk of HIV/AIDS infection.

Prevalence- refers to the total number of people in a population that developed the disease at a specified time regardless of when it is first appeared. It takes into account both old and new infections (cases). It is an indication of how seriously and how long a disease affects a population.

Syndrome - A combination of signs/symptoms that forms a distinct clinical picture indicative of the particular disorder.

Tuberculosis (TB) is a bacterial infection that attacks the lungs and can cause meningitis.

Vulnerability- Is the condition determined by physical, social, economic and environmental factors or processes, which increase the susceptibility of a community or group to the impact of hazards.