A Survey on Knowledge and Awareness of HIV/AIDS Among Slum Dwellers of Bangladesh

A Dissertation Submitted to The Department of Pharmacy,
East West University, Bangladesh, in Partial Fulfillment of The
Requirements for The Degree of Bachelor of Pharmacy

Submitted By

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I, **Sharif Mohammad Shad**, ID: 2013-1-70-045, hereby declare that the dissertation entitled- "**A Survey on Knowledge and Awareness of HIV/AIDS among slum dwellers of Bangladesh**" submitted by me to the Department of Pharmacy, East West University in partial fulfillment of the requirement for the award of the degree of Bachelor of Pharmacy is a record of research work under the supervision and guidance of **Nishat Nasrin**, Assistant Professor, Department of Pharmacy, East West University, Dhaka.

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Certificate by The Supervisor

This is to certify that the thesis entitled "**A Survey on Knowledge and Awareness of HIV/AIDS among slum dwellers of Bangladesh**" submitted to the Department of Pharmacy, East West University for the partial fulfillment of the requirement for the award of the degree Bachelor of Pharmacy is a bonafide record of original and genuine research work carried out by **Sharif Mohammad Shad**, ID: 2013-1-70-045 in 2016, under the supervision and guidance of me.

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Certificate by The Chairperson

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Dedication

This Research Paper is Dedicated to My Beloved Niece
“Raya”

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Abstract

HIV/AIDS is one of the most destructive diseases humankind has ever faced. It brings with it profound social, economic and public health consequences. It has become one of the world's most serious health and development challenges. Slum people are at high risk of HIV and AIDS infections due to their poor knowledge about the disease and its mode of transmission. Therefore, awareness is needed to control and prevent the transmission of HIV/AIDS. This study was aimed to assess slum dweller's knowledge about HIV, it's mode of transmission, control and prevention and attitude towards HIV infected person. It was a survey based study where 569 slum dwellers (both male and female) from Vashantek, BRP and Kalshi slum were interviewed with a pre structured questionnaire. All the respondents were above the age 18 and they have heard about HIV/AIDS. According to 78.56% of the respondents, HIV/AIDS can be transmitted through unprotected sex and from mother to fetus. About 75.57% respondents seem that HIV/AIDS can be transmitted through blood transfusion or by sharing infected needle. Majority of them have little knowledge or misconception about the mode of transmission like mosquito bite (49.74%), eating or drinking from same glass or plate (39.54%) and wearing same dress (36.38%). From the study 76.10% of the respondents think that using condom can be a mode of prevention of AIDS whereas 72.41% think by avoiding needle sharing and 72.41% think by increasing knowledge and awareness can help to prevent AIDS. Most participants showed positive attitude towards infected person. After analysis the data it has been shown that 71% of them wanted to take care in home or community and 74% participants told that they would like to continue relationship with the patient. Since only three slums (Vashantek, BRP and Kalshi) cannot reflect the overall view of the whole country, further research work should be carried out with more number of slum area and it is also important to increase the level of knowledge and awareness about HIV/AIDS; so that misconceptions don't arise among the slum dwellers.

Key Words: HIV/AIDS; knowledge; Mode of Transmission; Prevention; Attitude; Slum Dwellers; Bangladesh

Chapter 1

Introduction

Chapter 1: Introduction

1.1 Overview

HIV has become one of the world's most serious health and development challenges which brings with it profound social, economic and public health consequences. HIV or human immunodeficiency virus, is the virus that causes AIDS. HIV attacks the immune system by destroying CD4 positive (CD4+) T cells, a type of white blood cell that is vital to fighting off infection. The destruction of these cells leaves people infected with HIV vulnerable to other infections, diseases and other complications. AIDS is the final stage of HIV infection. A person infected with HIV is diagnosed with AIDS when he or she has one or more opportunistic infections, such as pneumonia or tuberculosis, and has a dangerously low number of CD4+ T cells ,less than 200 cells per cubic millimeter of blood (Hare, 2009).

National Institute of Allergy and Disease (NIAID) is committed to the research necessary to successfully end HIV/AIDS. In 2015 alone, more than 2 million people worldwide become infected with HIV, the virus that causes AIDS. Currently, there are an estimated 1.2 million people in the United States and nearly 37 million people globally who are living with HIV infection. In 2015, 1.1 million people died from AIDS-related causes. Through our laboratories and clinics at the National Institutes of Health to our vast network of supported research at universities, medical centers, and clinical trial sites around the globe, NIAID is working to better understand HIV and how it causes disease, find new tools to prevent HIV infection, develop new and more effective treatments for HIV-infected people, and find a cure (National Institute of Allergy and Infectious Diseases, 2015).

1.2 History

The history of the HIV and AIDS epidemic began in illness, fear and death. However, the development of highly effective antiretroviral drugs represented a major turning point by allowing people living with HIV to live long and healthy lives.

Here, we go through the key historical moments that have defined the HIV epidemic over the past 30 years. The first case of HIV infection in a human was identified in 1959. The infected individual lived in the Democratic Republic of the Congo. He did not know (and research could not identify) how he was infected. The first cases of HIV in the United States date back to 1981. Homosexual men began dying from mysterious, pneumonia-like infections. In June 1981, the U.S. Centers for Disease Control and Prevention (CDC) first described the symptoms of this unknown disease in one of their publications. Soon, healthcare providers

from around the country began reporting similar cases. The number of people with the disease increased. Sadly, so did the number of people dying from the unidentified disease.

In September 1982, the CDC uses the term acquired immune deficiency syndrome (AIDS) for the first time when describing the mystery disease. That same year, the first AIDS clinic opened in San Francisco. In 1984, Dr. Robert Gallo and colleagues at the National Cancer Institute discovered what causes AIDS. Gallo found the human immunodeficiency virus (HIV), which is the virus responsible for HIV infections. The infection is distinct from AIDS, the full-blown syndrome that, along with the consequences of a damaged immune system (such as pneumonia and Kaposi's sarcoma), is most often fatal. America's romantic leading man in the 1950s and '60s, Rock Hudson, passed away from complications related to AIDS in 1985. When he passed, he willed $250,000 to help establish the American Foundation for AIDS Research (amfAR). amfAR helps fund research and education around the globe (Holland, 2013).

U.S. Food and Drug Administration (FDA) approved the first commercial blood test, ELISA. The ELISA test allowed hospitals and healthcare facilities to quickly screen blood for the disease. Once the diseases were identified, HIV and AIDS quickly became an epidemic in the country. By 1994, AIDS was the leading cause of death among Americans ages 25 to 44.

The FDA approved the first protease inhibitor in 1995. This began a new era of strong treatment and response called highly active antiretroviral therapy (HAART). By 1997, HAART was the standard of treatment for HIV. Soon, the number of deaths caused by AIDS begins to fall. This medicine plan nearly cut the number of AIDS-related deaths in half in just one year. However, HAART had its detractors. Many were worried the treatment plan was too aggressive and might actually make treatment-resistant HIV strains.

The FDA approved the first at-home HIV test kit in 2002. The test was 99.6 percent accurate. This opened up the possibility for people to test their status in the privacy of their own homes. HIV and AIDS do not yet have cures. Once a person is infected with the virus, they cannot get rid of the virus. They can treat it and slow the progression of the disease. For people who are not infected, there is hope you may be able to prevent an infection. In 2013, the CDC released a study that found that a daily dose of medication may be able to halt the transfer of HIV from a positive person to a negative person (Holland, 2013).

Pre-1980

It is widely believed that HIV originated in Kinshasa, in the Democratic Republic of Congo around 1920 when HIV crossed species from chimpanzees to humans. Up until the 1980s, we do not know how many people developed HIV or AIDS. HIV was unknown and transmission was not accompanied by noticeable signs or symptoms.

While sporadic cases of AIDS were documented prior to 1970, available data suggests that the current epidemic started in the mid- to late 1970s. By 1980, HIV may have already spread to five continents (North America, South America, Europe, Africa and Australia). In this period, between 100,000 and 300,000 people could have already been infected.

1980 to 1989

- In December 1981, the first cases of *Pneumocystis carinii pneumonia* (PCP) were reported in people who inject drugs.
- In June 1982, a group of cases among gay men in Southern California suggested that the cause of the immune deficiency was sexual and the syndrome was initially called gay-related immune deficiency (or GRID).
- In September, the CDC used the term "AIDS" (acquired immune deficiency syndrome) for the first time, describing it as…

" A disease at least moderately predictive of a defect in cell mediated immunity, occurring in a person with no known case for diminished resistance to that disease"

- In January 1983, AIDS was reported among the female partners of males who had the disease suggesting it could be passed on via heterosexual sex.
- In April 1984, the National Cancer Institute announced they had found the cause of AIDS, the retrovirus HTLV-III. In a joint conference with the Pasteur Institute they announced that LAV and HTLV-III are identical and the likely cause of AIDS.
- In March 1985, the U.S Food and Drug Administration (FDA) licenses the first commercial blood test, ELISA, to detect antibodies to the virus. Blood banks began to screen the USA blood supply.
- In April, the U.S. Department of Health and Human Services (HHS) and the World Health Organization (WHO) hosted the first International AIDS Conference in Atlanta Georgia.

- In May 1986, the International Committee on the Taxonomy of Viruses said that the virus that causes AIDS will officially be called HIV (human immunodeficiency virus) instead of HTLV-III/LAV.
- In February 1987, the WHO launched The Global Program on AIDS to raise awareness; generate evidence-based policies; provide technical and financial support to countries; conduct research; promote participation by NGOs; and promote the rights of people living with HIV.
- In 1988, the WHO declared 1st December as the first World AIDS Day.
- In March 1989, 145 countries had reported 142,000 AIDS cases. However, the WHO estimated there were up to 400,000 cases worldwide.

1990 to 1999

- In 1991, the Visual AIDS Artists Caucus launched the Red Ribbon Project to create a symbol of compassion for people living with HIV and their careers. The red ribbon became an international symbol of AIDS awareness.
- The 1992 International AIDS Conference scheduled to be held in Boston, USA was moved to Amsterdam due to USA immigration rules on people living with HIV.
- In March 1993, the USA voted overwhelmingly to retain the ban on entry into the country for people living with HIV.
- In August 1994, the U.S. Public Health Service recommended the use of AZT to prevent the mother to child transmission of HIV.
- In December, the FDA approved an oral HIV test - the first non-blood HIV test.
- In June 1995, the FDA approved the first protease inhibitor beginning a new era of highly active antiretroviral treatment (HAART).
- In 1996, the Joint United Nations Program on AIDS (UNAIDS) was established to advocate for global action on the epidemic and coordinate HIV/AIDS efforts across the UN.
- In September 1997, the FDA approved Combivir, a combination of two antiretroviral drugs making it easier to people living with HIV to take their medication.
- In 1999, the WHO announced that HIV/AIDS was the fourth biggest cause of death worldwide and number one killer in Africa. An estimated 33 million people were living with HIV and 14 million people had died from AIDS since the start of the epidemic (Avert, 2016).

2000 to 2009

- In June 2001, United Nations (UN) General Assembly called for the creation of a "global fund" to support efforts by countries and organizations to combat the spread of HIV through prevention, treatment and care including buying medication.
- In April 2002, the Global Fund approved its first round of grants totaling $600 million.
- In January 2003, President George W. Bush announced the creation of the United States President's Emergency Plan For AIDS Relief (PEPFAR), a $15 billion, 5-year plan to combat AIDS, primarily in countries with a high number of HIV infections.
- In December, the WHO announced the "3 by 5" initiative to bring HIV treatment to 3 million people by 2005.
- In 2006, male circumcision was found to reduce the risk of female-to-male HIV transmission by 60%.80 Since then, the WHO and UNAIDS have emphasized that male circumcision should be considered in areas with high HIV and low male circumcision prevalence.
- In May 2007, the WHO and UNAIDS issued new guidance recommending "provider-initiated" HIV testing in healthcare settings to widen knowledge of HIV status and greatly increase access to HIV treatment and prevention (Avert, 2016).

2010 to 2015

- In January 2010, the travel ban preventing HIV-positive people from entering the USA was lifted.
- In July, the CAPRISA 004 microbicide trial was hailed a success after results showed the gel reduces the risk of HIV infection in women by 40%.
- Results from the iPrEx trial showed a reduction in HIV acquisition of 44% among men who have sex with men who took pre-exposure prophylaxis (PrEP).
- In 2011, results from the HPTN 052 trial showed that early initiation of antiretroviral treatment reduced the risk of HIV transmission by 96% among serodiscordant couples.
- In August, the FDA approved Complera, the second all-in-one fixed dose combination tablet, expanding the treatment options available for people living with HIV.
- In July 2012, the FDA approves PrEP for HIV-negative people to prevent the sexual transmission of HIV.

- For the first time, the majority of people eligible for treatment were receiving it (54%).
- In 2013, UNAIDS reported that AIDS-related deaths had fallen 30% since their peak in 2005.
- An estimated 35 million people are living with HIV.
- In September 2014, new UNAIDS "Fast Track" targets called for the dramatic scaling-up of HIV prevention and treatment programmers to avert 28 million new infections and end the epidemic as a public health issue by 2030.
- UNAIDS also launched the ambitious 90-90-90 targets which aim for 90% of people living with HIV to be diagnosed, 90% to be accessing antiretroviral treatment and 90% to achieve viral suppression by 2020.
- In July 2015, UNAIDS announced that the Millennium Development Goal (MDG) relating to HIV and AIDS had been reached six months ahead of schedule. The target of MDG 6 halting and reversing the spread of HIV saw 15 million people receive treatment.
- In September, the WHO launched new treatment guidelines recommending that all people living with HIV should receive antiretroviral treatment, regardless of their CD4 count, and as soon as possible after their diagnosis (Avert, 2016).

1.3 Mode of Transmission

HIV is not spread easily. Only certain body fluids from a person who has HIV can transmit HIV:

- Blood
- Semen (cum)
- Pre-seminal fluid (pre-cum)
- Rectal fluids
- Vaginal fluids
- Breast milk

To get infected, these bodily fluids need to get into one's blood through a mucous membrane (for example the lining of the vagina, rectum, the opening of the penis, or the mouth), breaks in the skin (like cuts), or be injected directly into bloodstream. A person living with HIV can pass the virus to others whether they have symptoms or not. People with HIV are most infectious in the first few weeks after infection (Centers for Disease Control and Prevention, 2015).

1.3.1 Sex Without a Protection

Having unprotected sex with someone who has HIV, particularly unprotected vaginal sex and anal sex to spread HIV during sex, HIV infection in blood or sexual fluids must be transmitted to someone. Sexual fluids come from a man's penis or from a woman's vagina, before, during, or after. An "undetectable viral load "does NOT mean "no HIV infection." If there is no contact with blood or sexual fluids, there is no risk. HIV needs to get into the body for infection to occur.

Unprotected sex has a high risk of spreading HIV. The greatest risk is when blood or sexual fluid touches the soft, moist areas (mucous membrane) inside the rectum, vagina, mouth, or at the tip of the penis. These can be damaged easily, which gives HIV a way to get into the body. Some men think that they can't transmit HIV if they pull their penis out before they reach orgasm. This isn't true, because HIV can be in the fluid that comes out of the penis before orgasm.

1.3.2 Sharing Injecting Equipment

Sharing needles, syringes or other equipment used to prepare and inject drugs with someone who has HIV. During an injection, some blood goes into the needle and syringe. A needle and syringe that someone living with HIV has used can still contain blood with the virus in it after the injection. If one then use the same equipment without sterilizing it, he can inject the infected blood directly into bloodstream.

Some people who inject drugs wrongly believe they are not at risk of HIV if they avoid injecting into a vein (intravenous injecting). You can also get HIV from injecting into the fat under the skin (subcutaneous injecting) and injecting directly into a muscle (intramuscular injection).Sharing a needle or syringe for any use, including injecting drugs under the skin (skin popping), steroids, hormones or silicone, can put you at risk of HIV and other infections found in the blood like hepatitis C (Hare, 2009).

There are many ways one could get HIV from injecting drugs, including

- preparing drugs with syringes that contain infected blood
- sharing water used to flush blood out of a needle and syringe
- reusing bottle caps, spoons, or other containers ("cookers") to dissolve drugs into water and to heat drugs solutions
- reusing filters - normally small pieces of cotton or cigarette filters used to filter out particles that could block the needle

unsafe disposal of used needles or syringes where infected blood accidently gets into the body of another person (Centers for Disease Control and Prevention, 2015).

1.3.3 Passed from Mother to Baby During Pregnancy, Childbirth and Breastfeeding

A mother infected with HIV can pass the virus to her baby via her blood during pregnancy and birth, and through her breast milk when breastfeeding.

1.3.4 Contaminated Blood Transfusions and Organ or Tissue Transplants

Receiving blood transfusions, blood products, or organ/tissue transplants that are contaminated with HIV. This risk is extremely small because most countries test blood products for HIV first.

If adequate safety practices are not in place, healthcare workers can also be at risk of HIV from cuts made by a needle or sharp object (needle stick injury) with infected blood on it. However, the risk of 'occupational exposure', is very low in most countries

Bodily Fluids That Are NOT Infectious

- Saliva /Spit
- Tears
- Sweat
- Feces
- Urine (Centers for Disease Control and Prevention, 2015).

1.4 Control and Prevention

1.4.1 Steps to Control HIV

- If anyone is HIV-positive (infected with HIV) or has engaged in sex or needle-sharing with someone who could be infected with HIV, he should take precautions to prevent spreading the infection to others.
- Antiretroviral medicines are advised to take. Getting treated for HIV can help prevent the spread of HIV to people who are not infected.
- The sex partner or partners must be aware of whether the person they are having sex with, are HIV positive or not.
- Safer sex practices should be followed, such as using condoms.
- Donation of blood, plasma, semen, body organs, or body tissues are strictly prohibited.

- One should not share personal items, such as toothbrushes, razors, or sex toys, that may be contaminated with blood, semen, or vaginal fluids.

If one is pregnant the risk of a woman spreading HIV to her baby can be greatly reduced by

- Taking medicine that reduces the amount of virus in her blood to undetectable levels during pregnancy.
- Continuous treatment during pregnancy is suggested.
- Breast-feeding is not recommended (Web MD, 2015).

1.4.2 Steps to Prevent HIV

Because the most common ways HIV is transmitted is through anal or vaginal sex or sharing drug injection equipment with a person infected with HIV, it is important to take steps to reduce the risks associated with these. They include:

1.4.2.1 Knowing HIV Status

Everyone between the ages of 13 and 64 should be tested for HIV at least once. If one is at increased risk for HIV, he should be tested for HIV at least once a year.

- If anyone has HIV, he can get medical care, treatment, and supportive services to stay healthy and reduce his ability to transmit the virus to others.
- If anyone is pregnant and find that she has HIV, treatments are available to reduce the chance that her baby will have HIV

1.4.2.2 Locating an HIV Testing Site

- One should abstain from sexual activity or being in a long-term mutually monogamous relationship with an uninfected partner.
- Number of sex partners needs to be limited. The fewer partners one has, the less likely he is to encounter someone who is infected with HIV or another STD.
- Correct and consistent condom use is another way.
- The partners should also test and treat STDs.

1.4.2.3 Locating an STD Testing Site

- Male circumcision has also been shown to reduce the risk of HIV transmission from women to men during vaginal sex.

- Do not inject drugs. If you inject drugs, you should get counseling and treatment to stop or reduce your drug use. If you cannot stop injecting drugs, use clean needles and works when injecting.

1.4.2.4 Locating Resources on Substance Abuse Treatment

- Obtain medical treatment immediately if you think you were exposed to HIV. Sometimes, HIV medications can prevent infection if they are started quickly. This is called post-exposure prophylaxis.
- Participate in risk reduction programs. Programs exist to help people make healthy decisions, such as negotiating condom use or discussing HIV status. Your health department can refer you to programs in your area (The AIDS Institute, 2011).

1.5 Stages of AIDS

1.5.1 Acute HIV Infection

Acute HIV infection is the earliest stage of HIV. Acute HIV infection generally develops within 2 to 4 weeks after a person is infected with HIV. During acute HIV infection, many people have flu-like symptoms, such as fever, headache, and rash. In this acute stage of infection, HIV multiplies rapidly and spreads throughout the body. The virus attacks and destroys the infection-fighting CD4 cells of the immune system. HIV can be transmitted during any stage of infection, but the risk is greatest during acute HIV infection

1.5.2 Chronic HIV Infection

The second stage of HIV infection is chronic HIV infection (also called asymptomatic HIV infection or clinical latency). During this stage of the disease, HIV continues to multiply in the body but at very low levels. People with chronic HIV infection may not have any HIV-related symptoms, but they can still spread HIV to others. Without treatment with HIV medicines, chronic HIV infection usually advances to AIDS in 10 to 12 years.

1.5.3 AIDS

AIDS is the final stage of HIV infection. Because HIV has destroyed the immune system, the body can't fight off opportunistic infections and cancer. (Examples of opportunistic infections include pneumonia and tuberculosis.) AIDS is diagnosed when a person with HIV has a CD4 count of less than 200 cells/mm^3 and/or one or more opportunistic infections.

Without treatment, people with AIDS typically survive about 3 years (The AIDS Institute, 2011).

1.6 Action of HIV Virus on Immune Cell

1.6.1 The Immune System and HIV

The HIV virus attacks white blood cells, which are called T-helper cells or CD4 cells. These are important when it comes to having a healthy immune system as they help us fight off diseases and infections.

HIV cannot grow or reproduce on its own. Instead, it makes new copies of itself inside T-helper cells which damages the immune system and gradually weakens our natural defenses. This process of T-helper cells multiplying is called the HIV life cycle.

How quickly the virus develops depends on how early a person is diagnosed, his overall health and how well he takes treatment. It's important to know that antiretroviral treatment will keep the immune system healthy if taken correctly and therefore prevent AIDS.

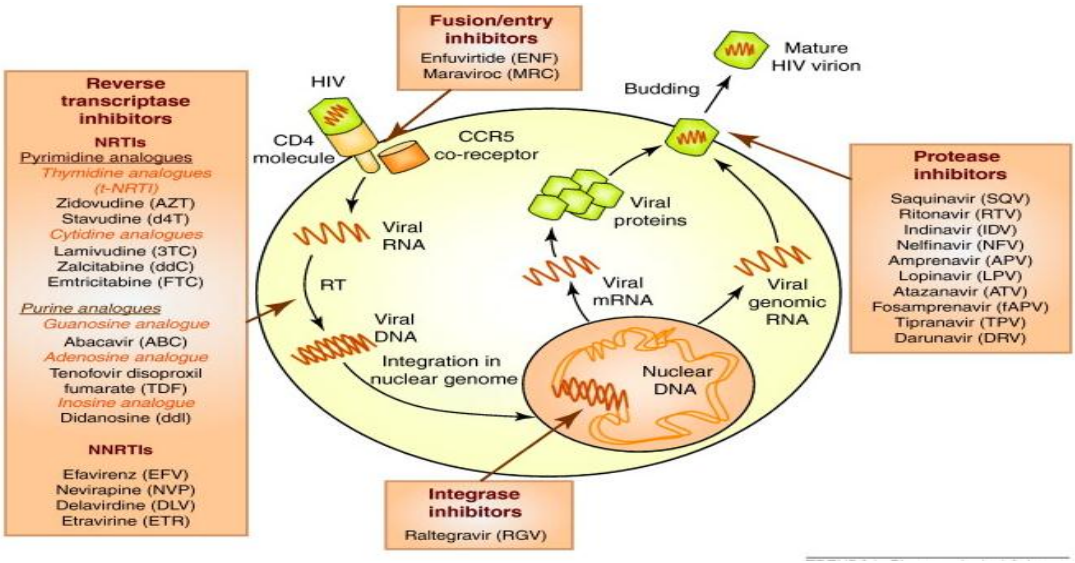

Fig 1.1: Action of HIV on immune cell (Apostolova, 2011).

1.6.2 The HIV Life Cycle

The life cycle of HIV goes through various different steps that can happen over many years. Antiretroviral treatment works by interrupting the cycle and protecting your immune system. There are different drugs offered depending on the particular stage of the HIV life cycle. Understanding the HIV life cycle helps scientists to know how to attack the virus when it is

weak and reduce the risk of drugs no longer working (drug resistance). This happens when drugs fail to prevent the virus from multiplying.

1.6.3 Stages of The HIV Life Cycle

- **Binding and Fusion**

First, the HIV virus attaches itself to a T-helper cell. The spikes on the surface of the HIV particle stick to the cell and allow them to join together. The contents of the HIV particle are then released into the cell.

The type of drugs that can stop this part of the process are called Fusion or Entry Inhibitors.

- **Reverse Transcription and Integration**

Once inside the cell, HIV changes its genetic material (called HIV RNA) into HIV DNA using an enzyme called reverse transcriptase. HIV DNA can then enter the DNA in the nucleus of the T-helper cell and control it.

The type of drugs that can stop this part of the process are called NRTIs, NNRTIs and Integrase Inhibitors.

- **Transcription and Translation**

The HIV DNA then makes long strands of messenger RNA proteins, and transports them towards the edge of the cell. This is then used for producing more HIV.

- **Assembly, Budding and Maturation**

Copies of HIV genetic material are contained among the strands of messenger RNA. These form new HIV particles, which are then released from the T-helper cell. These are then ready to infect other cells and begin the process all over again (Aidsinfo, 2015).

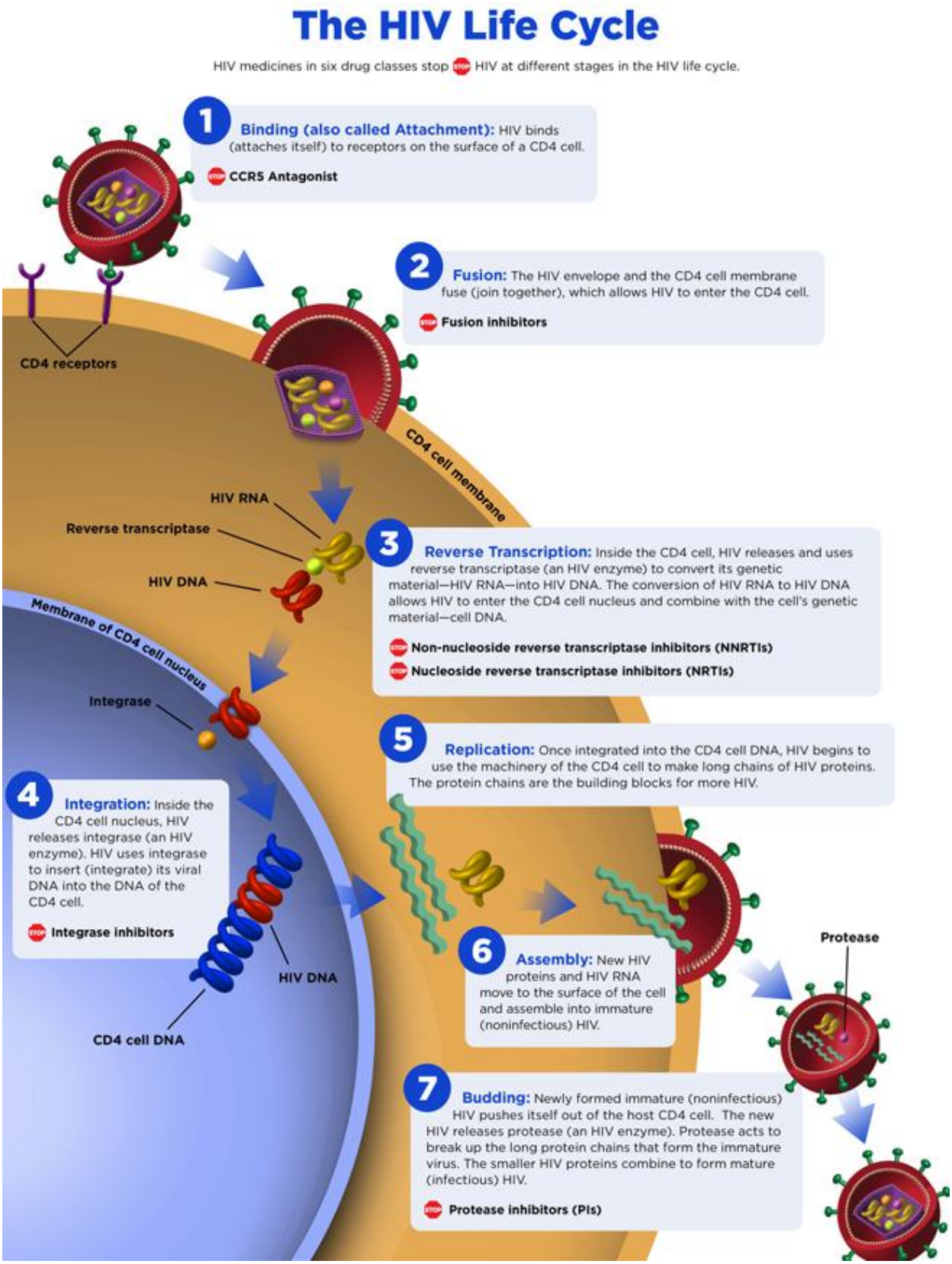

Fig 1.2: Stages of The HIV Life Cycle (Aidsinfo, 2015).

1.7 Treatment

HIV is treated using a combination of medicines to fight HIV infection. This is called antiretroviral therapy (ART). ART isn't a cure, but it can control the virus so that you can live a longer, healthier life and reduce the risk of transmitting HIV to others. ART involves taking a combination of HIV medicines (called an HIV regimen) every day, exactly as prescribed. These HIV medicines prevent HIV from multiplying (making copies of itself), which reduces the amount of HIV in your body. Having less HIV in your body gives your immune system a chance to recover and fight off infections and cancers. Even though there is still some HIV in the body, the immune system is strong enough to fight off infections and cancers. By reducing the amount of HIV in your body, HIV medicines also reduce the risk of transmitting the virus to others.

ART is recommended for all people with HIV, regardless of how long they've had the virus or how healthy they are. If left untreated, HIV will attack the immune system and eventually progress to AIDS (AIDS.gov, 2015).

1.7.1 HIV Drug Classes

The classes of anti-HIV drugs include

- **Non-nucleoside reverse transcriptase inhibitors (NNRTIs).**NNRTIs disable a protein needed by HIV to make copies of itself. Examples include efavirenz (Sustiva), etravirine (Intelence) and nevirapine (Viramune).
- **Nucleoside or nucleotide reverse transcriptase inhibitors (NRTIs).** NRTIs are faulty versions of building blocks that HIV needs to make copies of itself. Examples include Abacavir (Ziagen), and the combination drugs emtricitabine-tenofovir (Truvada), and lamivudine-zidovudine (Combivir).
- **Protease inhibitors (PIs).** PIs disable protease, another protein that HIV needs to make copies of itself. Examples include atazanavir (Reyataz), darunavir (Prezista), fosamprenavir (Lexiva) and indinavir (Crixivan).
- **Entry or fusion inhibitors.** These drugs block HIV's entry into CD4 cells. Examples include enfuvirtide (Fuzeon) and maraviroc (Selzentry).
- **Integrase inhibitors.** These drugs work by disabling integrase, a protein that HIV uses to insert its genetic material into CD4 cells. Examples include raltegravir (Isentress), elvitegravir (Vitekta) and dolutegravir (Tivicay) (Mayo Clinic, 2015).

1.7.1.1 Non-nucleoside Reverse Transcriptase Inhibitors (NNRTIs)

The NNRTIs act by binding non-competitively to the RT enzyme. The binding causes conformational change in the three-dimensional structure of the enzyme and create the NNIBP. Binding of NNRTI to HIV-1 RT makes the p66 thumb domain hyper extended because it induces rotamer conformation changes in amino acid residues Tyr-181 and Tyr-188. This affects the catalytic activity of the enzyme and blocks the HIV-1 replication by inhibiting the polymerase active site of the RT's p66 subunit. The global conformational change additionally destabilizes the enzyme on its nucleic acid template and reduces its ability to bind nucleotides. The transcription of the viral RNA is inhibited and therefore the replication rate of the virus reduces. Although the exact molecular mechanism is still hypothetical this has been demonstrated by multiple studies to be the primary mechanism of action.

Resistance to NNRTIS

Mutations in the pockets of the enzyme bring down the binding affinity of the NNRTIS to the enzyme. This is credited to the low genetic barrier to resistance of NNRTIS. Level of virus replication, how easily the enzyme can mutate are crucial factors to consider in determining resistance to NNRTIS (Iyidogan and Anderson, 2014).

1.7.1.2 Nucleoside reverse transcriptase inhibitors (NRTIs)

As nucleoside reverse transcriptase inhibitors (NRTIs) and nucleotide reverse transcriptase inhibitors (NtRTIs) have a similar mechanism of action, they are usually regarded as a single drug class.

When reverse transcription occurs in the presence of these drugs, they disrupt the construction of a new piece of proviral DNA. Instead of taking up a natural nucleotide from the supply in the cell, reverse transcriptase may use an NRTI or NtRTI triphosphate instead. Because these drugs have a slightly different structure than natural nucleotides, they cannot form the necessary chemical bonds, and natural nucleotides cannot be added on to continue the chain. Since HIV has no mechanism for correcting such mistakes, NRTIs and NtRTIs can interrupt reverse transcription and thereby halt HIV replication.

NRTIs and NtRTIs can stop reverse transcription and interfere with workings of human cells. Because they resemble the natural building blocks of DNA, there is a risk that NRTI or NtRTI triphosphates may be taken up when host cells reproduce. Some researchers believe this is a not a major problem, since the equivalent human enzyme, called DNA polymerase,

has a much lower affinity than reverse transcriptase for NRTI/NtRTI triphosphates. Moreover, human cells have mechanisms for recognizing and correcting mistakes in DNA production.

Nevertheless, certain NRTIs do have side-effects that have been attributed to damage to a specific type of DNA found within the mitochondria, tiny structures responsible for energy production within cells. Mitochondrial DNA also must be copied when a cell divides, a process carried vulnerable to the effects these drugs.1 2 Symptoms thought to be related to mitochondrial damage include lactic acidosis, lipoatrophy (fat loss in the face and limbs), and peripheral neuropathy. Throughout by an enzyme called polymerase-gamma. Compared with DNA polymerase, this enzyme has a relatively high affinity for NRTI/NtRTI triphosphates, so mitochondrial DNA is more Resistance to NRTIS (U.S. Department of Veterans Affairs, n.d.).

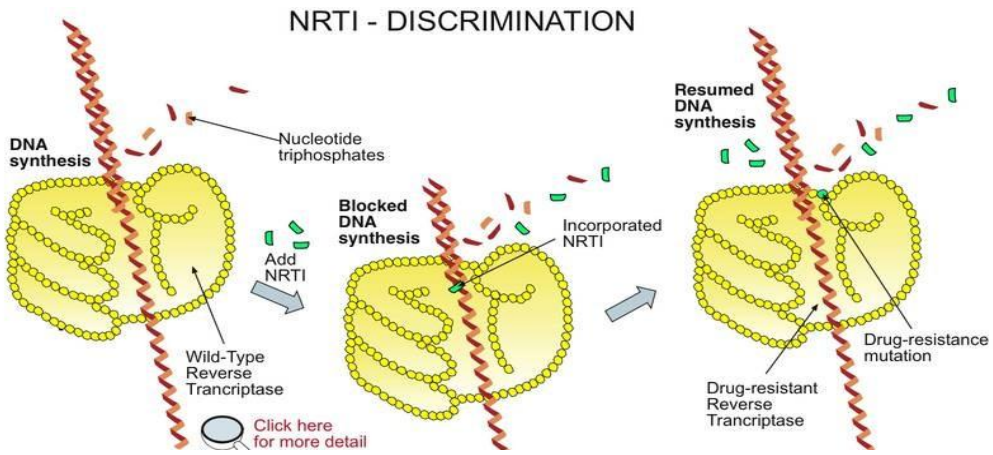

Fig 1.3: Mechanism of Nucleoside Reverse Transcriptase Inhibitors (Iyidogan and Anderson, 2014).

HIV resistance to NRTIs develops when it is given room for it to complete viral DNA synthesis and when NRTI-resistant RT retains the capacity to take up normal dNTPs with ease. This resistance can occur when NRTI-TP is incorporated or when NRTI is taken away from the end of the viral DNA after incorporation by RT (Iyidogan and Anderson, 2014).

1.7.1.3 Protease inhibitors

Protease inhibitors block the activity of the protease enzyme, which HIV uses to break up large polyproteins into the smaller pieces required for assembly of new viral particles. While

HIV can still replicate in the presence of protease inhibitors, the resulting virions are immature and unable to infect new cells.

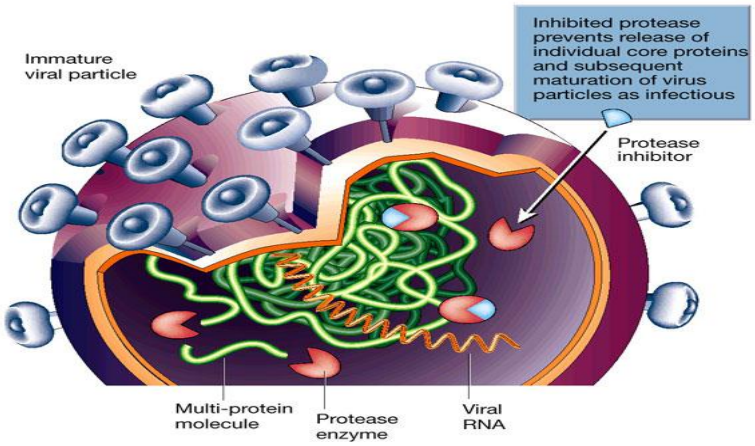

Fig 1.4 : Mechanism of action of protease inhibitor (NAM Aidsmap, 2016.).

Protease inhibitors are metabolized by enzymes in the liver and can interact with other medications by speeding up or slowing down their processing in the body. Ritonavir, in particular, is a strong inhibitor of these liver enzymes and slows the processing of many other drugs.

While this normally would be considered a drawback, researchers discovered that a small dose of ritonavir could be used to 'boost' blood levels of other protease inhibitors and extend dosing intervals. Kaletra combines in one pill both lopinavir and a boosting dose of ritonavir.

The HIV protease contains a binding pocket into which drugs must fit in order to block the activity of the enzyme. As HIV replicates, constant mutations change the shape of this structure. Some such changes make it impossible for one or more protease inhibitors to bind to the enzyme, resulting in drug resistance.

Second-generation protease inhibitors (atazanavir, darunavir, fosamprenavir, lopinavir, and tipranavir) work against HIV variants that have developed resistance to older drugs in this class. Darunavir and tipranavir differ from the others in that they are synthetic nonpeptidic drugs (NAM Aidsmap, 2016).

1.7.1.4 Fusion inhibitor

It is class of antiretroviral drugs that work on the outside of the host CD4 cell to prevent HIV from fusing with and infecting it. Fusion inhibitors act by binding to an envelope protein and blocking the structural changes necessary for the virus to fuse with the host CD4 cell. If HIV

cannot penetrate the host cell membrane and infect the cell, HIV cannot replicate within the host cell (Food and Drug Administration, 2016).

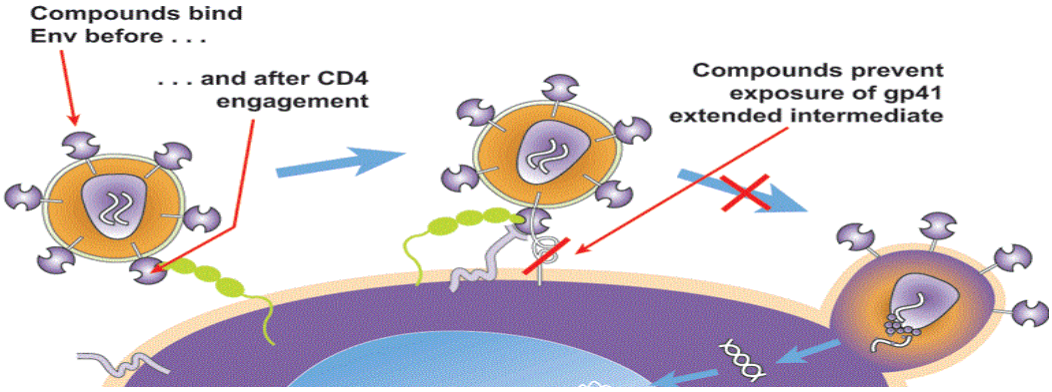

Fig 1.5: Mechanism of action of Fusion Inhibitor (Food and Drug Administration, 2016).

1.7.1.5 CCR5 antagonists (CCR5s)

It is also called entry inhibitor. Entry inhibitors work by preventing HIV from entering healthy CD4 cells (T-cells) in the body. They work differently than many of the approved anti-HIV drugs the protease inhibitors (PIs), the nucleoside reverse transcriptase inhibitors (NRTIs), and the non-nucleoside reverse transcriptase inhibitors (NNRTIs) which are active against HIV after it has infected a CD4 cell.

Entry inhibitors work by attaching themselves to proteins on the surface of CD4 cells or proteins on the surface of HIV. In order for HIV to bind to CD4 cells, the proteins on HIV's outer coat must bind to the proteins on the surface of CD4 cells. Entry inhibitors prevent this from happening. Some entry inhibitors target the gp120 or gp41 proteins on HIV's surface. Some entry inhibitors target the CD4 protein or the CCR5 or CXCR4 receptors on a CD4 cell's surface. If entry inhibitors are successful in blocking these proteins, HIV is unable to bind to the surface of CD4 cells and gain entry into the cells.

HIV-positive people who have become resistant to PIs, NRTIs, and NNRTIs will likely benefit from the entry inhibitors because they are a different class of drugs. This is good news for HIV-positive people who have tried and failed many of the currently approved anti-HIV medications (Iyidogan and Anderson, 2014).

1.7.1.6 Integrase strand transfer inhibitors (INSTIs)

There are several ways to target integrase but strand transfer inhibition is the most intuitively obvious and readily pursued to date. Other targets include, for example, the protein domains beyond the active site of IN. The domains interact with viral or host DNA and are important

for binding to the enzyme. It is possible to hamper functions of the enzyme by disrupting or removing these bindings. PIC is a multimeric protein structure inside the host cell, composed of both viral and host proteins. Integrase is a part of PIC‘s viral component. PIC‘s viral and host proteins are believed to modulate intrinsic activity of the enzyme, shuttle PIC to the nucleus and direct integration of viral DNA into a transcriptionally active region of the host genome. If it were possible to exclude certain proteins from the PIC it would block the ability of the virus to integrate into the host genome.

Mg2+ and Mn2+ are critical cofactors in the integration phase. Inactivating these cofactors (e.g. through chelation) causes functional impairment of IN. This concept gives researchers the opportunity to design and develop highly efficient IN inhibitors (INIs). In fact, all small molecule HIV-1 INIs that are now being researched contain a structural motif that coordinates the two divalentmagnesium ions in the enzyme’s active site.

Raltegravir and elvitegravir share the same mechanism of action against integrase, to bind to the active site of Mg2+ ions. Competitive inhibitors compete directly with viral DNA for binding to integrase in order to inhibit 3’ end processing. In doing this the inhibitors completely block the active site from binding to target DNA. This inhibition is called strand transfer inhibition (Iyidogan and Anderson, 2014).

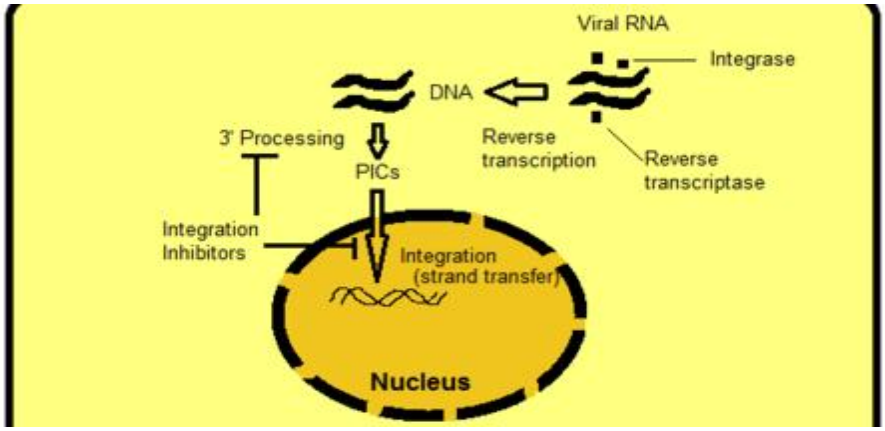

Fig 1.6: Mechanism of action of INSTIs (Iyidogan and Anderson, 2014).

1.7.2 Choosing An HIV Regimen

The choice of HIV medicines to include in an HIV regimen depends on a person’s individual needs. When choosing an HIV regimen, people with HIV and their health care providers consider the following factors

- Other diseases or conditions that the person with HIV may have
- Possible side effects of HIV medicines

- Potential interactions between HIV medicines or between HIV medicines and other medicines the person with HIV is taking
- Results of drug-resistance testing (and other tests). Drug-resistance testing identifies which, if any, HIV medicines won't be effective against a person's HIV.
- Convenience of the regimen. For example, a regimen that includes two or more HIV medicines combined in one pill is convenient to follow.
- Any issues that can make it difficult to follow an HIV regimen, such as a busy schedule that changes from day to day
- Cost of HIV medicines

There are several recommended HIV regimens, but selecting the best regimen for a particular person depends on the factors listed above (AIDS.gov, 2015).

1.8 Global Epidemiology

1.8.1 Current Global Snapshot

According to the latest estimates from UNAIDS

- There were 36.7million people living with HIV in 2015, up from 33.3 million in 2010, the result of continuing new infections, people living longer with HIV, and general population growth.
- Global prevalence (the percent of people ages 15-49 who are infected) has leveled since 2001 and was 0.8% in 2015.
- Million people died of AIDS in 2015, a 45% decrease since its peak in 2005. Deaths have declined due in part to antiretroviral treatment (ART) scale-up. HIV remains a leading cause of death worldwide and the number one cause of death in Africa.
- There were about 2.1 million new infections in 2015 or about 5,700 new infections per day. While there have been significant declines in new infections since the mid-199os, new infections among adults have failed to decline over the past 5 years and incidence is rising in some regions.
- Most infections are transmitted heterosexually, although risk factors vary. In some countries, men who have sex with men, injecting drug users, sex workers, transgender people, and prisoners are disproportionally affected by HIV.
- Although HIV testing capacity has increased over time, enabling more people to learn their HIV status, about 4 in 10 of people with HIV are still unaware they are infected.

- Women represent half (51%) of all adults living with HIV worldwide. HIV is the leading cause of death among women of reproductive age. Gender inequalities, differential access to service, and sexual violence increase women's vulnerability to HIV, and women, especially younger women, are biologically more susceptible to HIV.
- Young people, ages 15-24, account for approximately 35% of new HIV infections. In sub-Saharan Africa, young women 15-24 account for 25% of all new HIV infections among adults, even though they represent only 17% of the adult population.
- Globally, there were 1.8 million children living with HIV, 110,000 AIDS-related deaths, and 150,000 new infections among children in 2015. Since 2001, new HIV infections among children have declined by more than 70% (UNAIDS, 2015).

Table 1: HIV Prevalence & Incidence by Region, 2015

Region	Total No. (%) Living with HIV	Newly Infected	Adult Prevalence [%]
Global Total	36.7 million (100%)	2.1 million	0.8
Eastern and Southern Africa	19.0 million (52%)	960,000	7.1
Western and Central Africa	6.5 million (18%)	410,000	2.2
Asia and the Pacific	5.1 million (14%)	300,000	0.2
Western and Central Europe and North America	2.4 million (7%)	91,000	0.3
Latin America and the Caribbean	2.0 million (5%)	100,000	0.5
Eastern Europe and Central Asia	1.5 million (4%)	190,000	0.9
Middle East and North Africa	230,000 (<1%)	21,000	0.1

(UNAIDS,2015)

1.8.2 Sub-Saharan Africa

Sub-Saharan Africa, the hardest hit region, is home to nearly 70% of people living with HIV but only about 13% of the world's population. The sub-region of Eastern and Southern Africa is home to more than half (52%) of all people living with HIV, as well as more than half of the children living with HIV (56%). Almost all of the sub-region's nations have generalized

HIV epidemics that is, their national HIV prevalence is greater than 1%. In 8 countries, 10% or more of adults are estimated to be HIV-positive. South Africa has the highest number of people living with HIV in the world (7.0 million). Swaziland has the highest prevalence in the world (28.8%). New HIV infections among adults in Eastern and Southern Africa have declined by 4% since 2010.

1.8.3 Latin America and The Caribbean

An estimated 2.0 million people are living with HIV in Latin America and the Caribbean combined, including 100,000 newly infected in 2015. Annual new HIV infections among adults increased by 2% in Latin America and by 9% in the Caribbean between 2010 and 2015. Nine countries in Latin America and the Caribbean have generalized epidemics. Of the countries with available data, The Bahamas has the region's highest prevalence (3.2%), and Brazil the greatest number of people living with the disease (830,000).

1.8.4 Eastern Europe and Central Asia

An estimated 1.5 million people are living with HIV in this region, including 190,000 newly infected in 2015. New HIV infections in the region increased by more than 50% between 2010 and 2015. The epidemic is driven primarily by injecting drug use, which accounted for more than half of new HIV infections in 2015, although heterosexual transmission also plays an important role.

1.8.5 Asia and the Pacific

An estimated 5.1 million people are living with HIV in Asia and the Pacific. The region's annual number of new HIV infections declined by 3% since 2010. The region is also home to the two most populous nations in the world – China and India – and even relatively low prevalence translate into large numbers of people (Kaiser Family Foundation, 2017).

1.9 Scenario in Bangladesh

HIV in Bangladesh has continued to remain at relatively low levels in the most at risk population groups. The main reason for this low prevalence could be the early and sustained HIV prevention programs targeting high risk groups backed by a state-of-the-art surveillance system. Another contributing protective factor could be the high rates of male circumcision. There is, however, a concentrated HIV epidemic among injecting drug users (IDU), primarily due to sharing of unclean syringes and needles. As a result, the rate of new infections is still

on the rise and Bangladesh is the only country in the South Asia Region where new infections are rising.

1.10 State of the Epidemic

Bangladesh's latest round of serological surveillance (2011) showed that HIV prevalence among all key populations remained below 1 percent with the exception IDU. Although the overall prevalence of HIV was 1.2% among IDU in 2007/08, there is a concentrated epidemic among male IDU in Dhaka. The prevalence of HIV in this cluster increased from 4% in 2002 to 7% in 2007/08, which fell slightly in 2010 to 5.3%.

1.11 Risk Factors

In Bangladesh, as in other countries in the region, HIV risk arises mainly from unprotected paid sex, sharing of used needles and syringes by IDU, and unprotected sex between men who have sex with men. Recent data suggest that there are two key areas for HIV in the country. HIV prevalence has started to increase amongst IDU in Dhaka, rising to 7% in 2007/08 in one neighborhood. This epidemic "hot spot" is clearly a priority. International returned migrant workers: This group accounts for the majority of passively reported cases of HIV in the country and may be a potential source of HIV transmission.

An epidemic may also be emerging among female sex workers (FSW) in towns bordering India. The numbers are small but this area needs careful attention. Genetic analysis found that the HIV strains were different in each of these groups as of 2005. There is some overlap amongst sex workers, as some inject drugs and some engage with migrant workers. A rising epidemic in one of these groups, therefore, could lead to a spread in others (Rahman *et al.*, 2009)

The following factors associated with IDU, increases the risk of transmission of HIV infection:

1.11.1 Sharing of Needles and Syringes

Although declining trends are observed, the rates of sharing are still high the rate of borrowing needles decreased from 65% in 2002 to 55% in 2006/07 and the rate of lending fell from 90% to 60% over the same period. A four-year cohort study on male IDU in Dhaka revealed that the incidence of hepatitis C virus is declining (22% in 1999/00 to 12% in 2007), which suggests adoption of safer injecting practices or rising immunity of the cohort.

However, the rates of sharing needles and syringes are still high, putting IDU at risk, especially when injecting drugs and unprotected sex intersect.

1.11.2 Low Condom Use Among IDU and Intersection With Other High Risk Practices

Buying sex from sex workers and having female sex partners without using condoms are common among male IDU. In 2006/07 in Dhaka, 66% of the male IDU bought sex from FSW and 41% used condom during last sex with an FSW. Only 26% of IDU reported consistent use of condoms.

1.11.3 Lack of Knowledge and Awareness

People aged 15 to 49, account for approximately one-fifth of the total population of Bangladesh. Although the estimated HIV prevalence in this age group is negligible, a national survey in 2008 found that they lack knowledge and awareness about HIV and that many are engaged in risky sexual practices while having limited access to reproductive health information and services. A majority of the people surveyed (90%) had heard about HIV/AIDS but their level of knowledge of the disease was low. Only 38% of the people surveyed could correctly identify two or more routes of HIV transmission and only 40% could identify two or more routes of prevention. A national survey of youth found that almost 20% of unmarried males had premarital sex and one in three of them had their last sex with a sex worker. Around 10% married males reported having sex outside of marriage, half of whom had their last sex with a sex worker.

1.11.4 Other Socioeconomic Factors

The knowledge about HIV transmission in Bangladesh (2004) showed significant difference related to wealth, gender, education, and rural versus urban location. The lowest awareness was found among uneducated women in rural Bangladesh (20%) compared to educated urban males (78%). Homeless IDU have been shown to be more than five times as likely to be HIV positive as IDU living at a fixed address. Besides, IDU from HIV epidemic neighborhood in Dhaka (in comparison with IDU living in the rest of Dhaka) were less educated, fewer were currently married, and had lower average income (World Bank, 2012).

1.12 National Response to HIV/AIDS

1.12.1 Government

In late 1996, the Directorate General of Health Services in the Ministry of Health and Family Welfare of Bangladesh outlined a National Policy on HIV/AIDS. A high-level National AIDS Committee (NAC) was formed, with a Technical Advisory Committee, and a National AIDS/STD Program (NASP) unit in the ministry. The NAC includes representatives from key ministries, non-government organizations and a few parliamentarians. Action has been taken to develop a multi-sector response to HIV/AIDS. Strategic action plans for NASP set forth fundamental principles, with specific guidelines on a range of HIV issues including testing, treatment, safe blood supply, prevention among youth, women, migrant workers, sex workers, and STIs. While earlier commitment was limited and implementation of HIV control activities was slow, Bangladesh has strengthened its programs to improve its response. The Government of Bangladesh prepared the National Strategic Plan for HIV/AIDS for the period 2004-2010 under the guidance of NAC and with the involvement and support of different stakeholders. As a follow-up to this, the Government recently completed the National HIV Strategic Plan for 2011 to 2015. Efforts to mainstream HIV/AIDS in public sectors outside the Ministry of Health and Family Welfare were initiated through designation and training of focal points on HIV/AIDS in 16 government ministries .

1.12.2 Non-Governmental Organizations (NGOs)

More than 380 NGOs and AIDS Service Organizations have been implementing programs/projects in different parts of the country. These initiatives focused on prevention of sexual transmission among high-risk groups involving mostly female sex workers, MSM, IDUs, rickshaw pullers and truckers. NGOs are often better positioned than the public sector to reach vulnerable populations, such as sex workers and their clients and injecting drug users. Building the capacity of NGOs, especially the small ones, and combining their reach with the resources and strategic programs of the government is an effective way to change behavior in vulnerable populations and prevent the spread of HIV.

1.12.3 Donors

The Global Fund to fight AIDS, Tuberculosis and Malaria (GFATM) is active in Bangladesh supporting targeted interventions for key populations. Bangladesh has received funds from Rounds 6 and 8 and RCC (Rolling Continuation Channel) of GFATM (World Bank,2012).

1.13 Issues and Challenges: Priority Areas

Vigorous action is required to prevent further spread of HIV in Bangladesh. Key tasks include:

- Provision of comprehensive care, support & treatment for people living with HIV through public health facilities.
- Scale up behavior change activities and health promotion interventions for key populations, particularly IDU, men who have sex with men, sex workers and migrant workers.
- Expand advocacy and awareness among the general population through multi-sectorial agencies. Incorporate results of serological and behavioral surveillance surveys in the IEC campaign.
- Promote the social acceptability of condom use and ensure adequate supply and access.
- Reduce stigma and discrimination against people living with HIV and key populations at higher risk of HIV exposure through appropriate advocacy, policies, and related measures.
- Strengthen the Government's capacity for program implementation, management, and monitoring of program activities.
- Strengthen NGO capacity for program planning, implementation, and supervision of interventions (World Bank,2012).

Chapter 2

Literature Review

2.1 Knowledge of HIV / AIDS Among Migrants in Delhi Slums.

Gupta and Mitra, (1999) have reported that over the past decade, there has been a sharp increase in the reported and estimated numbers of HIV/AIDS cases in India. The UNAIDS estimates that up to 3 million people in India may be infected with HIV, of which 70-80% were infected through unprotected heterosexual activity. Findings are presented from an assessment of HIV/AIDS-related knowledge and awareness among slum dwellers in Delhi, India, and which factors affect that knowledge. To explore the links between socioeconomic, health, and migrant status generally, a survey was conducted in 1996 among 150 slum households from different parts of the city. The slum dwellers were all migrants from other states, living for at most 15 years in Delhi. All 361 adults in the selected households were interviewed. Despite significant investment in IEC activities by the State AIDS Cell over the past decade, respondents were found to be poorly informed about HIV/AIDS and how it is spread. The probability of having better knowledge about HIV/AIDS was higher among younger, more educated individuals, as well as among those who owned televisions and lived in certain zones (Gupta and Mitra, 1999).

2.2 Knowledge of HIV Status, Sexual Risk Behaviors and Contraceptive Need Among People Living With HIV in Kenya and Malawi.

Anand *et al.*, (2009) have reported that eighty-four percent of PLWHAs in Kenya and 86% in Malawi had sex in the past 12 months and in each country, 10% reported using condoms at last intercourse. Among sexually active PLWHAs, 86% in Kenya and 96% in Malawi reported their spouse or cohabiting partner as their most recent partner. In multivariate logistic regression models, married or cohabiting PLWHAs were significantly more likely to be sexually active and less likely to use condoms. Over 80% of PLWHAs were unaware of their HIV status. Of HIV-infected women, nearly three-quarters did not want more children either within the next 2 years or ever, but 32% in Kenya and 20% in Malawi were using contraception. In 2003–2005, majority of PLWHAs in Kenya and Malawi were unaware of their HIV status and were sexually active, especially married or cohabiting PLWHAs. Of HIV-infected women not wanting more children, few used contraception. HIV testing should be expanded, prevention programs should target married or cohabiting couples and family planning services should be integrated with HIV services (Anand *et al.*, 2009).

2.3 HIV Risk Perception and Constraints to Protective Behaviour Among Young Slum Dwellers in Ibadan, Nigeria.

A survey conducted by Adedimeji *et al.*, (2007). This study examined the relationship between HIV/AIDS risk perception and protective behavior among sexually-active urban young slum dwellers in Ibadan, Nigeria. The multistage sampling techniques were used for selecting 1,600 respondents aged 15-24 years. Of these, 1,042 (65%) respondents who reported unprotected sex in the last three months were selected for analysis. Although the sexually-active respondents demonstrated basic knowledge of HIV/AIDS and high risk perception, risky behavior was common and protective behavior was poor. About 48% of 505 males and 12% of 537 females had multiple partners. Similarly, 29% of males and 38% of females were engaged in transactional sex. Only 14% of males and 5% of females used any form of protection, resulting in the high rates of sexually transmitted infections reported by 27% of males and 10% of females. Structural and environmental constraints were identified as barriers to adopting protective behaviour. Therefore, program and policy interventions should be designed to address the peculiar circumstances of urban young slum dwellers to curtail the HIV epidemic (Adedimeji *et al.*, 2007).

2.4 HIV/AIDS Among Youth in Urban Informal (slum) Settlements in Kenya: What Are The Correlates of and Motivations for HIV Testing?

According to survey conducted by Kabiru *et al.*, (2011) nineteen percent of males and 35% of females had been tested. Among tested youth, 74% of males and 43% of females had requested for their most recent HIV test while 7% of males and 32% of females reported that they were required to take their most recent HIV test (i.e., the test was mandatory). About 60% of females who had ever had sex received an HIV test because they were pregnant. We found modest support for the HBM in explaining variation in testing behavior. In particular, we found that perceived risk for HIV infection may drive HIV testing among youth. For example, about half of youth who had ever had sex but had never been tested reported that they had not been tested because they were not at risk (Kabiru *et al.*, 2011).

2.5 AIDS Awareness in an Indian Metropolitan Slum Dweller : A KAP (Knowledge, Attitude, Practice) Study.

Kalasagor *et al.*, (2006) reported in their survey that the overall literacy rate was 64%, with males being 70% and females being 60% literate. 20% of males and 11% of females do not know about a disease called AIDS. Only 67% of males and 55% of females are aware of the

sexual mode of transmission. 34% of males and 50% females opine that AIDS is also a hereditary disease. Also 45% of males and 62% of females feel that AIDS also spreads by air, fomites, or mosquito-bite. Only 30% of males and 22% females know about the possible symptoms of AIDS. 30% of males and 45% of females never ask for a new syringe if not provided, as they are totally unaware of its significance. 43% of males and 78% of females do not know about the risk of a barber's blade. 56% of males and 71% of females feel that AIDS can be treated at least by a traditional medicine. Lastly, 48% of males and 60% females prefer out casting an AIDS patient from the slum (Kalasagor *et al.*, 2006).

2.6 Sexual Risk Taking in The Slums of Nairobi, Kenya, 1993-98.

A report was stated in a survey which was conducted by Zulu *et al.,* (2002) relatively less attention has been paid to reproductive health problems facing deprived urban residents than to those facing rural residents in sub-Saharan Africa. This is probably because the majority of Africans live in rural areas, where they are presumed to have poorer medical, educational, and other social services. Yet, the unprecedented rate of urbanization and the accompanying disproportionate growth in the proportion of poor city residents pose new challenges for health care in the region. This study examines differences in sexual behaviour between slum residents and non-slum residents in Nairobi city. The results show that slum residents start sexual intercourse at earlier ages, have more sexual partners, and are less likely than other city residents to know of or adopt preventive measures against contracting HIV/AIDS. The findings highlight the need to treat slum residents as a subpopulation uniquely vulnerable to reproductive health problems, and to expend more resources in slum settings (Zulu *et al.*, 2002).

2.7 An Intervention Study to Enhance AIDS Awareness Among Underprivileged Population in Chandigarh.

Bhatia *et al.*, (2004) reported in their survey that awareness about AIDS increased from 58.2% to 70% *($p < 0.01$).* The major sources of information were the mass media and friends. Knowledge regarding the mode of spread also increased after the campaign. Knowledge regarding prevention of AIDS by using condoms increased from 42% to 61.2%; having a single partner, from 59% to 72.3%; using safe blood, from 14.9% to 29%; and sterile needles/syringes, from 18.1% to 33.9%. Over 90% of respondents consider AIDS a dangerous disease (Bhatia *et al.*, 2004).

2.8 HIV Transmission Risk Behavior Among HIV-Infected Adults in Uganda: Results of a Nationally Representative Survey.

Bunnell *et al.*, (2008) reported that of 1092 HIV-infected respondents, 64% were female (median age was 33 years), 84% had HSV-2, and 13% reported one lifetime partner (1% of men and 23% of women). Twenty-one percent of adults knew their HIV status and 9% knew their partners'. Seventy-seven percent were sexually active, of whom 27% reported condom use at last sex. Of last unprotected sexual encounters, 84% were with spouses and 13% with steady partners. Of cohabitating persons, 40% had an HIV-negative spouse. Those who knew their HIV status were three times more likely to use a condom at last sex encounter [adjusted odds ratio (AOR), 3.0; 95% confidence intervals (CI), 1.9–4.7] and those who knew their partners' HIV status were 2.3 times more likely to use condoms (Bunnell *et al.,* 2008).

2.9 Awareness and Knowledge of AIDS Among Indian Women: Evidence From 13 States.

Balk and Lahiri, (1997) reported that the study carried out over 30,000 ever-married women in 13 (out of 25) Indian states where HIV is thought to be highly prevalent-Maharashtra, West Bengal, Tamil Nadu, and ten other less populous states-were surveyed about their awareness and knowledge of AIDS. Only one in six women had heard of AIDS. Among those, knowledge about transmission and prevention is poor. Multivariate analyses reveal that rural, poorly educated, and poor women are the least likely to be AIDS-aware and if aware, have the poorest understanding of the syndrome. Despite low levels of awareness and knowledge, we find a strong positive association between AIDS awareness and knowledge and condom use (Balk and Lahiri, 1997).

2.10 HIV/AIDS-Related Knowledge Among Malaysian Young Adults: Findings From a Nationwide Survey

Wong *et al*.,(2008) mentioned in their survey that total of 1075 young adult respondents aged 15–24 years participated in this survey. The response rate was 82.2%.The data indicated that HIV/AIDS knowledge among the respondents was moderate, with a mean knowledge score of 20.1 out of 32 points. The great majority had adequate knowledge of the major routes of HIV transmission, but fewer were aware of other modes of transmission, such as tattooing and piercing, sharing personal items, and breast-feeding from an infected mother. The great majority knew that HIV is not transmitted by mosquito bites, sharing meals, casual contact, and using public swimming pools and toilets (Wong *et al.,* 2008)

2.11 Survey on HIV/AIDS Related Knowledge and Behavior of High Risk Population in Taiyuan City

Wang *et al*., (2010) reported that, total of 531 respondents recruited in this study, 186 were commercial sex workers, 238 were drug users and 107 were MSM. The awareness of HIV/AIDS-related knowledge in sex workers was 61.9%, in drug users was 77.2% and in MSM was 90.4%. The condom user in sex workers at the last sexual activity was 74.9%, and in MSM was 58.9%. Sharing needle with others in intravenous drug users during the month before entering into the drug addiction treatment center was 57.9%. Except of sex workers in the top grade entertainment places, there was no statistically significant correlation between knowledge and behavior in these three high risk groups (Wang *et al*., 2010).

2.12 HIV/AIDS Awareness among VCT Clients: A Cross-Sectional Study from Delhi, India.

Mehra *et al.*,(2014) found in their survey the contribution of India to the global burden of HIV/AIDS is significant. A major barrier that the country has faced in its battle against this disease is the inadequate and inaccurate information about it among the population. The present analysis explores the knowledge about HIV/AIDS among clients attending a voluntary counseling and testing (VCT) facility in India. Two hundred clients attending the VCT facility were assessed in this regard using a structured predesigned questionnaire. Sixty-three (31.5%) of the respondents had never heard of HIV/AIDS. In comparison to males, a significantly higher number of females had not heard about the disease . Lower levels of education of participants were found to be significantly associated with the response of not having heard of HIV/AIDS as was an occupation status of being an unemployed man/housewife For the 137 (68.5%) respondents who had heard about HIV/AIDS, television was the source of information in 130 (94.9%) followed by posters in 93 (67.9%) and newspapers in 88 (64.2%). While the knowledge about HIV transmission and prevention was good, the extent of misconceptions was high (61.8%). Our study highlights the strong need to raise the levels of HIV awareness among Indian population (Mehra *et al.*,2014)

Significance of The Study

HIV/AIDS is one of the most destructive diseases humankind has ever faced. It brings with it profound social, economic and public health consequences. It has become one of the world's most serious health and development challenges. The first cases were reported in 1981 and since the beginning of the pandemic more than three decades ago; approximately 30 million people have died of AIDS-related illnesses. There are an estimated 35.3 million People Living with HIV (PLHIV).It is now the seventh leading cause of death among 1-4 year olds, sixth among 15-24 year olds and 1st among 25- 44 year olds (Adedimeji *et al*., 2007).

Two hundred sixteen HIV positive cases have been reported from Bangladesh in 2006. Two hundred forty have already developed AIDS among 874 HIV positive cases out of which 109 AIDS patients have already died. In achieving the World Health Organization (WHO) goal of reducing the global infection of HIV/AIDS and the healthy people 2010 goal of increasing the length and quality of life of individuals with HIV/AIDS. Although Bangladesh is a low HIV-prevalence country, it is important that prevention efforts are maintained to limit further spread of the virus (Azim *et al.*,2008)

Lack of knowledge on the control and prevention of this virus is harmful and main reason for spreading the disease. Mostly slum dwellers are at risk due to their lack of knowledge and awareness; so their knowledge about prevention and control is important. If they are properly informed about the diseases, it will help to disseminate the information in the society more effectively and efficiency. Our key aim is to support government efforts to control the spread of HIV and AIDS. They can grab information from our study and can take necessary steps to increase the knowledge and awareness regarding AIDS among slum dwellers.

Objective of the study

Objectives of the study were:

- To determine the knowledge level of slum dwellers in Bangladesh about HIV/AIDS.
- To assess the level of perception and misconception about the mode of transmission of HIV/AIDS.
- Their perception of mode of preventions and control of HIV/AIDS.
- Their attitude towards HIV/AIDS infected person.

Chapter 3

Methodology

3.1 Type of The Study
It was a survey based study.

3.2 Study Population
The targeted group was slum dwellers who reside in Vashantek,BRP and Kalshi. The survey was conducted among 569 people including male and female of all age except the children.

3.3 Inclusion Criteria
- Both male and female
- Anyone over the age of 18 years

3.4 Exclusion Criteria
- Anyone but slum dwellers
- Children

3.5 Data Collection Method
The data was collected through questionnaire that is formed in English language. It consists of multiple choice type questions to find out the knowledge about HIV/AIDS among slum dwellers. The data was collected by face to face interview.

3.6 Development of The Questionnaire
The questionnaire was developed based on different findings in available journal and research paper. Also from the observation of different behavior of Bangladeshi people.

3.7 Sampling Technique
In this study random sampling was followed to obtain a more scientific result that could be used to represent the entirety of the population.

3.8 Data Collecting Period
The duration of data collection was about four months that started from June 2016 to October 2016.

3.9 Data Analysis
After collecting, all the data were checked and analyzed with the help of Microsoft Office Excel 2010.

Chapter 4

Result

4.1 Socio Demography

4.1.1 Age Distribution

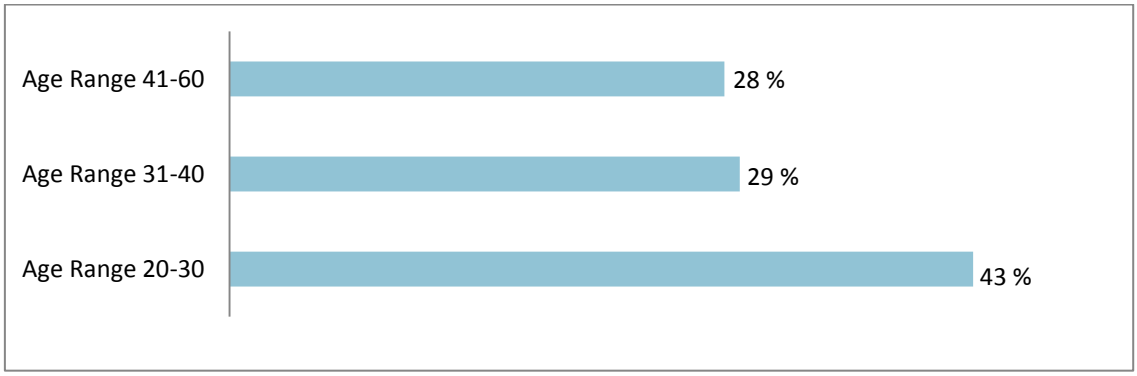

Fig 4.1.1: Age Distribution

In this survey about 43% slum dwellers were in the age range 20-30, 29% were in age range 31-40, and 28% were in age range 41-60 years.

4.1.2 Gender Distribution

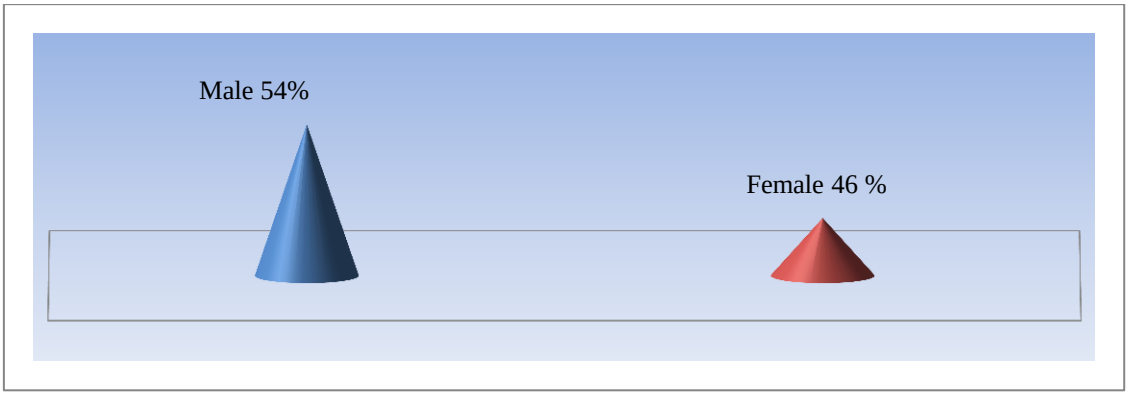

Fig 4.1.2: Gender of the Responds

In our study we found about 54% male and 46% female slum dwellers.

4.1.3 Marital Status

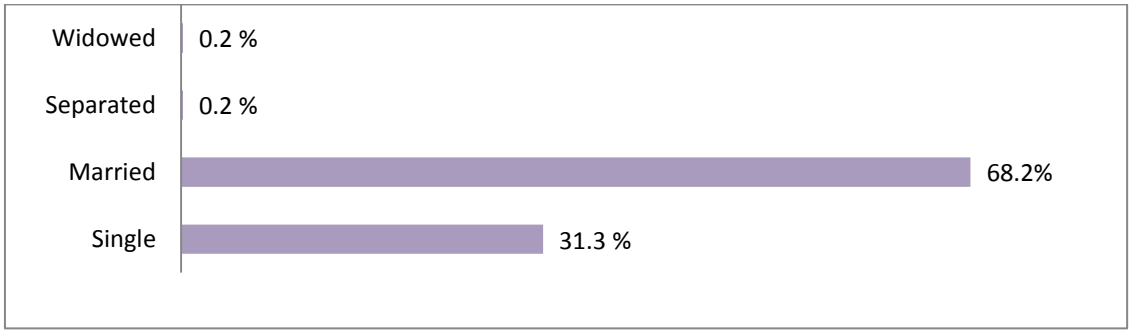

Fig 4.1.3: Marital status of responds

Among the total slum dwellers maximum population (about 68 %) were married, 32 % were single and very few were separated or widowed (about only 0.8 %).

4.2 Knowledge about HIV/AIDS

In this study all responders confirmed that they heard about the term HIV and AIDS.

4.2.1 Source of Information

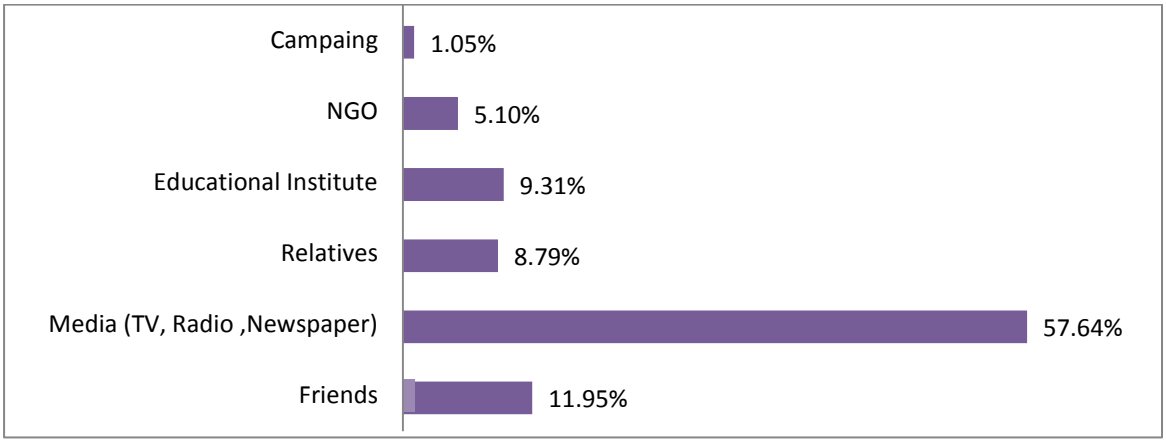

Fig 4.2.1: Source of information

Among the study population, 57.64% told that they were informed through media (TV, Radio, Newspaper), 9.31 % from Educational institutes and 11.95 %, 8.79 %, 1.05%, 5.10 % slum dwellers were informed from Friends, Relative Campaign and NGO respectively.

4.2.2.1 Knowledge about Differences between HIV and AIDS

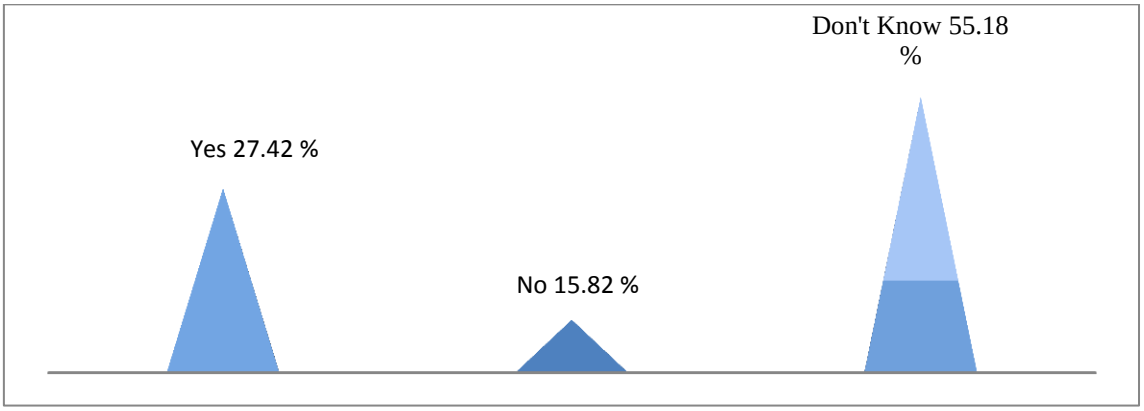

Fig 4.2.2.1: Knowledge about Differences between HIV and AIDS

Among the slum dwellers 27.42 % confirmed there was difference between HIV and AIDS whereas 15.82 % informed there is no difference between HIV and AIDS and 55.18 % had no idea about this.

4.2.2.2 Knowledge about Differences between HIV and AIDS

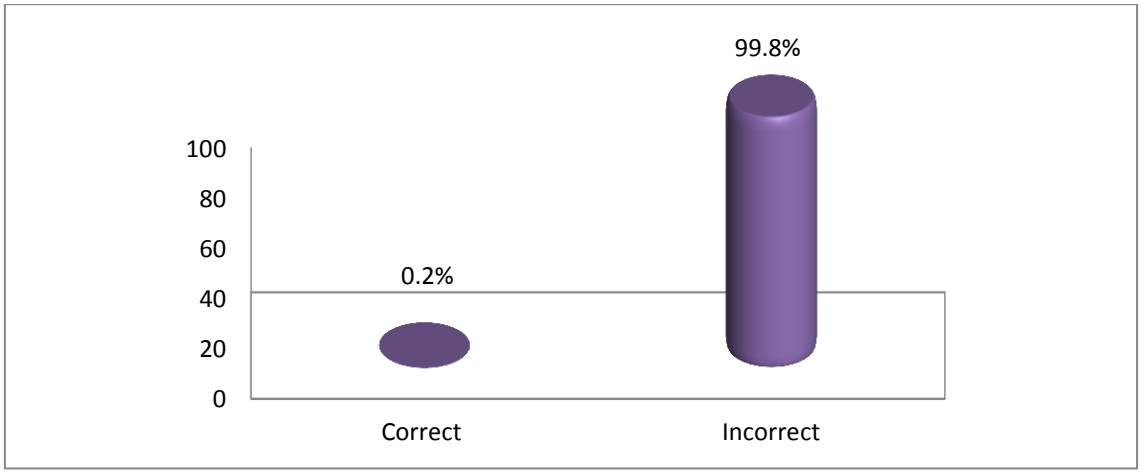

Fig 4.2.2.2: Knowledge about Differences between HIV and AIDS

Among the slum dwellers who said there is difference between HIV and AIDS; 0.2% of them could specify correctly but 99.80 % delivered wrong answer.

4.2.3 Knowledge about Treatment of HIV and AIDS

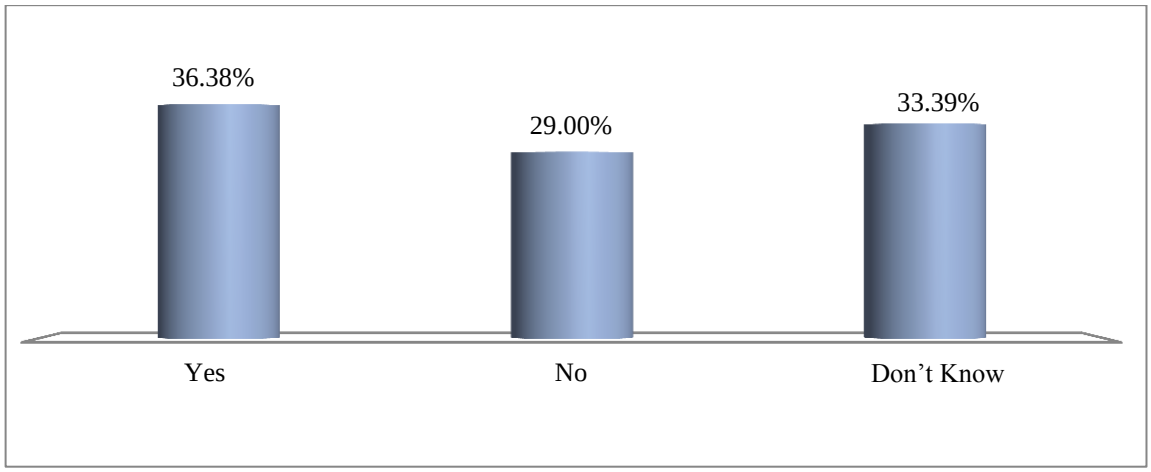

Fig 4.2.3: Knowledge about treatment of HIV and AIDS

On this topic, 36.38 % slum dwellers informed HIV and AIDS can be treated, 29 % slum dwellers confirmed it is not treatable, 33.39 % had no idea about this.

4.2.4 Knowledge about Vaccine Availability

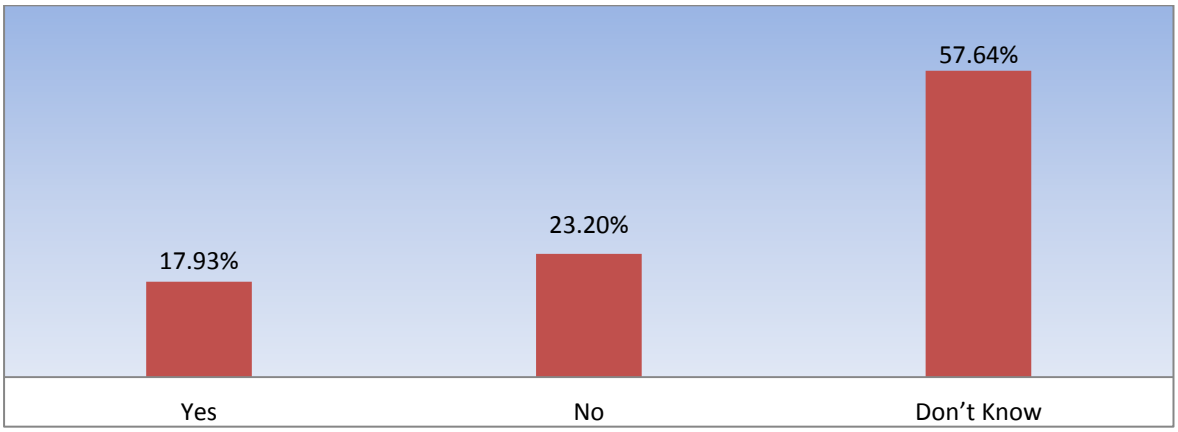

Fig 4.2.4: Knowledge about vaccine availability

About 23.20% slum dwellers answered there is no vaccine available, 17.93 % informed that vaccine is available and 57.64 % marked they don't know about this topic.

4.2.5 Knowledge about Mode of Transmission

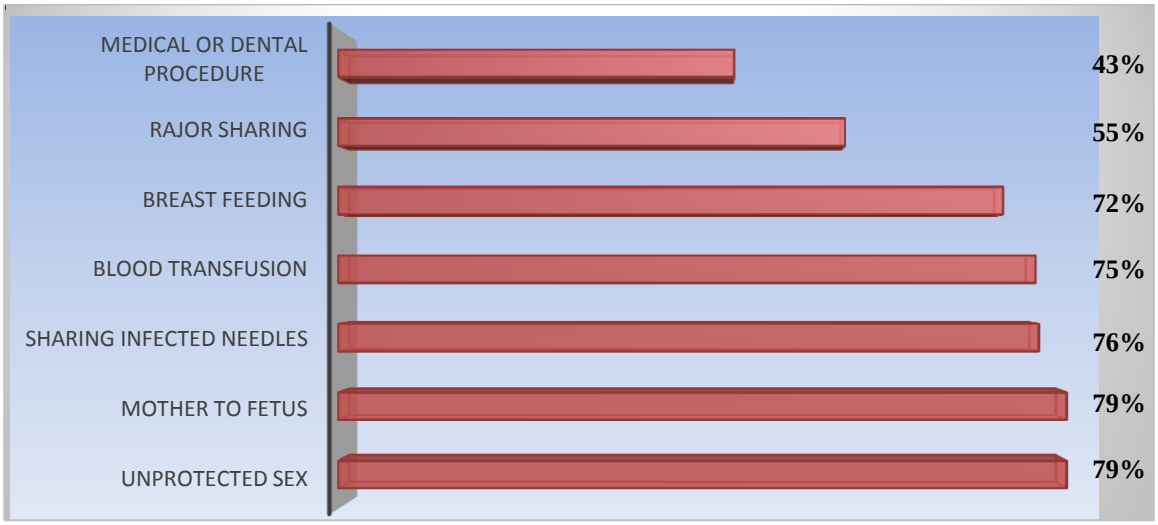

Fig 4.2.5: Knowledge about mode of Transmission

Most of the respondents (78.56 %) supported that HIV can be transmitted by unprotected sex. About 78.56 % slum dwellers said HIV can be transmitted from mother to fetus. On the other hand 75.57 % marked sharing infected needles or syringe as a way of mode of transmission and 75.22 % claimed that HIV can be transmitted by blood transfusion. Whereas 42.71 %, 54.66 % and 71.70 % population informed HIV can be transmitted by medical or dental procedure, razor sharing and breast feeding respectively.

4.2.6 Misconception about Mode of Transmission of HIV and AIDS

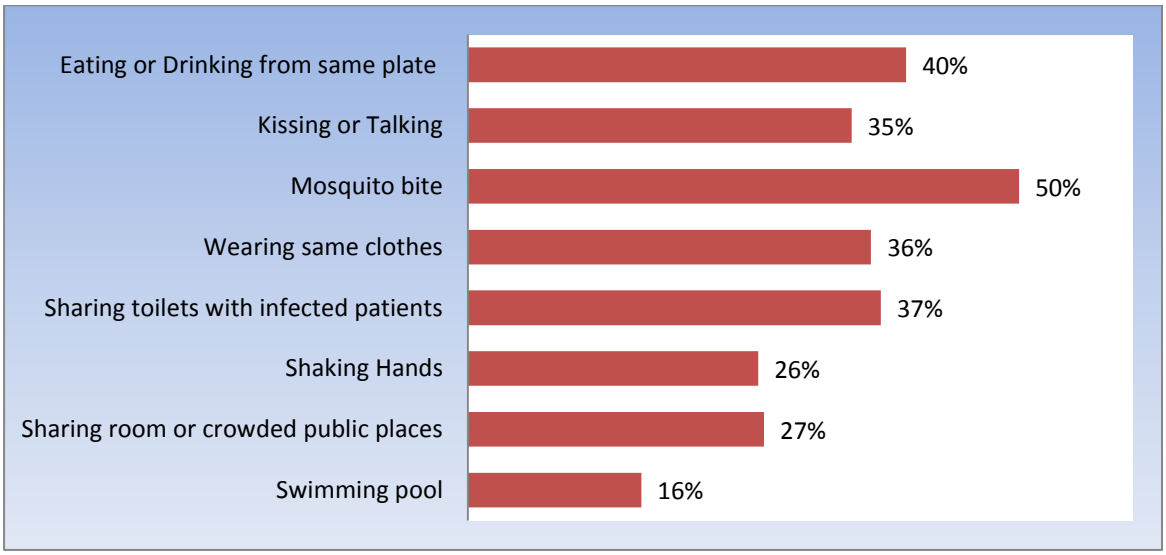

Fig 4.2.6: Misconception about mode of transmission of HIV and AIDS

Among the slum dwellers some don't have clear concept regarding this topic. Some of them (26%) confirmed that by shaking hand HIV can be transmitted and 39.54 % said by drinking and eating on same glass or plate HIV can be transmitted. About 36.38 % respondents said by wearing same cloth it can also be transmitted. About 37.26 % said by sharing toilet with infected person HIV can be transmitted whereas 49.74 %, 26.71 %, 34.62 % and 15.64 % of the respondents marked mosquito bites, sharing room or crowded places, kissing or talking and swimming in the same pool as a mode of transmission respectively.

4.3 Knowledge of Control and Prevention of HIV and AIDS

Fig4.3: Knowledge of control and prevention of HIV and AIDS

In our study we found, most of the slum dwellers (76.1 %) thought using condom can prevent and control this disease. Whereas 64.67%, 72.41%, 67.84%, 56.41% and 72.41% of them marked remaining faithful to single partner, avoiding needle share, blood test before marriage, avoiding casual sex, knowledge and education respectively as the control and prevention method.

4.4 Attitude towards HIV Infected Person

Attitude towards Infected Person	Yes (%)	No (%)	Don't Know (%)
Taking care of the patient	71	18	9
Continuing relationship	74	16	9
If person is shopkeeper, then buying food from him	54	34	11
If he/she is your employee/employer/co-worker	34	51	17
Infected by Unethical deeds	30	44	25
Allow their children to play with the affected person	45	4	15

Fig 4.4: Attitude towards HIV Infected Person

Most participants (71%) wanted to take care of the infected person. But only 18% of them didn't want to take care of the infected person. Maximum percentage (74%) of respondents wanted to continue relationship with infected person. About 54% of the respondents said that they won't mind buying food from the infected shopkeeper and will be positive towards the infected person. Approximately 51% said that they won't dismiss the infected one from their job whereas 34% will do so. A considerable number of participants (44%) believed that the disease does not occur due to unethical deeds and 45% mentioned that they will allow their children to play with the infected persons.

Chapter 5

Discussion and Conclusion

5.1 Discussion

The survey was based on the knowledge, awareness and attitude towards HIV/AIDS. Our study conducted onto 569 slum dwellers in Dhaka city. Most of them were in the age range between 20-30 (43%), 30-40 years (29%) and 41-60 years (28%). Majority of the slum dwellers were from Bhashantek, BRP and Kalshi slum.

In our survey about 54% population was male whereas the female was 46% but Kabiru *et al.,* (2011) found high percentage (35%) of female in their study .

During this study we came to know that all the respondents were familiar with the term HIV/AIDS. Kalasagor *et al.,* (2006) reported that 20% of male and 11% of female of Indian metropolitan slum do not know about a disease called AIDS So, it is seen that Bangladeshi slum people have more knowledge and also are aware of the fact of HIV than the people of Indian metropolitan slum.

From the study we have noticed that the major source of information is media (TV, Newspapers and Radio) (57.64%) and Educational institute (11.95%). Bhatia *et al.,* (2004) reported in their study that the major sources of information were the mass media and friends. Gupta *et al.,* (2013) found majority of the Indian secondary school students (85.0%) have heard HIV/AIDS from television, followed by the newspaper and friends/relatives (39.5%).

About 27.42 % slum dwellers confirmed in our study that there is a difference between HIV and AIDS. Shuma and Halder (2015) found 60% respondent who do not know if there is any difference between HIV and AIDS.

Among the population those who knew the difference between HIV and AIDS; 0.2% population could specify correctly. Wong *et al*., (2008) reported that many Malaysian young adult (64.9%) were unable to correctly differentiate HIV from AIDS.

We also found, among the respondents 36.38% slum dwellers informed that HIV and AIDS can be treated and 17.93% think there is vaccine available. Kalasagor *et al.,* (2006) mentioned in their survey that 56% of the male and 71% of the female seem that AIDS can be treated at least by a traditional medicine.

We have come to know by our study most respondents (78.56%) supported that HIV can be transmitted by unprotected sex, followed by blood transfusion (75.22%), sharing infected needles or syringe (75.57%) and fetal transfusion (78.56%). Wong et al., (2008) found most of the Malaysian young adults told that HIV is transmitted via sharing needles of an infected person (94.8%), having sexual intercourse (93.7%), receiving a transfusion of infected blood or receiving an organ (91.9%), having sex with multiple sexual partners (91.4%) and from an infected mother to her fetus (85.6%).

It has been shown from our study some slum dwellers who have misconception about transmission of HIV/AIDS. According to them shaking hands (26.19%), drinking and eating on same glass or plate (39.54%), wearing same cloth (36.38%), sharing toilet with infected person (37.26%) and mosquitoes bites (49.74%) are responsible for HIV/ AIDS transmission. Mehra *et al*., (2014) found (34.3%) VCT Clients who thought it can be transmitted by mosquito bite, while (23.3%) and (29.9%) incorrectly stated that it can be transmitted by eating with and by sharing towels/clothes/handkerchief of a person with HIV/AIDS, respectively.

A good findings of our study is that most of the population have batter knowledge about control and prevention of HIV/ AIDS. About 76.10% population think use of condom and 64.67% think remaining faithful to single partner can prevent HIV transmission. About 72.41% respondents think that the transmission of HIV can be prevented by avoiding needle share. According to 72.41% responds, knowledge and education is important for control and prevention of HIV/AIDS. Kalasagor *et al.*, (2006) mentioned in their study that 67% of males and 55% of females are aware of the sexual mode of transmission.

We have noticed that most of the slum people have positive attitude towards HIV infected person in term of taking care, continuing relationship and buying food. Thanavanh *et al*., (2013) found positive attitudes towards HIV/AIDS among 55.7% of the respondents in Lao People's Democratic Republic.

5.2 Conclusion

Based on all the facts, it can be concluded that slum dwellers do not hold a satisfactory level of knowledge about the mode of transmission of HIV/AIDS but their attitude towards the AIDS patients is satisfactory. So useful and informative media campaigns should be arranged to educate people regarding the health consequences of STDs including HIV/AIDS. As ours is an overpopulated country, proper knowledge among people especially young slum people who are at high risk of getting AIDS is necessary to cope up with this disease. Combined approach is strongly needed for creating knowledge and awareness to control the spread of HIV and AIDS among slum people in Bangladesh. If all could develop better knowledge about this fatal disease, it will be easy to prevent this. It is however needed to mention that this research was conducted on randomly chosen three slum areas and in a very small scale. So it doesn't reflect the whole idea. Therefore it is suggested that if a conclusive result about the knowledge and awareness about HIV/AIDS is desired, further large scale researches should be conducted.

Chapter 6

Reference

Adedimeji, A.A., Omololu, F.O. and Odutolu, O. (2007) HIV risk perception and constraints to protective behaviour among young slum dwellers in Ibadan, Nigeria. *Journal of Health, Population and Nutrition.* [Online] 25(2). p.146-157. Available from: http://www.jstor.org/stable/23499410?seq=1#page_scan_tab_contents [Accessed:14 November 2016].

AIDS.gov. (2015) *Overview of HIV Treatments.* [Online] Available From: https://www.aids.gov/hiv-aids-basics/just-diagnosed-with-hiv-aids/treatment options/overview-of-hiv-treatments/ [Accessed: 21 November 2016].

AIDS Info. (2016) *The Stages of HIV Infection.* [Online] Available From: https://aidsinfo.nih.gov/education-materials/fact-sheets/19/46/the-stages-of-hiv-infection [Accessed:12 December 2016].

Anand, A., Shiraishi, R.W., Bunnell, R.E., Jacobs, K., Solehdin, N., Abdul-Quader, A.S., Marum, L.H., Muttunga, J.N., Kamoto, K., Aberle-Grasse, J.M. and Diaz, T. (2009) Knowledge of HIV status, sexual risk behaviors and contraceptive need among people living with HIV in Kenya and Malawi. *Aids*. [Online] 23(12). p.1565-1573. Available from: http://journals.lww.com/aidsonline/Abstract/2009/07310/Knowledge_of_HIV_status,_sexual_risk_behaviors_and.15.aspx [Accessed: 04 September 2016].

Apostolova, N. (2011) *Mitochondrial interference*. [Image] [Online] Available from: http://www.cell.com/cms/attachment/614450/4945048/gr1.jpg [Accessed: 29 October 2016].

Avert. (2016) *History of HIV and AIDS Review*. [Online] Available From: http://www.avert.org/professionals/history-hiv-aids/overview [Accessed:14 November 2016].

Azim, T., Khan, S.I., Haseen, F., Huq, N.L., Henning, L., Pervez, M.M., Chowdhury, M.E. and Sarafian, I. (2008) HIV and AIDS in Bangladesh. *Journal of Health, Population and Nutrition*. [Online] 26(3). p.311-324. Available from: http://www.jstor.org/stable/23499576 [Accessed:21 November 2016].

Balk, D. and Lahiri, S. (1997) Awareness and knowledge of AIDS among Indian women: evidence from 13 states. *Health Transition Review*. [Online] 7(1). p.421-465. Available from: http://www.jstor.org/stable/40652316 [Accessed: 18 December 2016].

Bhatia, V., Swami, H.M. and Kaur, A.P. (2004) An intervention study to enhance AIDS awareness among underprivileged population in Chandigarh. *Indian Journal of Dermatology, Venereology, and Leprology.* [Online] 70(2). p.87. Available from: http://www.ijdvl.com/article.asp?issn=03786323;year=2004;volume=70;issue=2;spage=87;epage=91 [Accessed:09 November 2016].

Bunnell, R., Opio, A., Musinguzi, J., Kirungi, W., Ekwaru, P., Mishra, V., Hladik, W., Kafuko, J., Madraa, E. and Mermin, J. (2008) HIV transmission risk behavior among HIV-infected adults in Uganda: results of a nationally representative survey. *Aids*. [Online] 22(5). p.617-624. Available from: http://journals.lww.com/aidsonline/Abstract/2008/03120/HIV_transmission_risk_behavior_among_HIV_infected.8.aspx [Accessed: 25 December 2016].

Cdc.gov. (2016) *About HIV/AIDS | HIV Basics | HIV/AIDS | CDC.* [Online] Available from: http://www.cdc.gov/hiv/basics/whatishiv.html [Accessed: 28 November 2016].

Food and Drug Administration. (2016) *Antiretroviral drugs used in the treatment of HIV infection.* [Online] Available from: http://www.fda.gov/ForPatients/Illness/HIVAIDS/Treatment/ucm118915.htm [Accessed: 15 September 2016].

Gupta, I. and Mitra, A. (1999) Knowledge of HIV/AIDS among migrants in Delhi slums. *Journal of Health and Population in Developing Countries.* [Online] 2(1). p.26-32. Available from: http://www.popline.org/node/282120 [Accessed:28 November 2016].

Holland, K. (2013). The History of HIV. *Healthline.* [Online] Available from: http://www.healthline.com/health/hiv-aids/history#EarliestCase [Accessed: 29 November 2016].

Iyidogan, P. and Anderson, K.S. (2014) Current perspectives on HIV-1 antiretroviral drug resistance. *Viruses*. [Online] 6(10). p.4095-4139. Available from: http://www.mdpi.com/1999-4915/6/10/4095/htm [Accessed:26 November 2016].

Kabiru, C.W., Beguy, D., Crichton, J. and Zulu, E.M. (2011) HIV/AIDS among youth in urban informal (slum) settlements in Kenya: What are the correlates of and motivations for HIV testing?.*BMC Public Health*. [Online] 11(1). p.685. Available from: https://bmcpublichealth.biomedcentral.com/articles/10.1186/1471-2458-11-685 [Accessed:18 December 2016].

Kaiser Family Foundation (2017) *The Global HIV/AIDS Epidemic.* [Online] Available From: http://kff.org/global-health-policy/fact-sheet/the-global-hivaids-epidemic/ [Accessed: 14 November 2016].

Kalasagar, M., Sivapathasundharam, B. and Einstein, T.B.A. (2006) AIDS awareness in an Indian metropolitan slum dweller: A KAP (knowledge, attitude, practice) study. *Indian Journal Of Dental Research*. [Online] 17(2). p.66. Available from: http://www.ijdr.in/article.asp?issn=09709290;year=2006;volume=17;issue=2;spage=66;epage=9;aulast=Kalasagar [Accessed:15November 2016].

Mayo Clinic. (2015) *Treatments and Drugs.* [Online] Available From: http://www.mayoclinic.org/diseases-conditions/hiv-aids/basics/treatment/con-20013732 [Accessed: 10 December 2016].

Mehra, B., Bhattar, S., Bhalla, P. and Rawat, D. (2014) HIV/AIDS awareness among VCT clients: a cross-sectional study from Delhi, India. *BioMed research international*, *2014*. [Online] 13(1). p.605. Available from: https://www.hindawi.com/journals/bmri/2014/269404/abs/ [Accessed:15 October 2016].

Montagnier, L. (2002) A history of HIV discovery. *Science*. [Online] 298(5599). p.1727-1728. Available from: http://science.sciencemag.org/content/298/5599/1727 [Accessed: 17 November 2016].

NAM Aidsmap. (2016) *Types of HIV drugs - Protease inhibitors*. [Online] Available from: http://www.aidsmap.com/Protease-inhibitors/page/1729414/ [Accessed: 23 November 2016].

National Institute of Allergy and Infectious Diseases (2015) *HIV/AIDS.* [Online] Available From: https://www.niaid.nih.gov/topics/hivaids/Pages/Default.aspx [Accessed:16 December 2016].

National Institute of Allergy and Infectious Diseases (2015) *What are HIV/AIDS?*.[Online] Available From: https://www.niaid.nih.gov/topics/hivaids/understanding/Pages/whatAreHIVAIDS.aspx [Accessed:14 November 2016].

Nature, (n.d.). *Protease Inhibitors*. [Image] [Online] Available from: http://www.nature.com/nature/journal/v410/n6831/images/410995ad.2.jpg [Accessed: 1 September 2016].

Rahman, M.M., Kabir, M. and Shahidullah, M. (2009) Adolescent knowledge and awareness about AIDS/HIV and factors affecting them in Bangladesh. *J Ayub Med Coll Abbottabad*. [Online] 21(3). p.3-6. Available from: www.academia.edu/download/41477659/Adolescent_knowledge_and_awareness_about2016 0123-2461-1cqq9cx.pdf [Accessed:22 November 2016].

Thanavanh, B., Harun-Or-Rashid, M., Kasuya, H. and Sakamoto, J. (2013) Knowledge, attitudes and practices regarding HIV/AIDS among male high school students in Lao People's Democratic Republic. *Journal of the International AIDS Society*.[Online] 16(1). p.1-2. Available from: http://jiasociety.org/jias/index.php/jias/article/view/17387 [Accessed:13 November 2016].

The AIDS Institute (2011) *How Can HIV Be Prevented?*. [Online] Available From: http://www.theaidsinstitute.org/education/aids-101/how-can-hiv-be-prevented-0 [Accessed: 07 November 2016].

The World Bank. (2012) *HIV/AIDS in Bangladesh.* [Online] Available From: http://www.worldbank.org/en/news/feature/2012/07/10/hiv-aids-bangladesh [Accessed: 14 November 2016].

UNAIDS. (2015) *Fact sheet 2015*. [Online] Available From: http://www.unaids.org/en/resources/campaigns/HowAIDSchangedeverything/factsheet [Accessed: 15 November 2016].

U.S. Department of Veterans Affairs. (N.D.). Nucleoside reverse transcriptase inhibitors (NRTIs or 'nukes') - *HIV/AIDS*. [Online] Available From: http://www.hiv.va.gov/patient/treat/NRTIs.asp [Accessed: 26 November 2016].

Wang, T., Zhang, R., Ma, F., Yin, J., Meng, J., Zhang, C., Zhang, X. and Qu, C. (2010) Survey on HIV/AIDS-related knowledge and behavior of high risk population in Taiyuan City. *Wei sheng yan jiu= Journal of hygiene research*. [Online] 39(1). p.73-75. Available from: http://europepmc.org/abstract/med/20364594 [Accessed:14 November 2016].

Web MD. (2015) *HIV (Human Immunodeficiency Virus) Infection-Prevention.* [Online] Available From: http://www.webmd.com/hiv-aids/tc/human-immunodeficiency-virus-hiv-infection-prevention [Accessed: 14 November 2016].

Wong, L.P., Chin, C.K.L., Low, W.Y. and Jaafar, N. (2008) HIV/AIDS-related knowledge among Malaysian young adults: findings from a nationwide survey. *Journal of the International AIDS society*. [Online] 10(6). p.148. Available from: https://jiasociety.biomedcentral.com/articles/10.1186/1758-2652-10-6-148 [Accessed:14 November 2016].

Zulu, E.M., Dodoo, F.N.A. and Chika-Ezeh, A. (2002) Sexual risk-taking in the slums of Nairobi, Kenya, 1993-98. *Population studies*. [Online] 56(3). p.311-323. Available from: http://www.tandfonline.com/doi/abs/10.1080/00324720215933 [Accessed:14 November 2016].