CHAPTER – I

1. INTRODUCTION

AIDS stands for Acquired Immno Deficiency Syndrome, a pattern of devastating infections caused by Retro virus which attacks and destroys certain white blood cells that are essential to the body's immune/defense system. As the virus attacks and causes destruction and weakening of the body's immune system after a period of time it is known as Human Immunodeficiency Virus or HIV, which finally results into AIDS (STC, 2004). Hence, AIDS is the late clinical stage of infection and this time period varies, depending on factors such as access to AIDS drugs, and possibly such factors as nutrition, the presence of other medical conditions, and stress. In the absence of treatment, the average time between HIV infection and progression to AIDS is around ten years. From the history of HIV epidemic, HIV, the virus has been sweeping the world for the past decades, causing a disease which has killed millions of people and which looks likely to kill more resulting into the global pandemic threat.

Globally, only a small number of HIV infections are estimated to have occurred during the late 1970s and early 1980s. During 1990s, HIV prevalence increased markedly in sub-Saharan Africa (Joshi *et al.*, 2004). HIV has reached pandemic proportion resulting in more than 65 million infections and 25 million deaths world wide though promising developments have seen in the recent years in the global efforts to address the AIDS epidemic including increased access to effective treatment and prevention programmes. The global epidemic has emerged as a formidable challenge to public health, development, and human rights. In countries most severely affected by HIV, it has eroded improvements in life expectancy (WHO-SEARO, 2007). At the end of 2006, an estimated 39.5 million (34.1million-47.1million) people were living with HIV, globally, which is 2.6 million more than in 2004 (UNAIDS/WHO, 2006a).

Among the WHO regions, sub-Saharan Africa is the most affected followed by South-East Asia. New HIV infections are heavily concentrated among the people (15-24 years of age) in many region of the world. Among adults, 15 year and older young people

accounted for 40% of new infection in 2006**.** It had been estimated that 8.6 million people were living with HIV in Asia in 2006, out of which 2.2 million (1.3-3.6 million) people are from South and South East Asia (UNAIDS/WHO, 2006a). Although the overall adult HIV prevalence in South-East Asia is still low (0.7%), the total number of people affected is huge. The scale of the epidemic varies immensely across the South-East Asia where India has the single largest proportion of HIV cases within its boarder, second globally to South Africa. Approximately 5.7 million (3.4 million-9.4 million) people, of whom 5.2 million were adults aged 15-49 years, were living with HIV in 2005 (UNAIDS/WHO, 2006a). Nepal, the neighboring country of India, is in susceptible state for increasing HIV infection cases due to the porosity along the border region of Nepal/India contributing the spread of HIV/AIDS.

The epidemic remains extremely dynamic, growing, and changing character as the virus exploits new opportunities for the transmission resulting into the increase in number of HIV people and so does the number of deaths due to AIDS. There is no room for complacency anywhere. Virtually no country in the world remains unaffected.

Different parts of the world are affected by different types of epidemic. Based on the characteristics of epidemics in different parts of the world, they are of different types. They are low-level epidemic, concentrated epidemic and generalized epidemic.

The first AIDS case in Nepal was reported in 1988. Until the late 1990s, Nepal was classified as having a low-level epidemic. However, since 1997, as HIV infection has been increasing alarmingly among certain specific sub-groups like injecting drug users and female sex workers. Nepal is considered to enter into the concentrated epidemic (UNAIDS/WHO, 2006b). Different considerations that are made for the concentrated epidemic are –HIV spreads rapidly in a defined sub-population, but is not well established in the general population where the epidemic suggests active networks of risk within sub-population, HIV prevalence over 5% in at least one defined sub-population, and HIV prevalence is below 1% in pregnant women in urban areas. Since all these conditions are observed in the epidemic of our country, though Nepal has a low prevalence for HIV (0.5%) in general population, Nepal has entered the

"concentrated epidemic" stage with consistent HIV prevalence in certain risk groups like Female Sex Worker (FSW), Intravenous Drug Users (IDUs) that push Nepal people into greater vulnerability. The HIV/AIDS situation in Nepal has been described as an impending crisis (Seddon, 1998). By March 2007, National Centre for HIV and STD Control, MoH has reported 9043 cases of HIV infection out of which 2733 were female (NCASC and MoH, 2007). However, given the limitations of Nepal's public health surveillance system (http://siteresources.worldbank.org) and the lack of access to quality voluntary counseling and testing services coupled with the antiretroviral treatment, the actual number of infections is expected to be much higher and these prevalence figures are likely to be gross under-estimate (Singh *et al.*, 2005). According to UNAIDS, a dramatically higher estimate has been made of which 70,256 people were living with HIV/AIDS in 2005 including 15,310 women. Adult prevalence was 0.55% in 2005 (NCASC, 2005). The relatively low prevalence rates of HIV infection in general population are masking the concentrated epidemic in the high-risk sub-groups. Even different behavioral and surveillance data indicate the high potential for generalized epidemic in Nepal. It has been estimated that, if prevalence continues to increase at the current rate, AIDS could be the major cause of death in Nepal by 2010 (USAID, 2005). For Nepal around 100,000-200,000 young adults will become infected and that overall annual 10,000-15,000 annual AIDS cases and the deaths may be expected in the absence of effective interventions. So, even a "low to moderate growth scenario" would make AIDS the leading cause of death in the adult population over the coming years (NCASC, 2002).

In order to prevent the growing epidemic of HIV/AIDS, different epidemiological tools have been implemented like EPP, Workbook, Epi model, Spreadsheet etc. for upgrading the national prevention efforts. Surveillance of HIV incidence in itself is very complex and complicated which is due to the dynamic nature and progression stages of HIV virus. In addition, estimation of incidence of HIV infections in different exposure groups has not been conducted in Nepal and this study work aims to focus or reveal the status of HIV infection in Nepal by mode of transmission among various exposure

groups which will probably help the nation to give a vision for making the strategies in future considering different adult risk behaviors.

The epidemic progresses at different rates at different levels of intensity within different exposure groups even within the regions of different parts of the country. And the impact of national prevention efforts has been limited by the low coverage of prevention efforts. A careful analysis of the distribution of new infections, modes of transmission and the groups at the highest risk of becoming infected with HIV in a particular country are to be considered for better planning of prevention efforts. But, in most countries it is based on the types of epidemic rather than on analysis in different risk groups' distribution patterns. Beside this, in almost all regions of the world, transmission patterns have been changing over time but not the strategies to prevent it. So, the first and the foremost point is to understand the behaviors that put the people at risk of infection and the current distribution of new HIV infections by risk group so that the HIV epidemics can be controlled effectively and reach the people most in need along with the prevention strategies adapting to the changing patterns of HIV risk (Gouws *et al.*, 2006).

Capturing all those above mentioned needs, Spreadsheet, a new epidemiological tool has been developed in collaboration with UNAIDS Reference Group on Estimates, Modelling and Projections to quantify the number of new infections by mode of exposure resulting to develop costed national strategic plans. Using the current distribution of prevalent infections and the pattern of risk within different populations, the spreadsheet, here, was used to estimate the expected size of new adult infections in the identified risk groups in the coming year and their exposure to HIV infection which will probably help in sensible focus in intervention in targeted risk population. The result from research work will also help to identify the relative magnitude of infection within the risk groups promoting for correct intervention so as to prevent the spread of HIV/AIDS in near future.

CHAPTER – II

2. OBJECTIVES

2.1 General Objective

Short-term estimation of incidence of adult HIV infections in Nepal by mode of transmission among various exposure groups over the coming year

2.2 Specific objectives

- To divide defined population groups with particular risk of acquiring HIV
- To estimate the size of the risk groups by mode of exposure group
- To determine the relative magnitude of infection within the risk groups
- To determine the source of new HIV infection

CHAPTER – III

3. LITERATURE REVIEW

3.1 Introduction

AIDS, an acronym for Acquired Immune Deficiency Syndrome, is caused by a virus-HIV (Human Immunodeficiency Virus). It was first isolated in 1983. It has been identified in over 200 countries and territories worldwide and is spreading rapidly in many affected populations particularly in developing countries.

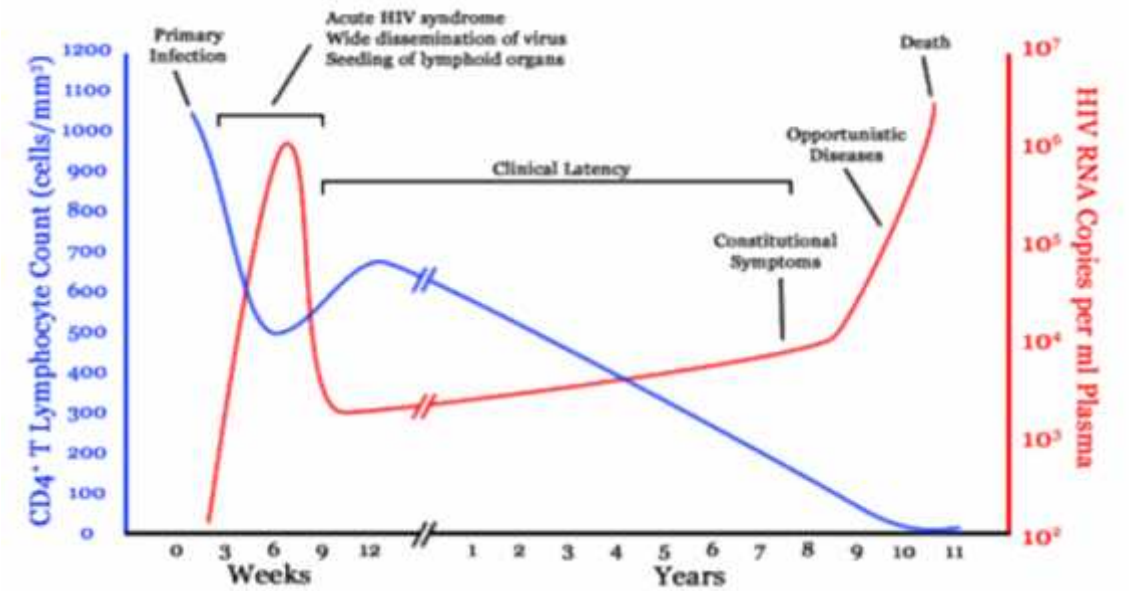
HIV belongs to an unusual group of virus called Retroviruses that lies in the family Retroviridae and subfamily lentivirus for being their association with the slowly progressive disease. The family Retroviridae contains many viruses from widely different host species that include viruses causing leukemia in humans, cats, cattle and other animals, and certain other virus found in monkeys and apes, sheep and goats. Retroviruses are single stranded RNA viruses that contained the enzyme reverse transcriptase, which is RNA directed DNA polymerase that seems to possess ribonuclease activity. It enables the RNA of the virus to produce DNA copy of itself in order to become integrated and replicate in host cells (Greenwood *et al.*, 2006).

There are two main strains of HIV. HIV-1 that has caused majority of infection and AIDS cases and HIV-2, which is concentrated in selected countries. Of the other known related viruses, a type of retrovirus found in many other primates (Simian Immunodeficiency Virus, SIV) may be the most likely contender of HIV. Of the many different strains of HIV found in various monkey and apes species in Africa, some causing an AIDS like diseases in their host, the most similar to HIV-1 in the chimpanzees SIV. Viruses mutate, or change, more easily than more complex organisms. HIV itself has many varieties and has been shown to mutate within an individual during the progress of the infection. AIDS develop in HIV positive person after years of infection, as HIV steadily weakens the body's immune system and increases its vulnerability to pneumonia, tuberculosis, diarrhea, tumors and other

opportunistic illnesses. With the number of people infected with HIV continuing to rise, the number of people dying of AIDS will multiply.

While the origins of AIDS remain obscure, it is known that HIV occurred as long as the late 1950s in isolated individuals. It began to be widespread in the mid- to late 1970s but, because of the long incubation period, the virus didn't cause widespread disease until the 1980s. In most counties, in its early stage the viral epidemic spread undetected.

The pathogenesis of HIV can be categorized into different stages depending on the natural course of HIV infection and the effects of HIV on the immune system. In HIV infection, there are distinct three phases, Acute infection (4-8 weeks), Asymptomatic infection or clinical latency (10-11 yrs) and ultimately AIDS defining diseases and death (2-3 yrs).



A generalized graph of the relationship between HIV copies (viral load) and CD4 counts over the average course of untreated HIV infection; any particular individual's disease course may vary considerably.

$CD4^+$ T Lymphocyte count (cells/mm^3)

HIV RNA copies per mL of plasma

After the establishment of primary infection, the virus is disseminated to lymphoid organs where it persists with minimal expression for the time of clinical latency and finally a profound expression of HIV provirus occurs leading to immune suppression and onset of opportunistic infection as well as neoplasms and eventually, the death.

Acute Retroviral Syndrome occurs in 50-70% of infected patients and is characterized by flu like or infectious mononucleosis like disease with fever, generalized lymphadenopathy, sore throat, arthralgia, myalgia, fatigue, rash, and/or weight loss. These symptoms typically resolve within 5-30 days.

The state of acute infection is followed by a long stage of disease free clinical latency. In most of the untreated adult patients, the median time to AIDS is estimated at 10-11 years. The incubation time may be as short as 2 to 3 years in 5-10% of patients who are rapid progressors.

AIDS is the end stage clinical manifestation of HIV infection where a predominant decrease of CD_4 lymphocytes occurs. Due to relentless production of HIV proteins, maintained by continuous viral replication in productively infected cells, and the ensuing elimination of host cells over many years finally lead to the destruction of immune system, which is clinically manifested by opportunistic infections and tumors. The infection in central nervous system (CNS) may lead to distinct HIV-associated disease, including the HIV associated dementia complex, vacuolar myelopathy, and sensory neuropathy (Price, 1996, Schupbach, 2003).

The overall picture of typical untreated AIDS progression indicates that during the clinical latency period, a very infection process is proceeding. First, there is an intense immune response to HIV; about one million virion are destroyed each day and HIV numbers drop. However this means that HIV is replicating at very high rate, and this replication results in corresponding destruction of about 100 million CD_4 and T-cells each day. Eventually, the immune system is simply overwhelmed, HIV levels increase and T-cells are finally completely destroyed, crippling the immune response and allowing the emergence of opportunistic infections.

3.2 Basic Epidemiology of HIV/AIDS

With the exception of HIV transmission from mother to child and via infected blood or blood products, tissues or organs, all other HIV transmission occurs only as a result of those human behavior(s) that place an individual at risk of acquiring or transmitting of

HIV infection include the sharing of drug injecting equipment and/or having unprotected sexual intercourse with multiple sex partners. Only those persons who are involved in some HIV-risk behavior(s) are at any risk of acquiring an HIV infection via sexual intercourse (WHO, 2001).

The epidemiological dynamics of HIV infection are different from other infectious disease agents, including other sexually transmitted infections (STI), because the risk of HIV transmission via sexual intercourse is very low compared to most other STIs. Various factors determine the transmission rate of HIV. Sexual practices, including the practice of anal intercourse and vaginal intercourse during menses, sexual mixing patterns and level of condom use, have all been recognized as factor affecting spread. Biological factors also seem to affect the efficiency of transmission; these factors include the level of viremia, infectivity and virulence of a particular HIV strain and the presence of STIs such as genital ulcers (Plummer and Simonsen, 1991). In the absence of facilitating factors, the transmission of HIV via a single episode of anal or vaginal intercourse is very low. Several epidemiological studies indicate that, in the absence of facilitating factors, the efficiency of vaginal intercourse for HIV transmission is about 1 or less per 1000 sex exposures (Padian *et al.*, 1997 and Gray *et al.*, 2001). The risk of HIV transmission via anal intercourse is generally believed to be higher than via vaginal intercourse, but the risk of HIV transmissions via anal intercourse is still believed to be low when compared with other STIs.

For extensive sexual transmission of HIV to occur, a pattern of concurrent or overlapping sex partners and a high frequency of sex partner exchanges along with a high prevalence of such behaviors must be present. These behavioral parameters can then generate two of the most important facilitating factors: 1) concurrent genital ulcerative lesions from other STI, and 2) a relatively high proportion of new and/or recent HIV infections that are very infectious compared with HIV infections of longer duration. Higher sex partner exchange rates for FSW and a larger proportion of males who visit FSW on regular basis were found to be important factor in a couple of high

HIV prevalence countries in Asia compared with too low HIV prevalence countries in Asia (Chin *et al.*, 1998).

Several epidemiological studies have shown that male circumcision is associated with a reduced rate of HIV acquisition (de Vincenzi and Mertens, 1994 and Halperin *et al.*, 1999). However, it is difficult to assess the extent to which these findings may be confounded by fundamental differences between populations with different rates of male circumcision- i.e. differences in social sexual patterns and prevalence of high-risk sexual behaviors. It is also possible that the relative protective effect of male circumcision may be correlated with the general level of genital hygiene, and lack of or poor genital hygiene in circumcised male may override any relative protective effect of circumcision.

3.3 AIDS epidemic

The HIV/AIDS pandemic consists of many separate epidemics. Each pandemic has its own distinct origin, in terms of geography and specific populations affected, and practices, for example, unprotected sex with multiple partners or sharing drug injection equipments.

Based on the different types of HIV epidemics present in the different world, it may be low-level epidemic, concentrated epidemic, and/or generalized epidemic, which indeed is based on different considerations or principle that are made for these various types of epidemics.

For Low-level Epidemic Although HIV infection may have existed for many years, it has never spread to significant levels in any sub-population. Recorded infection is largely confined to individuals with higher risk behavior, such as sex workers, drug injectors and men who have sex with men. This epidemic state suggests that networks of risk are rather diffuse (with low levels of partner exchange or sharing of drug injecting equipment) or that the virus has been introduced only very recently. HIV prevalence has not consistently exceeded 5% in any defined sub-population.

For Concentrated Epidemic HIV has spread rapidly in a defined sub-population, but is not well established in the general population. This epidemic state suggests active networks of risk within the sub-population. HIV prevalence is consistently over 5% in at least one defined sub-population. HIV prevalence is below 1% in pregnant women in urban areas.

For Generalized Epidemic HIV is firmly established in the general population. Although sub-populations at high-risk may continue to contribute disproportionately to the spread of HIV, sexual networking in the general population is sufficient to sustain an epidemic independent of sub-populations at higher risk for infection. HIV prevalence consistently over 1% in pregnant women (UNAIDS/WHO, 2005).

3.4 Global Snapshots of HIV/AIDS epidemic

With no signs of early development of HIV/AIDS curative therapies or vaccines to protect individuals, insight in the near future, HIV/AIDS seems to be assuming threat proportions especially in the developing and underdeveloped countries. The HIV/AIDS epidemic has already claimed million of lives and another million people are currently estimated to be living with HIV/AIDS worldwide. HIV/AIDS cases have been reported in all regions of the world, but most people living with HIV/AIDS (95%) reside in low- and middle- income countries where most new HIV infections and AIDS-related deaths occur (UNAIDS, 2006a). According to the World Health Report 2006, the HIV/AIDS has already devastated many individuals, families, and communities. HIV is the leading cause of death worldwide (among those aged 15-59). The HIV/AIDS has been occurred as the pandemic threat that has taken on different forms in various parts of the world.

Promising developments have seen in the recent years in the global efforts to address the AIDS epidemic including increased access to effective treatment and prevention programmes. However the number of people living with HIV continues to grow, as does the number of deaths due to AIDS. A total of 39.5 million (34.1 million-47.1 million) people were living with HIV in 2006, which is 2.6 million more than in 2004. This figure includes the estimated 4.3 million (3.6 million-6.6 million) adults and children who were newly infected with HIV in 2006, which are about 400,000 more

than in 2004. But, according to the recent report published by UNAIDS, a change has been found. A declination by 16% has been found in the total number of people living with HIV i.e. 33.2 million in 2007, down from 39.5 million in 2006. Of the total people living with HIV in 2007, declination has been found among adults from 30.8 million to 30.2 million and in women 15.4 million from 17.7 million. Nevertheless, a slight increase has been found from 2.3 million to 2.5 million among the children less than 15 years (UNAIDS/WHO, 2007).

In many region of the world, new HIV infections are heavily concentrated among the people (15-24 years of age). Among adults, 15 year and older young people accounted for 40% of new infection in 2006 (UNAIDS/WHO, 2006a).Worldwide most people living with HIV are unaware that they are infected (UNAIDS, 2006c).

3.5 Impact by region

The epidemic in each region of the world is influenced by specific risk factors that are associated with the spread of HIV/AIDS and the responses that have evolved to address (Goyle and Hill, 2001). The major route of HIV transmission worldwide is heterosexual sex, although risk factors vary within and across population. In many regions of the world, men who have sex with men, injecting drug users, and sex workers account for significant proportion of infections (UNAIDS, 2006a). Several countries and regions have been hard-hit by the HIV/AIDS pandemic (KFF, 2006), which are described below.

Regional HIV and AIDS statistics, 2007

	Globally	**sub-Saharan Africa**	**Asia**
People living with HIV	33.2 million	22.5 million	4.9 million
New HIV infections	2.5 million	1.7 million	440,000
Deaths due to AIDS	2.1 million	1.6 million	300,000

(Source: UNAIDS/WHO, 2007)

3.5.1 AIDS in sub-Saharan Africa

Sub-Saharan Africa remains the most affected region in the global AIDS epidemic. More than two third (68%) of people with HIV positive live in this region where more than three quarters (76%) of all AIDS deaths in 2007 occurred. It is estimated that 1.7 million (1.4 million- 2.4 million) people were newly infected with HIV in 2007, bringing to 22.5 million (20.9 million- 24.3 million) the total number of people living with the virus. Unlike other regions, the majority of people living with HIV in sub-Saharan Africa (61%) are women (UNAIDS/WHO, 2007).

Declines in national HIV prevalence are being observed in some sub-Saharan African countries, but such trends are currently neither strong nor widespread enough to diminish the epidemics overall impact in this region. (UNAIDS/WHO, 2006a).

As Southern Africa is the epicenter of the global HIV epidemic, 32% of people with HIV globally live in this sub region and 34% of AIDS deaths globally occur there. Declination of HIV prevalence had been found in the Harare, the capital of Zimbabwe where from the antenatal clinic data, (36% in 1996) declined to 24% in 2004 (Mahomva *et al.*, 2006). Zimbabwe has the declining national HIV prevalence in southern Africa (UNAIDS, 2005). However inconsistencies and biases in some of the data mean that the extent of the decline in HIV prevalence might not be as substantial as indicated by the antenatal clinic HIV data (UNAIDS, 2005). Combination of increased awareness, relative extensive health infrastructure and growing anxiety about AIDS mortality rates has contributed considerably to the decline in HIV (UNAIDS/WHO, 2006a). Nevertheless, approximately one in 5 adults in Zimbabwe is living with AIDS – one of the worst epidemic in the world. However, according to the recent data, this sub region accounts for 35% of all people living with HIV and almost one third (32%) of all new HIV infections and AIDS deaths globally in 2007. National adult HIV prevalence exceeded 15% in eight countries in 2005 (Botswana, Lesotho, Mozambique, South Africa, Swaziland, Zambia and Zimbabwe). While there is evidence of a significant decline in the national prevalence in Zimbabwe, the epidemics in most of the rest of the sub region have either reached or are approaching a plateau. Only in Mozambique latest

HIV data (in 2005) have shown an increase in prevalence over previous surveillance period (UNAIDS/WHO, 2007).

In South Africa, some 5.5 million (4.9 million – 6.1 million) people, as including 240,000 (13000 – 50000) children younger than 15 years, were living with HIV in 2005 (UNAIDS/WHO, 2006a). According to the gathered HIV data in the country's extensive antenatal clinic surveillance system suggest that HIV prevalence has not yet reached a plateau. The latest data show a continuing, rising trend nationally in HIV infection levels among pregnant women attending antenatal clinics from (22.4% in 1999 to 30.2% in 2005); an increase by 35% (DoH South Africa, 2006). As in the rest of sub-Saharan Africa, the epidemic in South Africa disproportionately affects women where young women (15 – 24 years) are four times more likely to be HIV infected than young men (Shisana *et al.*, 2005). Having emerged South Africa's epidemic has now reached the stage where increasing numbers of people are dying of AIDS though having merged a little later than most other HIV epidemics in sub region. At the statistics of South Africa of 2006, the latest official mortality data show in South Africa increased by 75% from 1997 to 2004 (from 316505 to 567488). A large proportion of the rising trend in death rates is attributable to the AIDS epidemic (Anderson and Phillips, 2006; WHO/CDC, 2006; Bradshow *et al.*, 2004; Dorrington *et al.*, 2001). Yet a large proportion of South Africans do not believe they are at risk of becoming infected with HIV, of whose, half of the respondents were found be HIV positive who took HIV test (Shisana *et al.*, 2005)

At present, Swaziland has the highest adult HIV prevalence in the world: 33.4% (21.2% - 45.3%). National adult HIV high levels are also high in Botswana, Lesotho and Namibia (20 – 24%). In 2005, estimate 230,000 (110000 – 360000) people were living with HIV in Namibia, where the adults' national prevalence was estimated at 19.6% (8.6% - 31.7%) in 2005 (UNAIDS, 2005).

Recent population based HIV surveys, along with other HIV data, Botswana's HIV epidemic prevalence remains among the highest in the world. Infection levels in pregnant women vary considerably across Botswana (MoH, Botswana, 2006). In

Lesotho, adult HIV prevalence has remained relatively stable in recent years at high levels with almost one in four (23.2% with a range of 21.9% - 24.7%) adults living with HIV in 2005 (UNAIDS/WHO, 2006a). Similar to many other countries in sub-Saharan Africa, the apparent stability in Lesotho's epidemic masks high rates of new infections and AIDS deaths. Angola is gradually acquiring a better understanding of its epidemic after having expanded its HIV sentinel surveillance system to the provinces in recent years. At less than 5%, national adult HIV prevalence in Angola is lower than in any other Southern African country. The HIV epidemic, though, varies dramatically between different provinces which partly infects the relative in accessibility of parts of the country during Angola's long running conflict, which ended in the mid – 1990s. Data from Mozambique show a significant increase in HIV infection levels since the turn of the century where the HIV prevalence in pregnant when (15 to 49 years) rose from 11% to 16% from 2000 to 2004 (UNAIDS, 2006), one of the steepest increases seen in sub-Saharan Africa in recent years. In addition, HIV levels in pregnant women are highest in the South and Central part of the country.

In 2005, almost a million people (940000 with average of 480000 – 1.4 million) were living with HIV in Malawi with an adult prevalence estimated at 14.1% (6.9 – 21.4%) in 2005 (UNAIDS/WHO, 2006a) i.e. close to 12.7% in 2004 (National Statistical Office and ORC Macro, 2005). Since the turn of the century, HIV infection levels in Malawi overall appears to have stabilized, with median HIV prevalence measured at sentinel surveillance sites fluctuating between 15% and 17% in 2001 – 2005 (National AIDS Commission Malawi, 2005). Although Malawi is a small country, its epidemic varies considerably from place to place.

HIV prevalence among women attending Antenatal Clinic (ANC) in Zambia has also found to be relatively stable since the mid – 1990s, and has remained at 19% - 20% between 1994 and 2004 among 15 – 39 years pregnant women. Yet, the data show divergent, localized patterns and trends, with HIV infection levels in pregnant aged 15 – 44 years ranging from under 10% to over 25% at several sites. Both in Zambia and Malawi, the highest HIV prevalence was found along the country's main transport

routes (MoH Zambia and Malawi, 2005; Bello *et al.*, 2006). At current levels of HIV prevalence, young persons in Zambia for a 50% life – time risk of dying AIDS, in the absence of treatment (MoH Zambia, 2005). In the Island nations of the Southern African coast are experiencing much smaller epidemics where national adult HIV prevalence in Madagascar was well union 1% in 2005, with an estimated 49,000 (16000 – 110000) living with HIV. Mauritius needs to focus stronger prevention efforts on IDUs and especially on those who also engage in sex works (Dewing *et al.*, 2006).

In most of the countries in East Africa adult HIV prevalence is either stable or has started to decline. The latter trend is most evident in Kenya, where the HIV epidemic has been declining amid evidence of changing behavior. Besides behavioral change, mortality of people infected with HIV several years ago has also contributed to the declines in prevalence (UNAIDS, 2007).

Having diminished during the 1990s, Uganda's epidemic has stabilized overall where the national adult HIV prevalence was 6.7% (5.7 – 7.6%) in 2005 but it was significantly higher among women (8%) than men (5%) (UNAIDS/WHO, 2006a; MoH Uganda and CRC Macro, 2006). Trends vary in Uganda's epidemic where HIV prevalence fell sharply among pregnant women in Kampala and other cities from the early 1990s to the early 2000s, in the context of significant behavior change (including sexual abstinence and condom use during casual sex) and increase AIDS mortality (Kirungi *et al.*, 2006).

With 1.3 million people (1.1 million – 1.5 million) currently living with HIV, Kenya is still contending with a serious AIDS epidemic, despite evidence of declining HIV prevalence among pregnant women (Cheluget *et al.*, 2006; WHO, 2005). National adult HIV prevalence fell from 10% in the late 1990s to about 7% in 2003 (MoH Kenya; 2005) and just over 6% (5.2 – 7.0 %) in 2005 followed by 5% in 2006 (UNAIDS/WHO, 2006a; 2007). There has been a steep drop in infection levels among pregnant women at a majority of ANC antenatal sites with consistent and comparable HIV data (Cheluget *et al.*, 2006).

Recently, according to the 2007 annual HIV/AIDS report released, by the Joint United Nations Programme on HIV/AIDS (UNAIDS) where declining HIV rates were most striking in Kenya and Zimbabwe. It is expected that the recently observed changes in behavior will maintain the declining trend.

An estimated 1.4 million adults and children were living with HIV in the United Republic of Tanzania at the end of 2005, making it one of the most affected countries in the world. Here, too, HIV infection level have diminished some state – from 8.1% to 6.5% nationally between 1995 and 2004 (Somi *et al.*, 2006), and from 14% and 11% among pregnant women in Dar el Salaam between 1995 and 2003 (Urassa *et al.*, 2006).

There are signs that IDU, which has spread rapidly in East Africa (McCurdy *et al.*, 2005a) could also become a contributing factor in Tanzania's epidemic. Among Tanzania's IDUs high-risk practices are common such as sharing of common syringes called "flashblood" among companion of IDUs and FSWs (McCurdy *et al.*, 2005b).

In the 2005, Rwanda's epidemic has stabilized but HIV prevalence remains high in the capital Kigali, where approximately 13% of pregnant women were HIV positive in 2003. Rwanda has expanded HIV surveillance, especially in rural areas introducing improved HIV estimation methodologies in recent years (Kayirangwa *et al.*, 2006) resulting the comparison of the consistent surveillance data, showing a drop in HIV prevalence among pregnant women in urban areas, particularly in 1998 – 2003.

In Burundi where approximately 150,000 people were living with HIV in 2005, divergent trends are evident in different parts of the country. In 2005, based on HIV data collected at antenatal clinics, national adult HIV prevalence in Ethiopia was more than five times higher in urban (10.5%) than in rural (1.9%) area. The most recent data from neighboring Eritrea also indicate a stable epidemic, with 2.4% of women seeking antenatal care testing HIV positive (MoH Eritrea, 2006).

No new HIV data are available for Somalia, where a 2004 sentinel surveillance survey found comparatively low HIV infection levels of 0.9% among pregnant women

nationally. However, according to WHO, HIV prevalence was considerably higher than 1999 – at Hargeisa it had raised from 0.7% to 1.6%, while in Berbera, risen from 0% to 2.3% (WHO, 2005a).

In most of the comparatively smaller epidemics in West and Central Africa, adult national HIV prevalence has remained stable overall. However, signs of declining HIV prevalence are evident in an increasing number of countries, notably Cote d' Ivory, Mali and urban Burkina Faso. In these countries, as well as in Benin, there is evidence of a shift towards safer behavior (UNAIDS/WHO, 2007). In West Africa, National adult HIV prevalence continued to be much lower than in other parts of sub-Saharan Africa. As in East Africa, HIV infection trends are generally stable although declining prevalence has been noted among pregnant women in several cities of Burkina Faso, Cote d' Ivory and Togo. Nigeria, where an estimate 2.9 million (1.7 million – 4.2 million) people were living with the virus in 2005, approximately 300,000 adults were newly infected with HIV in 2005. The overall trend in HIV infection level among pregnant women appears to be stable. In Senegal, national adult HIV prevalence remains just under 1% (0.4% - 1.5%) (UNAIDS/WHO, 2006a). Sex work still appears to be the main factor in Senegal's epidemic. There remains a danger of HIV spreading from sex workers and their clients to the general population (Gomes do Espiritp Santo and Etheredge, 2005). Men having Sex with Men (MSM), another risk factor, serve as a potential bridge for HIV transmission to women who ordinary would be at low risk of infection (Wade *et al.*, 2005).

After having remained stable for many years, the HIV epidemic in Mali could be growing where HIV prevalence among pregnant women rising from 3.3% on 2002 to 4.1% in 2003 and 2005**.** Guinea is experiencing one of the smallest AIDS epidemics in sub-Saharan Africa. Adult HIV prevalence was an estimated 1.5% (1.2% - 1.8%) in 2005 and approximately 85,000 (69000–100000) people were living with HIV. Available HIV data from Cote d' Ivories' suggest a relevant stable but serious epidemic, with at least 4% of adults living with HIV in 2005. HIV data for Togo also point out a serious epidemic. Overall adult HIV prevalence was an estimated 3.2%

(1.9% - 4.7%), and about 110,000 (65000 – 160000) people were living with HIV in 2005 (UNAIDS/WHO, 2006a).

Benin has a smaller epidemic with an adult HIV prevalence of 1.8% (1.2% - 2.5%) and so does the Ghana, where adult HIV prevalence was estimated at 2.3% (1.9% - 2.6%) in 2005 with signs of declination in epidemic of the country. The declination was also seen in Burkina Faso (to Ghana's north) where HIV prevalence remained an estimated 2% (1.5% - 2.5%) (UNAIDS/WHO, 2006a). HIV infections are especially prevalent among older women aged 35 – 39 years and in men aged 40 – 44 years (Akwara *et al.*, 2005).

In sparsely populated Chad, a recent national HIV survey has found adult HIV prevalence of 3.3%. In most countries of Central Africa, incomplete HIV data make it difficult to discern clear trends but Cameroon and the Central Africa, Republic appear to be most affected. In the later, almost 11% (4.5 – 17.2%) of adults (aged 15 – 49 years) were living with HIV in 2005, while adult HIV prevalence in the former exceeded 5% (4.9% - 5.9%) (UNAIDS/WHO, 2006a). Infection levels are highest in the North West and eastern regions (almost 9%) and lowest in the north of Cameroon (2% or lower). According to the 2005 Demographic and Health Survey, prevalence among adult women (15 – 49 years) was almost twice as high as for men (6.8% compared with 4.1%). It is estimated that, in the west of Republic of the Congo, some 120000 (75000 – 160000) people were living with HIV in 2005 (UNAIDS/WHO, 2006a).

As a whole, sub-Saharan Africa's HIV epidemics are following divergent trends with an evidence of diminishing or stable HIV spread in most east African and west African countries. In several other countries including – South Africa – the epidemics do not yet show signs of abating. In Southern Africa, HIV epidemics in Swaziland, South Africa, and Mozambique continue to grow. In Swaziland, an estimated one in three (33%) adults was living with HIV in 2005– the most intense epidemic in the world. Zimbabwe is the only country in Southern Africa where the epidemic has decreased over the past five years. Other countries in the rest of Africa where the epidemic appears to be decreasing are Kenya, Tanzania and Rwanda in East Africa and Burkina Fuso, Cote

d'Ivory and Ghana in the West Africa. In East Africa, where HIV infection have been lower than in the South of the continent, the general trend of a stabilizing or a declining HIV prevalence appears to be continuing. A recent development in sub-Saharan Africa is the emergence of IDU as a potential factor in the HIV epidemics of several countries, not only those of Kenya and Tanzania. Across sub-Saharan Africa, women are more likely than men to be infected with HIV and they are more likely to be the ones caring for people infected with HIV (UNAIDS/WHO, 2006a).

3.5.2 AIDS in Eastern Europe and central Asia

An estimated 150000 people (70000–290000) people were newly infected with HIV in 2007 bringing the number of people living with HIV in Eastern Europe and Central Asia to 1.6 million (1.2 million–2.1 million) compared to 630000 (490000–1.1 million) in 2001, a 150% increase over that time period. Nearly 90% of newly reported HIV diagnoses in this region in 2006 were from two countries: the Russian Federation (66%) and Ukraine (21%). Elsewhere, the annual numbers of newly reported HIV diagnoses are also rising in Azerbaijan, Georgia, Kazakistan, Kyrgyzstan, the Republic of Moldova, Tajikistan and Uzbekistan (which now has the largest epidemic in Central Asia). Of the new HIV cases reported in 2006 in Eastern Europe and Central Asia for which there was information on the mode of transmission, nearly two thirds were attributed to injecting drug use and more than one third were ascribed to unprotected heterosexual intercourse (UNAIDS, 2007).

3.5.2.1 Caribbean

Adult HIV prevalence in the Caribbean is estimated at 1.0% (0.9%–1.2%) in 2007. Prevalence in this region is highest in the Dominican Republic and Haiti, which together account for nearly three quarters of the 230000 people living with HIV in the Caribbean, including the 17000 who were newly infected in 2007. An estimated 11000 people in the Caribbean died of AIDS in this year and AIDS remains one of the leading causes of death among persons aged 25 to 44 years (UNAIDS, 2007).

3.5.2.2 Latin America

The HIV epidemics in Latin America remain generally stable, and HIV transmission continues to occur among populations at higher risk of exposure, including sex workers and MSM. The estimated number of new HIV infections in Latin America in 2007 was 100 000, bringing to 1.6 million the total number of people living with HIV in this region. An estimated 58 000 people died of AIDS in the past year. Unprotected sex between men is an important factor in the epidemics of Bolivia, Chile, Ecuador and Peru in South America, as well as in several Central American countries, including El Salvador, Guatemala, Honduras, Mexico, Nicaragua and Panama (UNAIDS, 2007).

3.5.2.3 North America, Western and Central Europe

In these regions, the total number of people living with HIV is increasing. This increase is due mainly to the life-prolonging effects of ART and an increase in the number of new HIV diagnoses in Western Europe since 2002, combined with a relatively stable number of new HIV infections each year in North America. Overall, approximately 2.1 million people in North America, Western and Central Europe were living with HIV in 2007, including the 78000 who acquired HIV in the past year. In the context of widespread access to effective ART, comparatively few people died of AIDS-32000 in 2007 (UNAIDS, 2007).

3.5.2.4 Middle East and North Africa

Despite recent improvements in some countries, epidemiological surveillance in this region remain limited (Obermeyer, 2006). Nevertheless, using available HIV information it is estimated that 35 000 (16 000–65 000) people acquired HIV in 2007, bringing to 380000 the total number of people living with HIV in the region. Because of AIDS-related illnesses, an estimated 25 000 people died in 2007 (UNAIDS, 2007).

3.5.2.5 Oceania

An estimated 14000 people acquired HIV in Oceania in 2007, bringing to 75000 the number of people living with the virus in this region. Unsafe heterosexual intercourse is estimated to be the main mode of HIV transmission, where the epidemic is still

expanding, although at slightly lower levels than previously believed, in Papua New Guinea. In Australia and New Zealand, HIV continues to be transmitted mainly through unprotected sex between men (UNAIDS, 2007).

3.5.3 Asia

In Asia, national HIV prevalence is highest in South-East Asia, with wide variation in epidemic trends between different countries. While the epidemics in Cambodia, Myanmar and Thailand all show declines in HIV prevalence, those in Indonesia (especially in the Papua province) and Viet Nam are growing. Although the proportion of people living with HIV in India is lower than previously estimated, its epidemic continues to affect large numbers of people. Overall in Asia, an estimated 4.9 million (3.7 million–6.7 million) people were living with HIV in 2007, including the 440000 (210000–1.0 million) people who became newly infected in the past year. Approximately 300000 (250000–470000) died from AIDS-related illnesses in 2007. According to the UNAIDS in 2003, there is particular concern about the epidemics in India, Indonesia, and China. Although the overall prevalence rate among the adult population is still low, the three countries combined contain almost half of the world's population. This is particularly worrisome because the rates of spread of the epidemic in India, China, and Indonesia are among the highest in the world.

In China an estimated 640000 (390000-1.1milllion) were living with HIV at the end of 2005 (MoH China, UNAIDS/WHO, 2006a). In China nearly half of the people living with HIV are believed to have been infected while injecting drugs (MoH China, UNAIDS/WHO, 2006a; Lu *et al.*, 2006). Sexual risk behavior among injecting drug users (IDUs) compound the likelihood of spread among and beyond IDUs (Zaos *et al.*, 2006). National surveillance data suggest that as many as 11% of drug users also engage in high-risk sexual activities (MoH China, UNAIDS, WHO, 2006).

HIV prevalence in sex workers overall has increased substantially during the past decade, from 0.02% in 1994 to just under 1% (0.93%) in 2004, according to sentinel surveillance data (MoH China, UNAIDS, WHO, 2006). More light is being shed on the role of sex between men in China's epidemic and now has been estimated that some 7%

of HIV infection, in China, were acquired during unsafe sex between men (Lu *et al.*, 2006). In Beijing, HIV prevalence of 3% and 4.5%, respectively, has been found in two studies among MSM (Choi *et al.*, 2006; Ma *et al.*, 2006).

Overall, it is estimated that half the new HIV infections in China in 2005 occurred during unprotected sex. With HIV spreading gradually from most–at-risk population to the general population, the number of HIV infection in women is growing, too (MoH China, UNAIDS, WHO, 2006). Recent analysis of the HIV tests results of 138000 pregnant women in almost half the countries of Yunan province found 0.3% were HIV positive, but prevalence varied from 0% to as high as 1.6% in specific countries (Zhang *et al.*, 2006). In parts of Henan and Xinjiang provinces, HIV prevalence higher than 1% has been found among pregnant women and women receiving premarital and clinical HIV testing (MoH China, UNAIDS, WHO, 2006), indicating that the virus is spreading relatively in some locales. Whether or not China curbs its growing epidemic will depend largely on the extent of its success in limiting the spread of HIV among and between IDUs, sex workers and their clients (UNAIDS/WHO, 2006a).

India, the world's second most populous country, is experiencing a highly varied HIV epidemic that appears to be stable or diminishing in some parts while growing at a modest rate in others. Approximately 5.7million (3.4million to 9.4million) people, of which 5.2 million were adults aged 15-49 years, were living with HIV in 2005 (UNAIDS/WHO, 2006a).

Notably, in the South of the country, infection levels in rural and urban populations tend to be similar (The World Bank, 2005). A recent analysis of HIV data from antenatal clinics and sexually transmitted infection clinics suggest that HIV prevalence among women aged 15-24 years in Sothern states declined from 1.7% in 2000 to 1.1% in 2004 (Kumar *et al.*, 2006). In addition, men aged 20 to 29 years attending STI clinics in South shows declining prevalence of HIV but there was no evidence of declining in North states. Various analysts suggested various reasons for the decline of HIV prevalence in Southern India like may be due to the trends in rise in condom use by men and FSWs, or may be due to a decline in HIV prevalence in Tamil Nadu, or due to

behavior change (Kumar *et al.*, 2006; Soman and Mathew, 2006; Hallet and Garnett, 2006). The bulk of HIV infections in India are occurring during unprotected heterosexual intercourse (NACO, 2005); resulting women in growing proportion of people living with HIV (some 38% in 2005) especially in rural areas. The law enforcement context of sex work is complex and often acts as a barrier against effective HIV prevention and treatment efforts though efforts targeting at sex workers are being implemented in India (Dandona *et al.*, 2006).

Recently, more accurate estimates of HIV indicate that approximately 2.5 million people in India were living with HIV in 2006, with the national adult HIV prevalence of 0.36%. Although the proportion of people living with HIV is lower than previously estimated, India's epidemic continues to affect large number of people. Many pockets of high HIV prevalence (mainly among population groups at high risk of exposure to HIV) have also been identified in states where overall prevalence is generally low, warning against complacency. Data from the expanded 2006 sentinel surveillance show stable or declining prevalence among the pregnant women in Tamil Nadu, Maharashtra, Karnataka and Andhra Pradesh, but high HIV prevalence among sex workers, and rising HIV prevalence among injecting drug users and men who have sex with men in a few states (UNAIDS/WHO, 2007).

Vietnam's epidemic continues to increase, with HIV having been detected in all 64 provinces and all cities. The number of people living with HIV has doubled since 2000, and reached an estimated 260 000 (150 000-430 000) in 2005. Some 40000 people are being infected with HIV each year (MoH Vietnam, 2005), the vast majority of injecting drug users and persons who buy or sell sex. The main risk factor associated with HIV infection are the injecting drug use and unprotected sex with non-regular partners or sex workers (Tuang *et al.*, 2007).

Due to the introduction of effective intervention in the behavior change efforts by the state and non-government organizations, Cambodia's epidemic appears to be stabilizing especially in the sex industry since the late 1990s. In 2003, 96% of brothel based sexworkers in five cities reported acts protected using consistent use of condoms with

clients (Gorbach *et al.*, 2006) compared with 53% in 1997 and so did the male clients (85% or higher) depending on the group (Sopheab *et al.*, 2006). However HIV prevalence among pregnant women attending antenatal clinics did not change much between 1997-2003 (Phal *et al.*, 2006) suggesting significant numbers of women are still being infected – likely by their spouses and other partners (National Center for HIV/AIDS, Dermatology and STIs, 2004; Gorbach *et al.*, 2000). A high proportion of married women (41%) admit being concerned about being infected by their husbands (Sopheab *et al.*, 2006). Among MSM, only little data are available on HIV trends. Different surveys show varieties of HIV prevalence. Though HIV prevalence is low in some of the provincial cities, there is rare practices in acts protected in behavioral trends as well, which shows that there is a strong likelihood that HIV could spread rapidly among MSM once the virus establishes itself in those networks (UNAIDS/WHO, 2006a).

In Thailand, an estimated 580 000 (330 000-920 000) adults and children were living with HIV at the end of 2005 (UNAIDS/WHO, 2006a). Though the number of new annual HIV infections continues to drop in 2005 than in 2004, a large percentage of new infections are occurring in people that were considered to be at low risk of infection (Gouws *et al.*, 2006). The government is now encouraging married couples to be HIV tested regularly because approximately one-third of the HIV incidence has been increased in married women by their spouses in 2005 according to the Ministry of Public Health. As for the MSM in Thailand remain at high-risk of HIV infection, which has risen steeply among MSM of Bangkok- from 17% in 2003 to 28% in 2005. The lack of awareness among MSM about their HIV serostatus has been cumbersome where fully 80% of the men were found HIV positive that had never tested for the virus or believed they were HIV negative. (Van Griensven *et al.*, 2006). HIV rates among FSWs are relatively difficult to ascertain as some research points to comparatively low HIV infection levels while other research has highlighted a recent trend of erratic condom use by FSWs (Plipat *et al.*, 2006; Buckingham *et al.*, 2005). In Thailand's multifaceted epidemic, IDU continues to be a risk factor for infection. According to one recent study

some 35% of the HIV infection has been found chiefly due to the large proportion of IDUs who use contaminated paraphernalia (Longfield *et al.*, 2006).

The epidemic in Myanmar is also showing the signs of decline, with HIV prevalence among pregnant women at antenatal clinics having dropped from 2.2% in 2000 to 1.5% in 2006 (National AIDS Programme Myanmar, 2006). Despite the overall decline in prevalence, the high HIV infection levels are found in M-A-R-P (Most At Risk Population), such as sex worker and IDUs. The proportion of men who reported to be involved in acts protected was 60% among young men and 50% among older men (Thwe *et al.*, 2005).

In Pakistan, high HIV infection levels among groups of IDUs should cross over into other populations, including male and female sex workers. Different level of HIV prevalence were found in different cities like Larkan, 8% IDUs, 6% in Faisalabad, Lahore, Sargodha and Sailkot etc. In Karachi, 26% of IDUs were HIV positive in a 2005 Study (Emmanuel *et al.*, 2006). Very low proportion of FSWs and their clients were found to be consistently in a very low rate as of the study in Karachi and Rawalpindi (Abbas, 2006).

Afghanistan, now has evidence that HIV is present there where conditions favor the rapid spread of HIV. Afghanistan emerging epidemic is likely to hinge on a combination of IDU and unsafe paid sex (UNAIDS/WHO, 2006a) as in Vietnam where there is presence of very low level of knowledge about acts protection and HIV transmission.

In Indonesia, the high infection levels were found and estimated 145000 to 170,000 IDUs (Pisani, 2006) herald possible wider HIV outbreaks in the country. In studies, most IDUs report high-risk practices, including using non-sterile injecting practices and frequent unprotected sex, often with several partners (Pisani, 2003). The majority of infections are estimated to occur through the use of contaminated injecting equipment, unprotected paid sex and, to a lesser extent, unprotected sex between men (MoH Indonesia, 2006).

In Malaysia, an estimated 69000 (33000-220000) people were living with HIV in 2005. The most common risk factor for HIV infection was exposure to contaminated drug injecting equipment (which accounted for 3 in 4 HIV infections in 2002, most of them in men, aged 20-40 years) (UNAIDS/WHO, 2006a). High level of infection have been found among IDUs in the provinces of Keleantan and Terengganu of 41% and 31% respectively while low level of HIV prevalence were found among pregnant women seeking antenatal care (MoH Malaysia and WHO, 2004). Up-to-date HIV data from Malaysia are limited, but the available information indicates a small but growing proportion of new HIV infections (17% in 2002, up from 7% seven years earlier) is attributable to unsafe sex, much of it between current or former IDUs, their sexual partners and sex workers (MoH Malaysia and WHO, 2004; Huang and Hussein, 2004).

In the Philippines, HIV is being transmitted primarily during unprotected sex, but national HIV prevalence remains well under 0.1% (UNAIDS/WHO, 2006a). The spread of virus during paid sex have been prevented since early 1990s with the efforts to screen and treat sex workers for STIs, along with other prevention efforts (Mateo *et al.*, 2003). Less than 1% of sex workers are infected with HIV, according to successive sentinel surveillance rounds since 2002. For the MSM, HIV prevalence higher than 1% has not yet been detected, either (DoH, Philippines, 2005). But, it cannot be guaranteed that such situation will continue.

As for our neighboring country, Japan, approximately 17000 (10000-29000)) adults and children were living with HIV in 2005. Here, MSM is the main sub-population for HIV incidence, which account for at least 60% of annual reported HIV infections (Shimada *et al.*, 2006).

3.5.3.1 Nepal

Nepal, a landlocked country, shares borders with India and China that is made up of 75 districts in five different development regions. The Himalayas cover the northern third of the country from east to west bordering China. To their south lies a long east-west stretch of lower mountains the hilly region with southern flanks flattened into the Terai, a fertile sub tropical plain spanning the border with India. These contours have played a

major role in helping to determine the geographical and social diversity that characterizes Nepal. According to the Human Development Report, Nepal is one of the poorest countries in the world. More than 40% of the Nepali population lie below the poverty line, nearly half of all children <5 years are underweight and nearly 60% of all adults are illiterate. Additionally, women have, traditionally, a lower status than men and gender inequality is deeply rooted. In Nepal, the topography, environmental degradation, poverty and economic migration are all linked, and they continue with other factors to increase vulnerability to HIV (UNAIDS/NCASC, 2004).

3.5.3.1.1 State of the epidemic on HIV/AIDS in Nepal

The first HIV/AIDS infection in Nepal was identified in 1988. In ten years that followed, the country found itself facing a "concentrated epidemic", among certain subpopulations (NCASC, 2005). According to the report of NCASC, March 2007, 1293 cases of AIDS and 9043 cases of HIV infection were officially reported, with nearly 3 times as many men reported to be infected as women. However, given the limitations of Nepal's public health surveillance system or in the absence of community based HIV prevalence data, these figures were obtained from sentinel surveillance and voluntary counseling and testing centers, and are gross under estimate of community prevalence. According to the UNAIDS estimates 75,256 people were living with HIV at the end of 2005 where adult prevalence (15-49 yrs) is of 0.55%. Yet compared with other countries in Asia and the world, available epidemiological data suggest that Nepal has a low prevalence of HIV in the general population. However the currently low prevalence seen in the general population masks an increasing prevalence in several sub-groups and new epidemiological data suggest that HIV may be increasing more rapidly than expected in certain sub-groups. In fact it is now apparent that Nepal has entered the stage of 'Concentrated Epidemic', i.e. the HIV/AIDS prevalence consistently exceeds 5% in one or more sub-groups. These include IDUs nationwide, FSWs in urban areas, returning FSWs from India, but also returning labour migrants from India especially from Mumbai (UNAIDS/NCASC, 2004). The potential for a rapid spread of the epidemic was first recognized by J. Chin in 1999/2000 who estimated that in the

absence of effective interventions, HIV prevalence in Nepal may, over the coming decade, increase to 1-2% among the age group 15-49 year. For Nepal, a generalized epidemic with high mortality in the productive age group would start a “vicious circle” (UNAIDS/NCASC, 2004), resulting HIV as the nation’s number one killer among those age by 2010 (NCASC, 2005).

3.5.3.2 Scenario of HIV/AIDS in different sub-populations of Nepal

Since 1990s, an explosive increase in HIV infection has occurred. Nepal’s HIV epidemic is highly concentrated in high-risk groups, especially female sex workers (FSW) and IDUs. IDU appears to be extensive in Nepal and to significantly overlap with commercial sex. Another important factor is the high number of sex workers who migrate or are trafficked to Mumbai, India to work, thereby increasing HIV prevalence in the sex workers’ network in Nepal more rapidly (STC, 2006).

In many studies, it has been documented that the predominant mode/route of HIV/AIDS transmission in Nepal is through heterosexual relations. Sex-workers, their clients, labour migrants, IDUs and MSM are identified as the primary sub-population driving the epidemic. Many IDUs has heightened their risk of contracting HIV and other infections engaging in risky behaviour. Needle sharing habit among IDUs is considered one of the risky behaviour. To support their habit, some IDUs resort to sex-work which provides a conduit for HIV to enter the non-drug using population forming large networks (NCASC, 2005).

An expanding sex industry in urban area, the trafficking of girls and women to Indian brothels; increased international migration, including cross border migration of young adult and labour migrants, and the continuation of political unrest in Nepal are the prominent forces leading to substantial increases in the rate of HIV infection (NCASC, 2005).

In addition, the stigmatization and discrimination associated with HIV/AIDS, irregularities in the reporting of HIV/AIDS cases, limitations of the national HIV/AIDS

surveillance system, and the difficulty of tracking the mobile population all acts as secondary forces that fuel the epidemic taking place in Nepal (NCASC, 2005).

Nepal health report indicate that the rate of HIV infection is growing fast and entering also into low risk groups, which is not confirmed to a certain administrative or ecological region within Nepal. With the rapid urbanization taking place, including the extension of highways and improved transportation planning along with the mobility of people all over Nepal and resulting to adaptation to changes in life style, which can eventually lead to population engaging in risk behavior(NCASC, 2005). Nepal's epidemic will continue to grow if immediate and vigorous action is not taken and will be largely driven by IDUs and sex-work. Here is the scenario of different sub-population of Nepal that contributes to the increasing spread of HIV/AIDS.

3.5.3.2.1 Intravenous Drug Users (IDUs)

IDUs can be defined as people who inject themselves with various types of drugs into their veins or muscles. Estimating the number of IDUs in Nepal is a difficult task, as given the existing medical and public health infrastructure in Nepal and lack of poor and continuous surveillance systems reporting along the accessibility to quality VCT services coupled with ART treatment, leading to the lack of credible data. In the 1990s, the numbers of cases of IDU were estimated to be in the range of 2500 to 4000 nationwide. 2000 of which were said to be present in Kathmandu valley (Crofts, 1998), and 1200 in Pokhara (Dixon, 1999) which later in the same decade had surpassed into a higher HIV prevalence rates. Until 1995, HIV prevalence among male IDUs in Nepal was less than 2% (NCASC, 1999), which substantially increased to 40% in 1999 (Karki, 2000).

The dynamics of epidemic are especially dramatic in Kathmandu valley where HIV/AIDS prevalence was 2% or lower 1.57% in 1991 and 2.56% in 1992 (Crofts, 1998) which suddenly climbed 50% in 1999 (NCASC, 1999) and later reached 68% by 2002 (New Era/SACTS/FHI, 2002b) and at present overall HIV prevalence has decreased to 52% which measure a 15% change (New ERA/SACTS/FHI, 2005a).

As for the Pokhara, the HIV prevalence is also high whose rate had increased to 22% in 2003 (New ERA/SACTS/FHI, 2003b) from 0% in 1990s, but a slight or same prevalence level was found in 2nd round of IBBS conducted in 2005 (New ERA/SACTS/FHI, 2005b). Similarly in male IDUs in Eastern Terai districts showed 35.1% HIV prevalence (New Era/SACTS/FHI, 2003a) in 2003 that declined to 31.6% in 2005. The HIV prevalence of 11.7% were found among IDUs (male) in the seven Western to Far-Western Terai districts (Rupandehi to Kanchanpur), conducted in 2005. According to the studies of CREHPA and FHI, 2002, diverse networks are found among IDUs with widespread sharing of unclean needles and risky sexual activity patterns and within and outside their groups contributing to the spread of HIV even to the general population.

3.5.3.2.2 Female Sex Workers (FSWs)

FSWs can be defined as the women providing sex services for financial or material gain (NCASC, 2005). Due to their highly marginalized status in society, FSWs have little access to accurate information about reproductive health and STIs. Cultural, economic and social constrains limit their access to legal protection and medical services (UNAIDS/NCASC, 2004). Mainly two types of FSWs have been identified in Nepal namely “street based FSWs” and “establishment based” FSWs (CREHPA/FHI, 2002 and NEW ERA/FHI, 2002). FSWs are the groups that lie next to IDUs acting as the contributor for high HIV epidemic. Nationally it has been estimated that 25,400 to 34,100 number of FSWs to be living in the country in the year 2005 (NCASC, 2005).

A number of studies have concentrated on areas with high concentration of FSWs, such as the highway route of the low land Terai (New ERA, 2000a; New Era/SACTS/FHI, 2000b) and Kathmandu (SACTs/FHI, 2000). HIV prevalence level has increased from less than 1% in 2001 in Kathmandu valley. It was estimated that between 4000 and 5000 FSWs are working in Kathmandu valley (CREHPA/ FHI, 2005); figures very similar to those obtained in 2001. The 2004 survey showed that an HIV prevalence of 2% among the street based sex workers in the Kathmandu valley (New ERA/SACTS/FHI, 2004). In 2001, the first HIV prevalence was conducted among

establishment-based FSWs in Kathmandu where a 2.5% of HIV prevalence was found. A prevalence of two percent was found in a similar survey in 2004.Unlike in Kathmandu, there were very few establishment-based FSWs in Pokhara in a rapid qualitative study of FSWs conducted by FHI/CREHPA in 2002. HIV prevalence among FSWs in Pokhara in 2001 was 0.8% (NCASC/ UoH/CREHPA, 2001), but increased to 2% in 2004 (New ERA/SACTS/FHI, 2004).

A prevalence of 3.9% of FSWs were found to be HIV positive in 1999 which dropped to 3% in 2003 in the 16 Terai Highway districts between Jhapa and Rupandehi, while in the six highway districts between Kapilbastu and Kanchanpur, none of the FSWs sampled tested positive (New ERA/SACTS/FHI, 1999; New ERA/SACTS/ FHI, 2003).

In Far-Western regions of Nepal, in 1991, FSWs of the Badi community who were extensively involved in the commercial sex work (Pike, 1999) were tested for VDRL and HIV-1 prevalence, where 70% of 228 women were found to be VDRL positive but none of 250 was HIV positive (Bhatt *et al.*, 1993). Zero HIV prevalence was found among FSWs tested in 1992 and 1993 in the city of Nepalgunj. A similar kind of test was duplicated in the early 1990's among the FSWs in Nuwakot, Sindupalchok, Pokhara, and Dharan, and HIV prevalence was found to be less than 2% as reported by NCASC surveillance data.

3.5.3.2.3 Clients of female sex workers (CoFSWs)

There are diverse sub-groups of clients of FSWs among the male population, some of which are transport workers, rickshaw pullers, industrial laborers, students, armed personnel, civil servants, businessmen, IDUs, vegetable vendors, soldiers etc. Among these male clients, transport workers, rickshaw pullers, daily wage laborers and armed personnel who are reportedly to frequent FSWs the most (NCASC, 2005). According to the national estimates of 2005, there are 564,000 to 754,000 of male clients of FSWs which is to be taken into consideration seriously for they play a key role resulting to a high epidemic of HIV/AIDS into the general population.

In 1999, a survey conducted among 400 truck drivers in the 16 terai districts showed an HIV prevalence rate of 1.5% (New ERA/SACTS/FHI, 2000b), while another study in the same area showed 1.75% three years later. The HSS conducted in the early 1990's provides time series data on HIV prevalence among STI patients, however there is no way of telling whether these patients contracted HIV through FSWs due to the lack of information on their sexual history. Clients visiting clinics with the suspicion of having STI, or when developing STI symptoms, it is likely that this group may have had a higher chance of being infected with HIV compared to other men showing physical signs of having STI (NCASC, 2001).

HIV prevalence was more widespread in the Far-Western and Mid-Western sentinel sites compared to the Eastern sites. For example, 0.35% of STI patients were HIV-positive in Jhapa, whereas in Mahendranagar, the HIV prevalence rate was as high as 8.3%. Similarly, in Pokhara and Nepalgunj, HIV prevalence of 3.1% and 5.3% respectively was found among STI patients. Surprisingly, a nil percentage of HIV prevalence rate among STI patients was reported for Kathmandu site in the same year (NCASC, 2001). However, it should be noted that the absence of HIV among this group does not match with the prevalence of HIV among FSWs in Kathmandu. The recruitment procedure for studying participants in HSS was also ill documented, and as a result it is difficult to determine how the figures were obtained (NCASC, 2003).

3.5.3.2.4 Seasonal labor migrants and their spouses

These are the sub-populations that create conditions that can increase peoples' vulnerability to HIV/AIDS, but, mobility and migration are not the risk factor in itself. Migrations pattern both within Nepal and internationally provide opportunities for extensive sexual networking, both in terms of distance and frequency. The seasonal and short-term migration of Nepalese youth and young men to urban areas of Nepal, India and other countries for employment has engaged as the major factor in driving the HIV epidemic in Nepal (Furber et al, 2002; Seddon, 1998; Puri et al, 2004). Among all these migrant population, a substantial proportion of adolescent and adult male labor migrant who go to "high-risk" Indian cities such as Mumbai and visit FSWs are becoming a

most-at-risk group. According to the national estimate of 2005, a range of 967000 to 1511000 are estimated as seasonal labor migrants. A random sample survey in 11 districts of mid and far-West indicated that 15% of the adult population migrate seasonally (Subedi *et al.*, 1994).

Infected labor migrants upon returning home are likely to transmit their disease to their spouses, contracted from FSWs or other casual partner through unprotected sex. Cross border migration into India has had a significant effect on the spread of HIV/AIDS in Nepal. A study conducted among 99 labor migrants returning to Doti District from the Indian city of Mumbai, found 10% of men to be HIV positive (NCASC, 2005). India has one of the fastest growing HIV/AIDS epidemics in the world (Schwartlander *et al.*, 1999). In Achham district, HIV prevalence among the general population was 2.3%, where as this figure was 3.7% among international migrants. Among the international migrants, those returning from Mumbai have about 8% HIV prevalence. The same study was found among internal migrants to be 3%, as compared to 0.7% their non-migrant counterparts (New ERA/SACTS/FHI, 2002a).

Achham, Doti, Kailali, Surkhet and Kaski districts in one cluster, and the other of Nawalparashi, Palpa and Syanga districts are the main places from where people are migrated to India. Men from Bajang districts in Far-Western Nepal often sought work in Banglore while from Doti and Achham districts often head to Mumbai. Among migrants, nearly half of the male and 40% of the female migrants reported to be having extra marital or premarital sexual relations (Subedi *et al.*, 1994).

3.5.3.2.5 Men Having Sex with Men (MSM)

Nepal's public self-image is that of a country where homosexuality does not exist. According to the report on the first outreach training workshop for MSM in Nepal, MSM seems to be relatively common, particularly within Kathmandu (Pant, 2001). Nationally the number of MSM has been estimated to be in the range of 64000-193000. MSM have been classified into two groups – MSM and MSW. Community based research conducted in other South Asian countries provides ample evidence of the pervasiveness of male-to-male sexual practice taking place, however in Nepal this

remains largely unexplored. Information regarding social, cultural, and behavioral dynamics of MSM community is extremely limited (NCASC, 2005). In this marginalized community many of the men engaged in casual sex with other men neither have knowledge, nor practice safe sexual behavior during sexual relation. Furthermore, it has been found that many men engaged in sexual community are also married, putting at risk of being infected with HIV (UNAIDS/NCASC, 2004). Current HIV prevalence among urban-based MSM is 4%. The limited information presents a significant barrier to the development of any understanding of the possible relationship between male homosexual activity, and the transmission of HIV and other STD.

At present, MSM in Nepal are emerging as a group at contracting HIV and other STIs, and are likely to bridge the infection to other people. Based on the information of study conducted by FHI 2001, the assumption was made that HIV prevalence among MSM was high. In 2005, the first ever IBBS study among 358 MSM in the Kathmandu valley was carried out, resulting in an HIV prevalence of 3.9% (CREHPA/BDS/SACTS/FHI, 2005). Currently there is no information on HIV/AIDS prevalence among the MSM sub-population outside the Kathmandu valley. HIV infection levels among MSM in the South-East Asia region however vary widely- like HIV prevalence among MSM in Indonesia is reported to be as low as 0.11%, 6.5% in Chennai, India; and 11% in China (Vivian 2004; AIDS Education and Prevention, 2004; PRB, 2005). In the purposes of the estimation exercise, the level of HIV infection among MSM outside Kathmandu Valley was assumed between 0.5% and 2.5% depending on the epidemic zones of the country (NCASC, 2005).

Besides these above mentioned high-risk population, there are some of the low risk groups, which at present, is in risk of contracting risk of HIV/AIDS through various M-A-R-P groups.

3.5.3.2.6 General women

According to the national estimates, general women have been classified into urban low risk population and rural low risk population. The HIV prevalence in general population may still be low, but masks an increasing prevalence in several risk groups in which

HIV prevalence consistently exceeds over 5% in sub-populations like IDUs, FSWs, and migrant workers (The World Bank group, 2004). And, these risk groups are acting as a driving force in the crisis of HIV/AIDS epidemic. At present Nepal is experiencing transition of HIV epidemic from a high-risk behavior groups to a low risk population like housewives (Subedi, 2006). Nationally, it has been estimated that the number of HIV infected urban low risk group to be in the range of 912784 to 944114 and that of rural low risk group to be in the range of 5367650 to 5375020 with an HIV prevalence range of 0.10% to 0.30% and 0.12% to 0.34% respectively.

As of November 2005, 13.5% of the 5,564 HIV cases reported to NCASC were housewives (NCASC, 2005), which indicates that HIV is spreading to 'low risk' women. It is more than likely that they contracted the virus from their spouses who were earlier infected through casual sex including with FSWs or drug injecting partners. Between the period of 1993 and 1999, the HSS among the antenatal clinics attendees in different locations of the country showed HIV prevalence to be between 0.2 to 0.3 percent respectively (NCASC, 1992 and 1999). A later study conducted in 2002 among 300 pregnant women in Pokhara, found that 0.2% of the women were infected with HIV. A high HIV prevalence of 10% and 20% was found among housewives of Kavre and Jhapa districts respectively who had used VCT services provided by ADRA and AMDA. The high prevalence of HIV among housewives could be attributed to the fact that their spouses were HIV positive, and had utilized VCT services to determine their status (ADRA/CREHPA, 2005). In one of the analysis study of trend of HIV infection among housewives, the ratio of housewives infected with HIV among all HIV infected women has almost equaled. The estimation also shows that housewives have acquired HIV three times more than the FSWs in absolute numbers. It is the matter of concern for all those working in HIV/AIDS and also a serious challenge to achieve the millennium development goals (Subedi, 2006). It also signals the necessity to address aggressively the issue.

3.5.3.2.7 Blood donors

In 1992, the screening of all blood donations was initiated in Nepal. The Nepal Red Cross Society, after two years, began screening blood sources used in government facilities (NCASC, 2005). With the view of providing safe blood and blood-products to the needy patients all blood collected is routinely tested against HIV, HBsAg, HCV, syphillis besides grouping , cross matching , and antibody-titration in the centre (NRCS, 2006/07).

According to the National Policy on AIDS control (1995) all donated blood must be screened for HIV, HBsAg, HCV and Syphilis before transfusion. NRCS has estimated that HIV prevalence among blood donors ranged from 0.37% in 2003 and 0.18% in 2006 (NRCS, 2005; 2006/07) showing a declining HIV prevalence among blood donors.

3.6 Burden of STIs and the need of biological and behavioral surveillance

STIs and HIV are inter-related because of the behavioral, epidemiological and host factors. STIs increase susceptibility to HIV and also increase the risk of transmitting HIV. STI surveillance data can be used as an early warning of the emergence of HIV and also an evaluation tool for HIV prevention programmes.

Globally over 340 million new cases of curable STI, i.e. syphillis, gonorrhea, Chlamydia and trichomoniasis, occur every year in men and women aged 15-49 years, with the largest proportion, 151 million (44%), in the South and South-East Asia regions. Although STIs rates are generally high in the South-East Asia region, patterns are variable. The highest STI rates in the region continue to be seen among sex workers and other population groups with high-risk behaviors. In Nepal, prevalence of STIs was 19.4% among migrants and 11% in their wives (WHO-SEARO, 2007).

It is generally accepted that other STI, especially those that cause ulcerative lesions, such as chancroid and syphilis, increase the efficiency of HIV transmission. It is clear from many epidemiological studies that if an individual has an ulcerative genital lesion,

the risk of HIV transmission is increased. However, no internationally accepted measures or indices have been developed to reliably quantify the prevalence of STI between different countries. STI prevalence surveys are difficult to conduct and data are limited to small, selected samples, mostly from STD clinics. These limited data suggest that the prevalence of STI, especially those associated with ulcerative lesions, is higher in populations with high heterosexual HIV prevalence than in countries with low heterosexual HIV prevalence.

At the end of 1999, one of the studies of regional estimates of HIV prevalence, together with a regional STD index, calculated from estimates of regional STD prevalence made in 1998 (Gerbase *et al.*, 1998) shows a good correlation with HIV prevalence and a calculated STD index (WHO, 2001).

As for the recognition, diagnosis and reporting of HIV/AIDS, is generally very incomplete, so HIV infections and AIDS cases reported to health authorities throughout the world constitute a variable and, usually, only a small fraction of the estimated total (i.e., "the tip of the iceberg"), especially in developing countries. Reporting of HIV infections is usually much more incomplete and inaccurate than AIDS case reporting, even in those countries where HIV reporting is required. Therefore reported AIDS cases and HIV infections should serve only as a starting point for estimation of actual HIV infections and AIDS cases that have occurred (WHO, 2001).

The figures that were being reported till now to the NCASC can probably be grossly underestimated given the existing medical and public health infrastructure and limited HIV/AIDS surveillance system in Nepal. Under the HIV/AIDS surveillance plan, NCASC has been conducting integrated bio-behavioral surveys (IBBS) on a regular basis since 1999 among the most at risk populations, in selected geographical areas of Nepal.

3.7 National estimation of HIV/AIDS

One of the greatest challenges faced by the present-day world is the pandemic of AIDS, which is likely to take serious dimensions in the present century (Rao and

Srivenkatatamana, 2001). In fact, AIDS epidemic is dynamic. The dynamics of national HIV epidemics are complex and almost all HIV epidemics consist of multiple sub-epidemics. These sub-epidemics may effect different sub-populations, occur with different timing and severity in different geographical regions, and usually occur at different rates (Ghys *et al.*, 2004). The dynamic of HIV epidemics, what is true in one country is not necessarily true in another, and what was true two years ago may no longer be true this year. The process of evaluation, which stands at the core of the estimation process, leads to a better understanding of who is infected with HIV and who is at risk at any given time. And that enhanced understanding leads, in turn, to better advocacy and better programme planning—the two fundamental reasons for making reliable estimates of HIV infection. So, public health officials must regularly monitor the data, evaluating information about HIV and risk behavior to see if HIV epidemics are changing over time. Lobbying for the resources for HIV prevention and care, countries need to have credible data based estimates of how many people are already living with HIV and how many are potentially at risk of contracting HIV infection because they engage in high-risk behaviors.

Good national estimate based on reliable data provide information on who is most likely to be infected with HIV, who is most likely to be at the risk of infection and which behavior are putting them at risk. Information on the distribution of these people, both geographically and by age can also be provided through strong estimation process. All this information is necessary to help plan HIV prevention and care interventions that will have the greatest impact on the spread of HIV and the welfare of those affected (UNAIDS/WHO, 2004).

3.8 Points to be considered during the estimation of concentrated epidemic

Estimates based on the prevalence among women at the antenatal clinics may be inaccurate in countries where the bulk of HIV infections are concentrated within population whose behavior puts them at especially high-risk of contracting and passing viruses. Different sub-groups like MSM and male IDUS, if they make up a large proportion of those infected with HIV, antenatal-based estimates will miss a significant

part of the epidemic. Some types of heterosexually driven epidemics aren't well captured by antenatal based estimates. The latter assumes that infection is spread relatively equally between men and women in the general population while, in some countries a relatively large number of male clients buy sex from a relatively small number of female sex workers. So during estimation the considerable number of infection rate of men may be missed. There may also be the connection between the two or more sub-groups. This connection helps in rapid transmission of HIV infection. For example: IDUs may also be involved in sexual contact with their partners.

Behavioral change in sub-groups, For example: IDUs may give up the injecting behavior and living normal life; FSWs may give up their profession and marry with another partner etc, that are to be considered during the estimation procedure otherwise the error in estimation is inevitable for the regions with concentrated epidemic. Therefore, different points are to be considered and taken into mind during estimation of HIV infections in concentrated epidemic than with the generalized epidemic where only the antenatal clinic attendees on the rural and urban basis are to be taken into considered (UNAIDS/WHO, 2004).

3.9 Methods of estimation and projection

Various methods have been improving for the estimation and projection of HIV epidemics. Due to the dynamic nature of HIV epidemic and the finding of drawbacks more or less of the devised methods in the past, the gradual modifications and improvements in estimation principles and tools were being made over time in order to approximate data in the analysis of HIV estimation. Eventually, at present, UNAIDS/WHO have come up with the epidemiological tools like Spreadsheet by mode of exposure, Estimation and Projection Package (EPP), workbook and various other for estimating the HIV status in the region with general or concentrated epidemics.

In recent years, there has been an increasing need for estimates and projections, for advocacy purposes; monitoring and evaluating trends of incidence, impacts, relevant interventions; and planning for future needs and resource allocation. Some of the history of development of methods for estimating HIV prevalence are-

3.9.1 Back calculation method

Back calculation method was one of the methods of estimating HIV prevalence in the most developed countries before the advent of effective therapy. The method used annual progression rates from HIV infection to AIDS and reported annual AIDS cases (usually after adjustments for incomplete and delayed reports) to calculate how many annual HIV infections would have been needed to generate the estimated AIDS cases.

3.9.2 Ratio method

In the late 1980s and early 1990s, a method to estimate HIV prevalence used an estimated ratio of prevalent HIV infections to prevalent AIDS cases. As the epidemic of HIV is dynamic, the HIV:AIDS ratio changes rapidly over the time, resulting variable HIV:AIDS ratio from many thousands to one during the first few years of an epidemic, to less than ten to one after the first decade. This decline occurs whether HIV incidence is increasing or decreasing because, in the absence of effective treatment, virtually almost all HIV infections progress to AIDS and the HIV: AIDS case ratio will gradually decrease. Hypothetically, the HIV: AIDS ratio will be equal to 1:1 when all HIV transmission is stopped. It is so because almost all the HIV infections eventually will progress to AIDS.

3.9.3 Multiplication of annual AIDS cases by 20

It is the best method for the estimation of current HIV prevalence in a “mature” HIV epidemic (one that has been in progress for about 10 years or longer). Here, the estimated annual AIDS cases are multiplied by 20. It has been assumed that if the median period of HIV infection to the development of AIDS is 10 years, then about 10 years after the start of an HIV epidemic, about 5% of prevalent HIV infections will develop AIDS on an annual basis. For example:

If, estimated annual number of AIDS cases is 5000

Then, estimated HIV prevalence is 5000×20=100000

Conversely,

If, estimated number of HIV prevalence is 10000

Then, expected annual number of AIDS cases is 5% of 100000=5000

This is a 'quick check and balance" method to see if the national estimate of HIV prevalence is compatible with the estimated annual number of AIDS cases or the reverse- if the estimated annual number of AIDS cases "fits" with the estimated national HIV prevalence.

3.9.4 Using results of serological surveys

In case of absence of the reliable estimates of AIDS cases, this method is used for making estimate of HIV prevalence where the data from serological surveys are used and extrapolated to the total 15-49 years old population. This method has been the primary method and continues to be used in developing countries to estimate HIV prevalence. Major problems with this method are the limited number of seroprevalence studies that may be representative of specific populations or sub-groups, and the wide variability in estimates of the sizes of important HIV-risk behavior groups or cohorts, such as FSW, IDU and patients seen in STI clinics. Nevertheless, epidemiologists have derived reasonable working estimates of the prevalence, general distribution and trends of HIV infection for many countries by an objective and detailed analysis of all HIV serosurvey data and demographic data on general population distribution.

3.9.5 Estimation of HIV prevalence by using HIV serological data

The UNAIDS/WHO had not developed a uniform methods of estimation of HIV prevalence, but often limited serological data, before 2001. As a result, many epidemiologists have developed their own methods, assumptions and biases for using the available HIV serological data to derive a seroprevalence estimate. Although HIV Sentinel Surveillance Systems (HSS) weren't designed to provide data for making HIV prevalence estimates, they have been widely used for this purpose, simply because there are usually no better serological data available. HIV/AIDS programmes have routinely used HSS data to estimate HIV prevalence in the major sentinel groups. HIV prevalence in the 15-49 year-old population has been calculated according to the following general formulae:

- The number of HIV infections in each of the major high-risk groups = estimated HIV seroprevalence rate (from HSS data) multiplied by the estimated number of the high-risk group(estimated for a specific population or a province); and

- The number of HIV infections in the 15-49 year-old population = estimated HIV seroprevalence rate in antenatal women in the province (from HSS data) multiplied by the estimated number of 15-49 year-olds in the province (from census estimates).

3.10 Methods for Projecting HIV

Though there is great uncertainty in projecting the future of HIV epidemic, in an attempt to predict future trends and prevalence of HIV, various methods have been used.

3.10.1 Delphi Survey method

To improve the reliability of the judgments needed in relatively uncertain situations, as well as to provide a means of quantifying such judgments, this method was developed. This method obtains educated guesses from the selected experts in a reiterative fashion, and the responses regarding the average and range are used for projections. Despite the economy and promptness in procedure, it is difficult to select truly knowledgeable experts (i.e., experienced quantitative epidemiologists who are families with epidemiology of HIV and general demographics of specific countries of populations) to develop reliable estimates or projections of the number of HIV infections. This method should be used only for the populations where no data are available. This method has extremely wide ranges.

3.10.2 Mathematical and computer/stimulation models

This method has been used to develop short and long range projections of HIV prevalence. Such models should be primarily used for hypothesis testing but not for making estimates and projections of the annual incidence/prevalence of HIV infection or a specific country or population as according to the recommendation made by UK expert committee after reviewing the situation in UK in 1994. This committee concluded that due to uncertainty of various input parameters such as the size of risk

groups as well as reliable data on their current partner exchange rates, made estimation and projection of HIV/AIDS incidence and prevalence in the UK extremely uncertain. As a result, the outputs of such model were recommended not to be used for the specific programme or policy development. However, some countries and many agencies have used for programme and policy development ignoring such recommendations.

There are different short-term estimation methods of HIV/AIDS developed during the late 1980s by the Surveillance, Forecasting and Impact Assessment (SFI) unit of the former Global Programme on AIDS (GPA) of the World Health Organization (WHO) which are described below.

3.11 EPIMODEL

It is software developed by WHO Global Programme on AIDS in the late 1980s when few surveillance data were available (Chin *et al.*, 1991). Though it is still used for this specific task, most problems encountered by users of EPIMODEL are associated with its misuse.

EPIMODEL was not designed to provide projections of HIV infection. However, short-term projections of AIDS cases for longer than 3 to 5 years can be produced by assuming that annual HIV infections beyond the reference year will continue along the curve selected for use. However, long-term projections of AIDS cannot be projected for it is less reliable.

The basic module EPIMODEL uses estimates of HIV prevalence and distributes this prevalence by annual HIV infected cohorts back to the estimated start of the HIV epidemic along a selected epidemic curve. EPIMODEL then applies annual progression rates from HIV infection to the development of AIDS to each of the annual HIV cohorts to calculate annual numbers of adult AIDS cases and deaths. EPIMODEL provides default values for several input parameters that may be considered appropriate for modelling HIV/AIDS in a sub-Saharan African population, but all input parameters for EPIMODEL can be easily changed to better “fit” the specific population that is being modeled. EPIMODEL uses estimates of HIV seroprevalence, estimates of the shape and

age of the HIV epidemic curve, and estimates of average progression rates from infection to AIDS and death to derive its output. All these estimates have to be constantly reviewed, and revised, as additional data become available.

Basically, the module of EPIMODEL was designed to estimate and project adult AIDS cases and deaths. This module can, with the additional input of a population denominator, calculate annual incidence and prevalence rates for HIV infection. Other modules of EPIMODEL include a child module that estimates and projects annual numbers of HIV infected and uninfected infants born to infected women. This pediatric module also calculates pediatric AIDS cases and deaths, and the age of maternal orphans during the year of their mother's death. Though it is used for the specific task, various errors in using EPIMODEL include the following:

a) The greatest error could occur in estimating HIV point prevalence. This isn't really an error of the model, but an extra work of caution in selecting input parameters for EPIMODEL. If a very high HIV seroprevalence estimate is used, the number of resultant estimated AIDS cases will also be very high.

b) The 'stage' of the HIV epidemic will have a significant impact on the estimates of annual HIV incidence and on estimates of annual deaths due to severe immune deficiency related to HIV infection. For a specific point prevalence estimate of HIV prevalence, the estimated annual incidence of HIV infection will be greater In the early or increasing phase of an HIV epidemic than it will be in the later or declining phase of an HIV epidemic. The stage and duration of the modeled HIV epidemic will also have a major impact on the estimated cumulative incidence of HIV infections and AIDS deaths.

c) Another possible source of error in producing estimates and projections of AIDS cases and deaths with EPIMODEL is the selection of the median interval period from HIV infection to death due to severe immunodeficiency related to HIV infection. The median interval from HIV infection to the development of severe immune deficiency appears to be similar in all populations (i.e. in developed and

developing countries) and is estimated to be about 7-8 years. However, there is a consensus that the survival period from the development of severe immune deficiency to death is much shorter in most developing countries than in the developed countries, where the advent of HAART therapy has significantly increased survival of patients with moderate immune deficiency related to their HIV infection. A review of several cohort studies (Uganda, Thailand, Haiti) indicate that the median interval from HIV infection to death is 9 years, and this median period will now be uniformly used to calculate annual HIV incidence and annual deaths due to immune deficiency related to HIV infection. There is a deliberate movement by UNAIDS/WHO to avoid estimation of AIDS cases because of vagaries of AIDS definitions.

The default median progression period from infection to AIDS in EPIMODEL in 10 years and the default median interval from AIDS to death for developing countries is less than 1 year. This has resulted in a median interval from HIV infection to death of 11 years. The change from this 11 years median survival period to the 9-year median progression period from infection to death results in much higher (up to 30% higher) cumulative numbers of HIV infections. In addition, use of a 9-year median survival period results in a higher (up to 60% higher) annual number of AIDS death. This increase in annual deaths is needed to compensate for the increase in cumulative HIV infections.

Country HIV and AIDS estimates have been published by the Joint United Nations Programme on HIV/AIDS (UNAIDS) and the World Health Organization (WHO) every two years since 1998, and the 2006 Global Report is the fifth release of country estimates. Since 1998 much has changed in the approaches and methods used to produce national estimates using data from surveillance systems and research studies. In recent years, these estimates have become more accurate, owing much to the availability of results from national population based surveys in countries with generalized epidemics, and to the use of an explicit analytic framework and the greater availability of data on the size of groups with high-risk behavior in countries with low level or concentrated

epidemics (Boerma *et al.*, 2003; Walker, 2004). The focus of these analyses has also been shifting from the global level to the national and increasingly to the sub national level. This is a trend that parallels a shift in the use of these analyses from global advocacy to improved national planning of prevention and treatment as programmes are scaled up towards universal access which is available at http ://data.unaids.org/ Topics / Universal Access/UniversalAccess_Concept_Jan2006_en.pdf.

Different types of software tools have been developed for the estimation and projection which have been further modified into simple form according to the need of time and change in trend of HIV epidemic. Some of which are discussed below:

3.12 Workbook

The UNAIDS methodology uses HIV surveillance data to produce national HIV prevalence estimates. For making estimates and short term projections of HIV/AIDS prevalence, workbook is one of the methods, has been developed and proposed with low and concentrated epidemics since 2001 (Walker *et al.*, 2004; Roman, 2005). Unlike in countries where the epidemic is generalized and HIV surveillance among pregnant women attending the general adult population (WHO, UNAIDS, CDC, 2003) there is no standard set of representative data that can be used to estimate adult prevalence in these countries. Instead the approach has been to develop estimates for populations which are most exposed to HIV and then combined to produce an overall estimate of adult prevalence in a country (Lyerla *et al.*, 2006).

The work book method, an excel ^{TM} spreadsheet developed by WHO and UNAIDS staff (UNAIDS/WHO, 2005). The estimation and projections workbook is part of set of methods that the Joint United Nations Programme on HIV/AIDS (UNAIDS) and WHO, with support from the UNAIDS Reference Group on Estimates, Modelling and Projections, has developed (UNAIDS Reference Group on Estimates, Modelling and Projections, 2002). National AIDS programme in countries around the world have used these methods and tools for making estimates and developing scenarios of HIV

prevalence levels in countries (Walker *et al.*, 2004; Ghys, 2004) and for estimating the demographic impact of HIV/AIDS in countries (Stover, 2004).

An early version of the projection component of this software was used to produce regional projections of HIV prevalence, which, in 2005, under went revisions and changes, based on recommendations by experts and on the experiences of implementing this approach in many countries to improve the process and ease of use (Lyerla *et al.*, 2006). Currently the software exists as a single Excel file with several spread sheets in which both point prevalence and a curve fitting historical prevalence estimates can be produced. Briefly the workbook approach focuses on identifying populations who are at high-risk of infection through their own or their sexual partners' risk behavior (Walker *et al.*, 2004). It consists of two parts: firstly, those groups or populations who are most exposed to HIV (for example, MSM, IDUS, SW, CoSW) have to be defined in terms of population size and HIV prevalence for predefined geographical regions. For each of these regions, an approach must also be selected to estimate prevalence in the population at lower exposure to HIV; either using data on sexual partners of those must exposed to HIV, or using data on women attending antenatal clinics. The total estimate of prevalence for a specific region will then be the sum of the number of people living with HIV across all regions. The second part of the software consists of obtaining the point prevalence, nationally as well as by region for a number of previous years in order to fit an epidemic curve to the prevalence data. The epidemic curve can finally be read into the spectrum software from which demographics projections of the impact of the HIV epidemic can be made (Stover, 2004).

Currently, for the countries with an epidemic level that is neither clearly generalized nor clearly concentrated, both methods developed for concentrated epidemics (workbook) (Walker *et al.*, 2004) or generalized epidemics (the EPP) (Ghys *et al.*, 2004) can be applied. At past there was an early version of the EPP which was used to produce the end 2001 UNAIDS/WHO estimates only for the most heavily affected countries in the world (UNAIDS, 2004; Walker *et al.*, 2004).

3.13 Estimation and Projection Package (EPP)

Many models of HIV spread have been developed that incorporate complex patterns of risk behavior and mixing (Anderson *et al.*, 2000). These provide a useful tool for understanding the spread and control of HIV, but require a large numbers of biological and behavioral parameters. Such models are in appropriate for the country-specific estimates made by UNAIDS, where the relevant behavioral data are rarely available. A simpler model is therefore required, but one which captures the dynamics of HIV transmission, and which can be used for all countries.

UNAIDS established an Epidemiology Reference Group in 1999 which advise them and other organizations on HIV estimates and projections of HIV/AIDS. During the meeting of the reference group in 2001, four priority areas were identified where methods and assumptions should be reviewed and perhaps modifies: a) models of the HIV epidemic, b) survival of adults with HIV-1 in low and middle income countries, c) survival of children with HIV-1 in low and middle income countries and, d) methods to estimate numbers of AIDS orphans. Hence, the reference group has provided reviews of current knowledge, help develop methods for estimates and projections, and has identified areas for future research that are relevant for improving estimates and projection of HIV/AIDS.

Research and literature reviews were carried out by Reference Group members and invited specialists, prior to meetings held during 2001–2002 so as to present approaches to estimating and projecting HIV prevalence appropriate or all countries of the world. Six modelling key features; compartmental models or parametric curves, time scale, stratification by age and/or sex, description HIV positive adult survival, inclusion of ‘not-at-risk’ population, dynamic or fixed parameters, demographic specifications, data fitted and method of obtaining best fit, and production of prediction intervals. A discussion of the features necessary to maintain epidemiologic realism and inter protection, but which allowed the practical application to many countries with different epidemics lead to the current UNAIDS/WHO model. This model represents hybrid of those models presented the Reference Group meeting, Software implementing the

model, termed the epidemic projection package, which is available at www.tfgi.com; www.who.int; www.unaids.org.

As software, EPP is a 15 MB Java based software package which has user friendly interface with easily comprehensible windows and buttons. It replaces Epi Model which was used by WHO's Global Programme on AIDS and UNAIDS to make previous estimates; all time when very little surveillance data was available. The EPP interface is designed to lead the user through the process of defining and modelling a national epidemic in terms of locally relevant sub-epidemics. The interface consists of seven key pages corresponding to the steps involved in defining and modelling an epidemic which are-1) Work set page, 2) Define epidemic page, 3) Define Populations page, 4) HIV data entry page, 5) Projection page, 6) Results page and7) Audit check page

The EPP can be applied by people of varying professional backgrounds, including national epidemiologist, data analysts, and monitoring evaluation professional in countries. EPP has been designed as a fool for epidemiologists and analysts to construct national and sub-national epidemic curves, an essential step in the estimation of levels and trends in the epidemic and its impact; allowing to address epidemic complexity more realistically than has been possible in the past (Ghys *et al.*, 2004). EPP can be used for either concentrated or generalized epidemics according to the different conditions and rules provided for HIV prevalence infections.

EPP is generally used to estimate and project the national HIV/AIDS epidemic in a particular country. Within the national epidemic structure, there are two major divisions, geographic sub-epidemics and sub-population. Surveillance data are usually collected to monitor the status of the epidemic in different sub-population. The particular sub-population selected for each country will depend on the surveillance data available. Most commonly these sub-populations will include:-In generalized epidemic includes people in urban and rural areas. In concentrated epidemic includes FSW, MSM, IDU, STI patients, TB patients, blood donors, migrants, military personnel truck drivers, and low risk men and women.

Finally, EPP allows calculating the individual HIV epidemic curves for each important sub-population and then combining these curves easily to form a national estimate of HIV prevalence trends. These two general types of epidemics are appropriate for most countries (UNAIDS/WHO, 2005).

3.14 Spreadsheet

Spreadsheet, a new tool has been developed to help quantify the number of new HIV infections by mode of exposure (Gouws *et al.*, 2006), building on earlier approaches (Pisani *et al.*, 2006). It is the simple epi tool and the best method that can be used for Nepal in the context of HIV/AIDS situation of this country. This tool is of particular relevance for helping to develop costs for developing national strategic plans, as these plans need to prioritize programmes according to the importance of the different modes of exposure. The model can serve to help identify priorities for the expansion of surveillance systems (Ghys *et al.*, 2006).

The spreadsheet that has been used here was developed by Geoff Garnett and Peter White (Imperial College) in collaboration with Neff Walker and Peter Ghys (UNAIDS), John Stover (TFGI), Tim Brown (East West Center) and Elizabeth Pisanie (FHI) in 2002, Bangkok; and revised by Peter White and Eleanor Gouws in 2005. The model is based on formulae of Weinstein et al and employed in the model Avert (UNAIDS Reference Group on Estimates, Modelling and Projections, 2005).

The epidemic affects different parts of the world differently and even within regions the epidemic progresses at different rates and at different levels of intensity within different exposure groups. However, prevention efforts are often built on broad classifications of the type of epidemics in a country or region rather than on a careful analysis of the distribution of new infections, modes of transmission and the groups at highest risk of becoming infected with HIV in a particular country. Patterns of transmission have changed over time in almost all regions of the world. Low coverage of prevention programmes is another most important factor that has limited the impact of national HIV/AIDS prevention. In order to control HIV epidemics effectively and to reach those most in need, prevention strategies need to be adapted to the changing patterns of HIV

risk. However, to target those most in need, it is important to first understand the behaviors that put people at risk of infection and the current distribution of new infections by risk group (Gouws et al, 2006).

Using the current distribution of prevalent infections and the pattern of risk within different populations, the model, here, was used to estimate the expected size of new adult infections in the identified risk groups in the coming year and their exposure to HIV infection which will probably help in sensible focus in intervention in targeted risk population so as to prevent the spread of HIV/AIDS in the near future.

3.14.1 Principle of the model

A model (currently available as an Excel spreadsheet) was developed in collaboration with the UNAIDS Reference Group on Estimates, Modelling and projections to calculate the expected short term incidence of HIV infections among the adult population by mode of transmission, using as input data the current prevalence of HIV infection, the individuals in particular risk groups, and the risk of exposure to infection within each group (UNAIDS, 2005). The model was first applied in 2003 (Pisani *et al.*, 2003) and has subsequently been developed as part of the UNAIDS /WHO set of methods and has been included in regional training courses conducted by UNAIDS and WHO. The model and instruction for application are available at http://www.unaids.org. In the model it is assumed that the risk of infection on susceptible individual is a simple binomial function of the number of partners and number of contacts with each partner. The risk per susceptible which depends upon current prevalence of infection within their contacts is then derived, taking into account the transmission probabilities, either in the presence or absence of sexually transmitted infections (STI). By multiplying this by the number of susceptible at risk in the population, the expected incidence for the coming year is then

$$I=S[1-\{p(B(1-\beta'(1-\nu))^{\alpha}+(1-B)(1-\beta)^{\alpha(1-\nu)})+(1-p)\}^{n}]$$

Where,

I = the incidence of HIV in the target population, which depends upon the number susceptible, S, and the HIV prevalence in the partner population, p.

B, the variable, is prevalence of STIs in the target or partner population, whichever is higher,

β' and β represent the probability of transmission of HIV during a single contact in the presence or absence of an STI (in the case of transmission by needle-sharing β' = β),

ν is the proportion of acts currently protected by effective condom use or the use of sterile needles,

$_{\alpha}$ is the number of contacts per partner and n is the number of partners.

CHAPTER-IV

4. MATERIALS AND METHODS

4.1 Materials

4.1.1 Different data required and their sources

For the estimation of incidence of HIV infections, different data are required for different sub-groups as according to the requirement of an epidemiological tool, the spreadsheet. With the use of the spreadsheet, different demographic data like the total adult population, population of different risk groups including the bio-behavioral surveillance, the national incidence can be estimated. As a whole the optimization exercise requires the gathering of a substantial amount of data including defining the sub-population groups targeted, size estimation of different sub-populations, HIV prevalence data of the respective sub-groups, and different biological and behavioral surveillance data which are shown in table below along with the sources in summary.

A summary of the data required for each risk groups, and potential sources of data, is provided in table 1.

Table 1: Data required and sources of information

Data required for each risk groups	**Potential sources of data**
1. Number (or percentage) of individuals in risk group	The size estimate of different sub population has been retrieved basically from National Estimate of Adult HIV infection 2005. Surveillance (HIV, STI, Behavioral), Population based surveys e.g., Demographic and Health Surveys (DHS), other published reports/papers. From NDHS reports, data was retrieved from the chapter on “HIV/AIDS-related Knowledge, attitudes and behavior”.

	Data for the blood transfusion was collected from the Nepal Red Cross Society (NRCS).
2. HIV prevalence in risk group	HIV surveillance, Population based surveys, UNAIDS/WHO Epi Fact sheets. Different HIV prevalence data have been collected from the studies of different published and unpublished surveillance works or studies conducted by Family Health International (FHI)/ New ERA/ STD/AIDS Counseling and Testing Services (SACTS)/ Center for Research Environment Health and Population Activities (CREHPA)/ National Centre for AIDS and STD Control, Nepal (NCASC). Data for the blood transfusion was collected from the Nepal Red Cross Society.
3. Prevalence of STI	Surveillance (Behavioral and biomedical) and special studies conducted by FHI/ New ERA/ SACTS/ CREHPA. From DHS reports, data on self-reporting of STIs can also be found in the chapter on "HIV/AIDS-related Knowledge, attitudes and behavior". Data for the blood transfusion was collected from the Nepal Red Cross Society.
4. Average number of partners per year	Studies from Behavioral surveillance, population based surveys, published papers/reports conducted by FHI/ New ERA/ SACTS/ CREHPA. Data can also be found in the chapter on "HIV/AIDS-related Knowledge, attitudes and behavior" in DHS reports. Blood transfusions and Medical injections: Number received should be reported (usually 1 per year)

5. Number of acts per partner per year	Behavioral surveillance, population based surveys, published papers/reports conducted by FHI/ SACTS/ CREHPA/ New ERA. From DHS reports, data can also be found in the chapter on "HIV/AIDS-related Knowledge, attitudes and behavior". For Blood transfusions and Medical injections: Fixed at 1.
6. Percentage of potential exposure acts protected	Behavioral surveillance, population based surveys, published papers/reports conducted by FHI/ SACTS/ CREHPA/ New ERA.

7. Transmission probability

Transmission probability per act of exposure with and without STIs is an important factor and the values were recommended to use default values that are derived from published literature. Estimates of transmission probability per contact were based on the exhaustive review of the literature on HIV infectivity (per partnership and per contact) by Imperial college in 2004 as part of UNAIDS report (Baggaley *et al.*, 2004) for different modes of transmission, including heterosexual and homosexual intercourse, parenteral and blood transfusions. However, country specific estimates of infectivity can be used although these estimates are provided in the spreadsheet as default transmission probabilities.

4.1.2 Spreadsheet

Spreadsheet, a tool developed in collaboration with the UNAIDS Reference Group on estimates, modelling and projections that is used for the estimation of expected incidence of HIV infection over coming year based on the use of current prevalence of HIV infection, number of individuals with particular exposures, and the rate of these exposures. Spreadsheet contains a number of columns and rows with different variables of defined sub-populations in which the user of the spreadsheet has to supply biological and behavioral data to inform the values in the cells for the spreadsheet as shown in

table 2. The defined risk groups in the spreadsheet are mutually exclusive. Overall, all the relevant data were obtained from different HIV surveillance systems, national statistics, published and unpublished papers, Nepal Red Cross Society (NRCS), US Census Bureau Population Division International programs center, Central Bureau of statistics, Department of Health Services and from local and international studies to produce estimate of all the variables that feed into the model.

After reviewing of different available literature on different risk groups and their scenario in country's HIV epidemic, the reliable adult risk behavior size was taken from the national estimate produced by NCASC in 2003 and 2005. The total adult population was retrieved from the "Annual Report 2004/2005", Department of Health Services, Nepal and from Central Bureau of Statistics. For the estimation of HIV and STI prevalence data, regional averages were used from different IBBS conducted by Nepal country office of Family Health International (FHI) and from the National estimates in the absence of data in certain risk behavior groups. Different knowledge and behavioral surveillance on different sub-populations were also reviewed from different published and unpublished IBBS conducted by FHI, Nepal. Beside this, before the entry of the data in different cells of the sub-populations, experts pertaining to the relevant subject matters were consulted about the different consideration of the population size and bio-behavioral parameters of the risk behavior while visiting to different VCTS and NGOs working on HIV/AIDS. Different branch working on HIV/AIDS in different specific populations like WATCH Rupandehi, Youth Vision Kathmadu, FPAN, Naulo ghumti Rupandehi, Nava kiran Plus Kathmandu, Recovering Nepal Rupandehi, Youth Vision, Kathmandu branch, Blue Diamond society, Rupandehi, Nava Kiran Plus, Kathmandu, Maiti Nepal, Kathmandu were visited for collection of different information as required which were reviewed again with the experts and finally used for the estimation purpose.

4.2 Methods

After the review and the analysis of surveillance data on various sub-populations, the data were ready to enter into the tool as according to the model developed by UNAIDS.

Various methodological steps were being considered during the entry of different surveillance data of different regions of the country into the model. They are-

4.2.1 Dividing and defining the sub-population groups targeted

The population was categorized into groups according to their main source of exposure to HIV. According to the model, various risk groups such as Intravenous Drug User (IDU), partners of IDU, Sex Workers (SWs), Clients of Sex Workers (CoSWs), Partners of CoSWs, Men having sex with men (MSM), Female partners of MSM, Casual Heterosexual Sex (CHS) i.e. having multiple partners, regular sex partners of those who have CHS, adults with low risk behavior (including those of former high-risk behavior), adults with no risk of HIV (those that do not inject drugs and are not involved on any sexual activity), adults who receive medical injections, and adult who receive a blood transfusions were specified in different rows (from row 4 to row 16) of the column A as shown in the table 2.

For each risk group, a number of variables were required from column B to J.

4.2.2 Size estimation of different risk groups

For the size estimation of different population, the mean sizes of each risk groups were cited from National Estimates of Adult HIV Infections 2005/2003. The size of these risk groups were specified in the cells B4 to B16 and C4 to C16.

For medical injections, it was assumed that the entire population is exposed, while for the size of blood transfusions population and total adult population, were collected from NRCS and Annual Report of Nepal 2004/2005.

Here, the total adult population size (cell 17) was made equal to the sum of the population sizes in the risk groups specified in the cells C4 to c14.

4.2.3 Specification of the current HIV prevalence in these risk groups

It can be defined as the percentage of people in the particular risk group who were infected with HIV. The HIV data were specified in the cells D4 to D16, which were retrieved from the different surveillance systems conducted in different regions of the

country by different organizations like FHI/New ERA/CREHPA/SACTS etc. In the absence of the data in certain specific sub-population, the HIV prevalence data were considered in the range provided by National estimates.

4.2.4 Specification of the prevalence of STI in the risk groups

The prevalence of STI in the different risk groups was entered according to the surveillance data conducted till date from the cell E4 to E16. According to the model, risk groups like partners of IDU, partners of sex work clients, female partners of MSM, regular partners of those who have casual heterosexual, sex partners those who receive medical injections, and those who receive blood transfusions do not require these data.

4.2.5 The average number of partners per year

The average number of partners per year was specified in cells F_4 to F_{16}.

For the average number of partners per year, the data was obtained from bio-behavioral surveillance conducted by FHI/New Era/SACTS etc. Here, the average number of partners for most risk groups – all except IDU, medical injections and blood transfusions, it is the average number of sexual partners they have per year. For IDUs, the average number of needle sharing partners they have per year was considered as partners, while for medical injections and blood transfusion, the number of injections or transfusion received in which each one is counted as a partner was considered.

4.2.6 The average number of acts of potential HIV risk exposure per partner per year

The average number of acts of potential HIV risk exposure per partner per year was entered into cells G_4 to $G_{16.}$

It can be defined as the average number of contacts with each partner per year. For blood transfusions and unsafe medical injections there is one ‘act’ per ‘partnership’. The average data were entered obtained from the different calculation after the various bio-behavioral surveillance studies.

4.2.7 The average percentage of acts of exposure that is 'protected'

The average percentage of acts of exposure that is 'protected' was specified in cells H_4 to $H_{16.}$

It can be defined as the fraction of acts that are protected by condom use/safe needle use/screening of blood used for transfusions. Study of different biological and behavioral surveillance conducted in Nepal was calculated as the average percentage of acts of exposure that is 'protected' in their respective cells.

4.2.8 The transmission probability per risky exposure acts

The transmission probability per risky exposure acts in cells I_4 to I_{16} and J_4 to J_{16} were specified. Here, according to the model of spreadsheet, the default values which is based on a literature review was used which was recommended by UNAIDS. However, on the presence or availability of data, the values can be changed. Since no such surveillance surveys had been conducted in our country, the default values were used.

Cells I_5 to I_{14} is the transmission probabilities or sexual transmission of HIV from HIV+ individuals who have an STI, and cells J_5 and J_{14} contain the transmission probabilities for sexual transmission of HIV from HIV+ individuals who do not have an STI. Cell J_4 contains the transmission probability for HIV transmission amongst injecting drug users, cell J_{15} contains the transmission probability for unsafe medical injections, and cell J_{16} contains the transmission probability for blood transfusions. It defines the average infectivity of the transmission probability for each risk group of HIV+ partners to whom they are exposed.

4.2.9 Examination of the incidence pattern

After being fed all the required data into the respective cells, in the spreadsheet, of the different sub-populations, then, the estimation of HIV incidence was observed and examined the incidence pattern by risk behavior among various exposure groups.

CHAPTER-V

5. RESULTS

After the accomplishment of entry of various data of HIV/AIDS as per the need of the spreadsheet, different number of incidence as well as the percentage of incidence was observed in different categories of risk groups. The incidence of mode of transmission is shown in figure 1 and 2 with the respective bar diagram and pie chart.

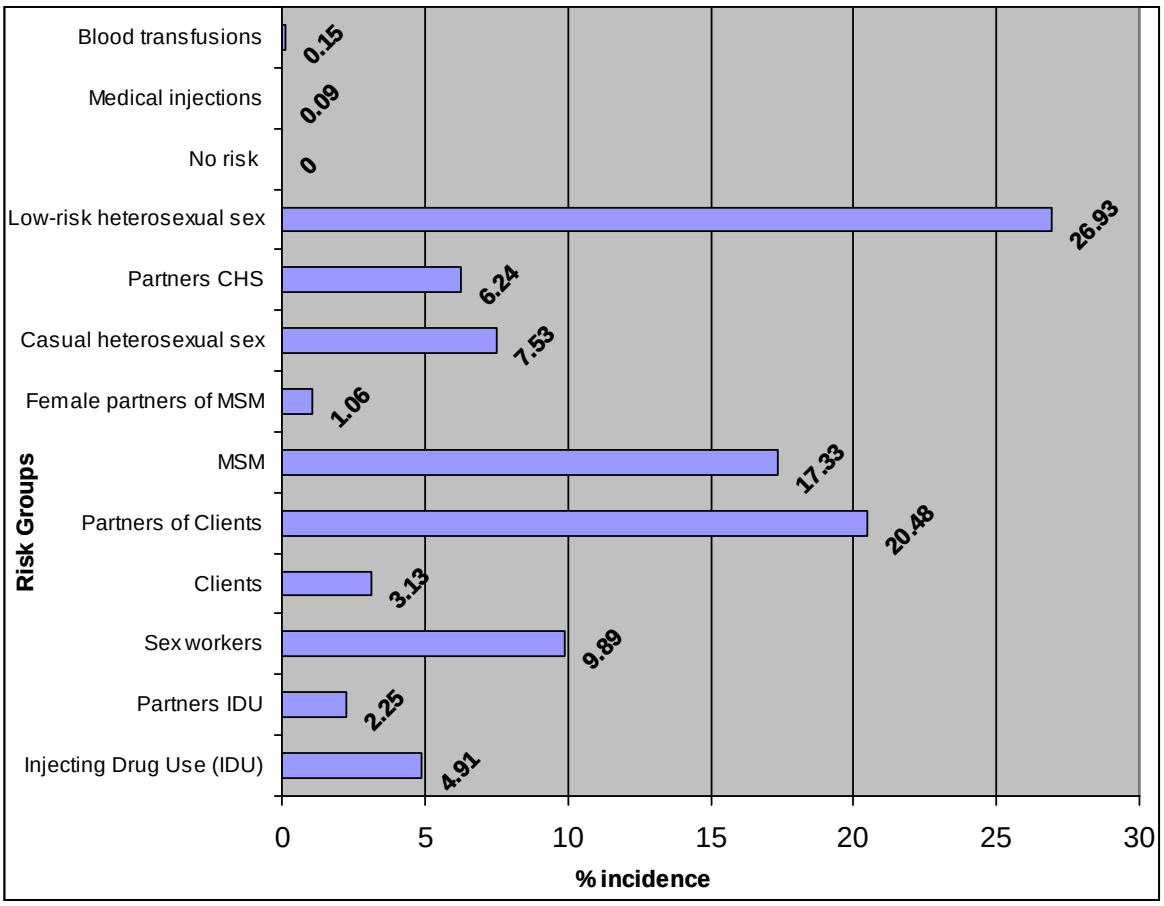


Figure 1: Distribution of HIV incidence by mode of transmission in different sub-populations

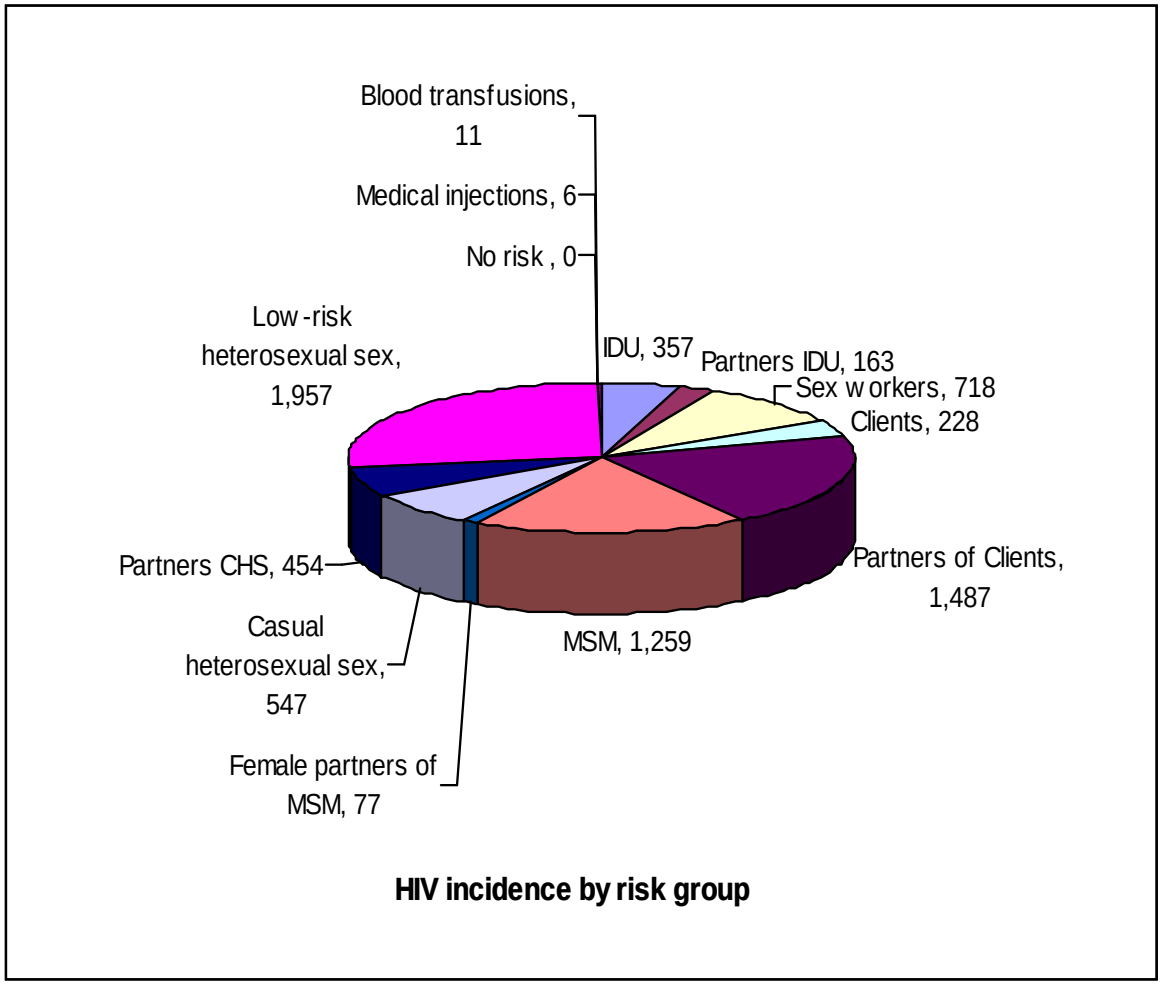


Figure 2: Distribution of incidence cases in different risk groups

As according to the result obtained in different risk groups from figure 1 and figure 2, a total of 7,265 new infections (out of a total 15 to 49 year adult population of about 15,108,617) were estimated to have occurred in 2007 in Nepal. Of these new infections, the majority occurred among the general low risk population (26.93%, 1,957), partners of clients (20.48%, 1,487) followed by MSM (17.33%, 1,259). Other risk groups that contributed significantly to the number of new infections were sex workers (9.89%, 718), clients (3.13%, 228), CHS (7.53%, 547) as well as their partners (6.24%, 454), IDUs (4.91%, 357), partners of IDUs (2.25%, 163) and partners of MSM (1.06%, 77). The percentage of new infection related to medical injections and blood transfusions were small, 0.09% (6) and 0.15% (11) respectively.

Adult risk group	Incidence per 100 per year
Injecting drug Use (IDU)	1.816
Partners IDU	2.704
Sex workers	2.378
Clients	0.035
Partners of clients	0.376
MSM	0.981
Female partners of MSM	0.195
Casual heterosexual Sex (CHS)	0.022
Partners of CHS	0.037
Low-risk heterosexual sex	0.023
No risk	0.000
Medical injections	0.000
Blood transfusions	0.010

Table 3: HIV incidence per 100 per year by risk group

The above table shows the estimated incidence per 100 per year in different adult risk behavior sub-population. The estimated incidence per 100,000 per year in different risk groups is more interpretative by the bar diagram as shown in figure 3. From the figure, it is found that the highest incidence was to be in partners of IDUs followed by sex workers and then by IDU which in turn is followed by MSM that significantly contribute in the national incidence of HIV. Other sub-populations that pose in the

contribution of HIV incidence in decreasing order are partners of clients (376), female partners of MSM (195), partners of CHS (37), clients (35), low-risk heterosexual sex (23), casual heterosexual sex (22), and finally blood transfusion (10).

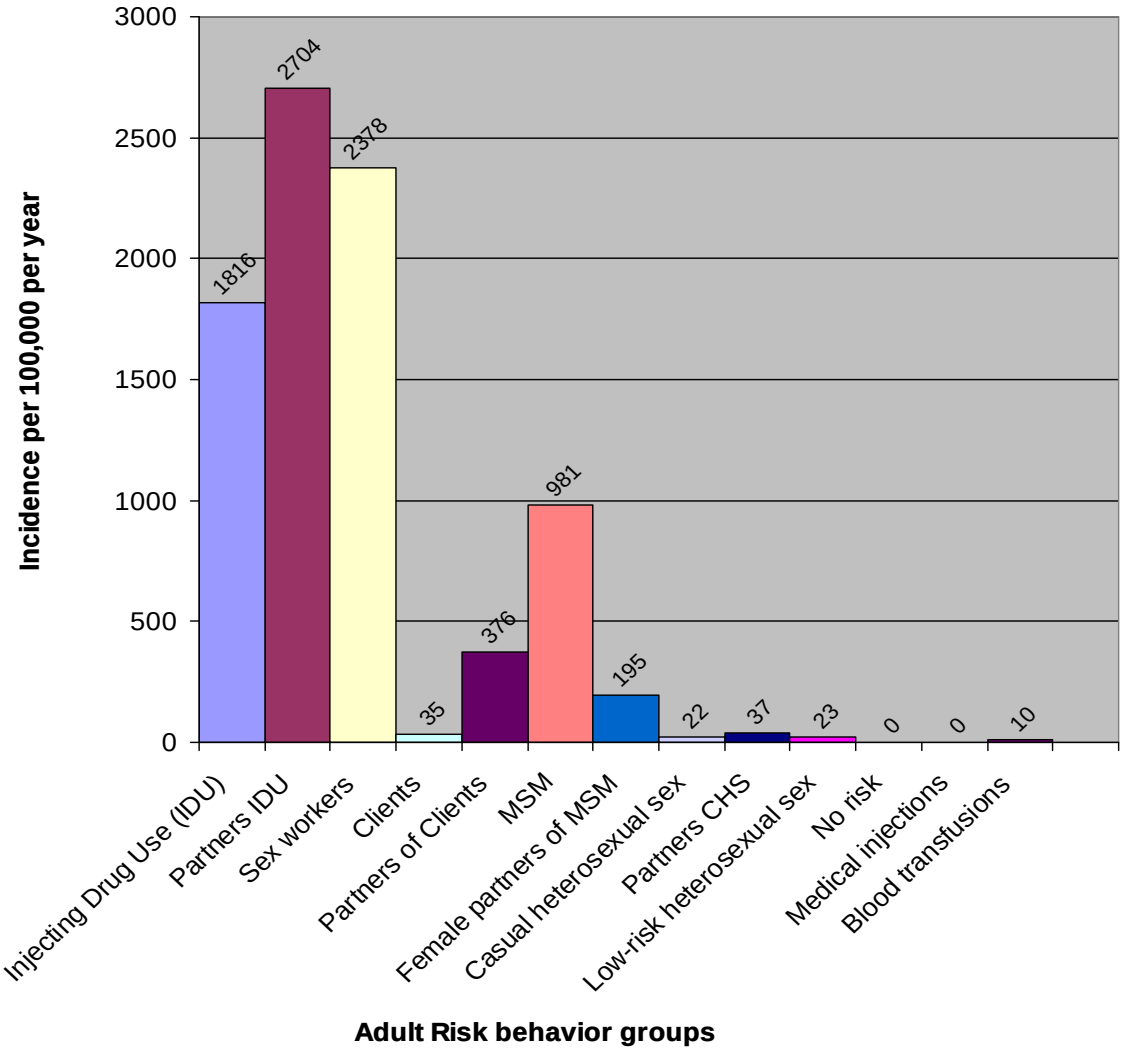


Figure 3: Incidence per 100,000 per year in different risk groups

Besides this, the total percentage of incidence in the partners of high-risk groups was found to be 30.03% (excluding females of low-risk heterosexual sex) which is more than one forth of the total percentage of incidence estimated to be occurred. More over, the most striking and the significant point to be noted is that the percentage of incidence

in the total partners of high-risk groups was found to be three times more than that of the FSWs which is interpretive by the figure 5 figure 6 indicating the transition of HIV epidemic from high-risk behavior group to low risk groups via the mediator or bridging group.

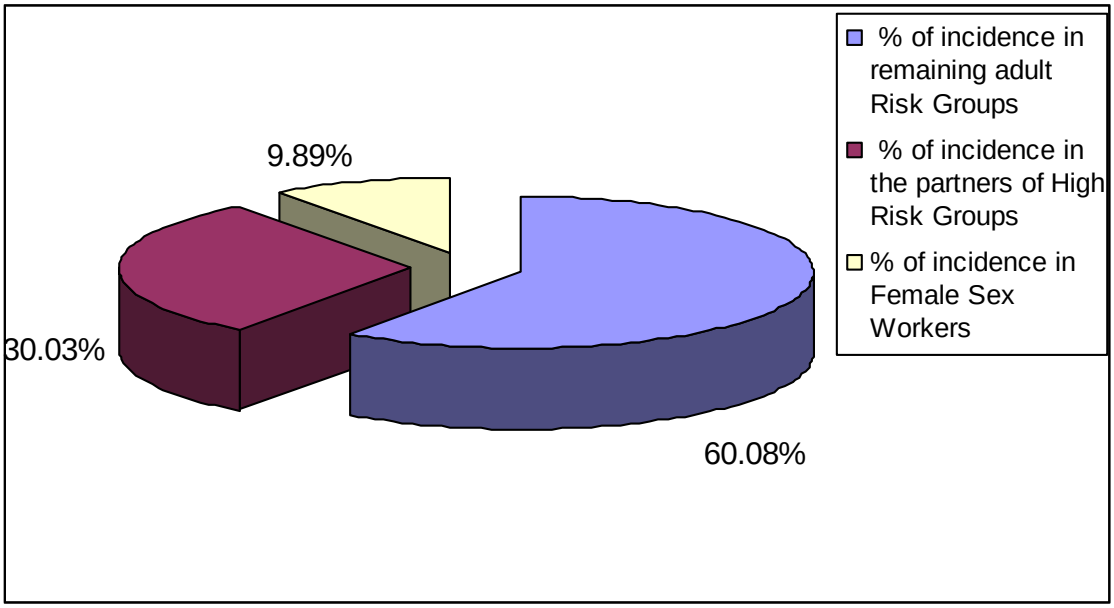


Figure 5: Distribution of HIV incidence among remaining adult risk groups, incidence in partners of high-risk groups and FSWs

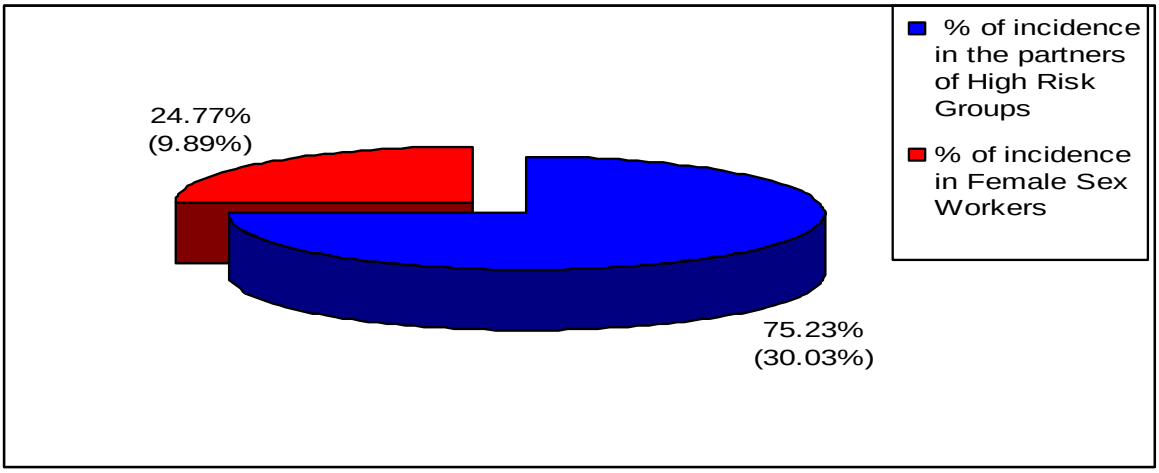


Figure 6: Relative magnitude of incidence in FSWs and incidence in partners of high-risk groups

The incidence of risk groups of HIV/AIDS is found increasing every year. According to the reported cases of HIV incidence by NCASC of the year 2007, a total of 1,424 cases of incidence have been reported. It is, however, unclear to what extent this reported figure reflects the real picture of HIV infections in Nepal. According to the estimation, a total of 7,265 HIV incidence has been found with regard to different bio-behavioral surveillance. When compared the total estimated HIV incidence cases with that of the total reported cases of HIV incidence in 2007 from the monthly reports of NCASC, relatively high difference was found which is shown below in figure 7.

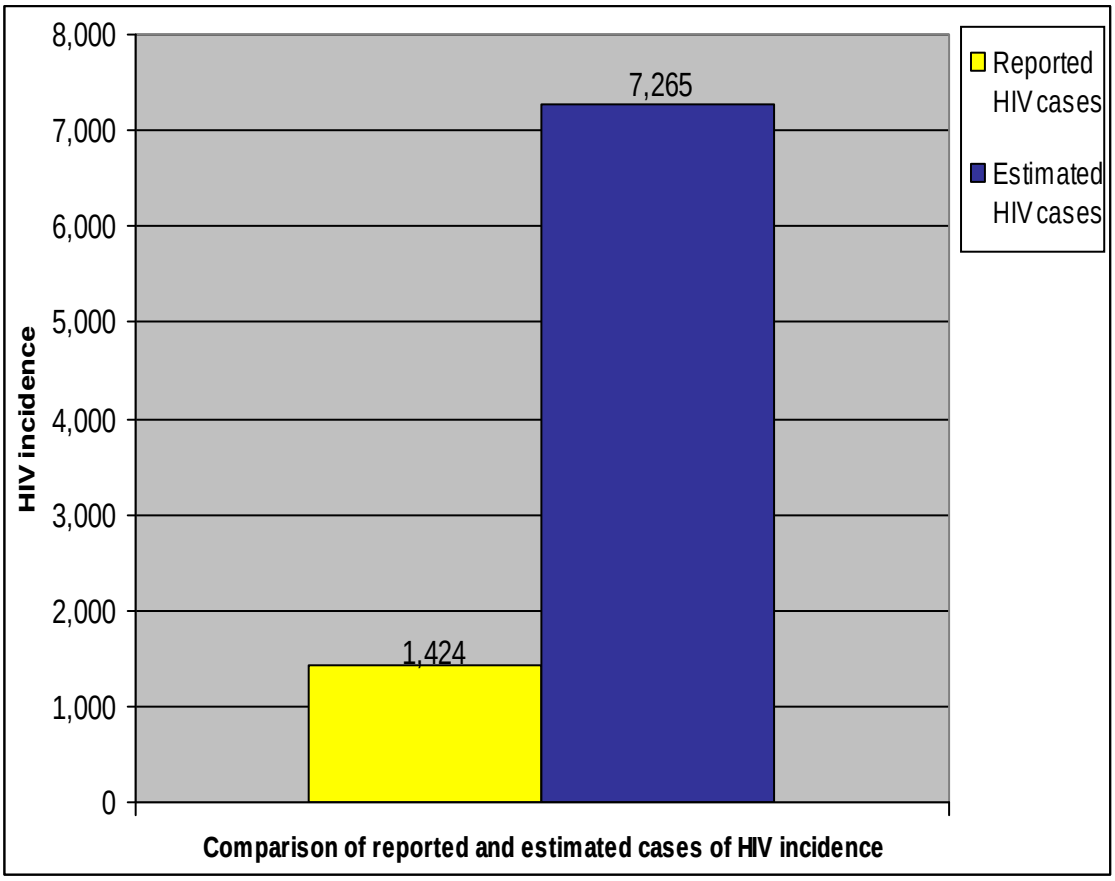


Figure 7: Comparison of reported and estimated cases of HIV incidence of year 2007

CHAPTER – VI

6. DISCUSSION AND CONCLUSION

6.1 Discussion

This dissertation work has been conducted with an attempt to estimate the HIV incidence in Nepal by mode of transmission, which at present has traversed into concentrated epidemic from low-level epidemic in certain specific sub-populations. Ever since, after the first reporting of AIDS in 1981, HIV has reached pandemic proportions resulting into the erosion of improvements in life expectancy. HIV epidemic, a global issue, has emerged as a formidable challenge to public health and development.

The number of people living with HIV continues to grow, as does the number of deaths due to AIDS, though promising developments have been seen in recent years in global efforts to address the AIDS epidemic including increased access to effective treatment and prevention efforts and programmes. However the qualitative interpretation of the severity and implications of the pandemic has altered little in 2007 which is based in the advances in the methodology of estimates applied to an expanded range of country data that resulted in substantial changes in estimates of numbers of persons living with HIV worldwide.

HIV and AIDS surveillance data are presented regularly in the form of monthly report by NCASC. However, surveillance data understate the magnitude of the HIV epidemic because such data are subject to reporting delays, underreporting and changing patterns in HIV testing behaviors (who comes forward for testing); surveillance data also do not include individuals who remain untested and undiagnosed. Since HIV is a chronic infection with a long incubation period, many newly infected persons may only be diagnosed in the years after infection. Consequently, the number of new HIV positive tests reported in a given year does not estimate the new HIV infections that occurred in that year because many will have been infected in earlier years. Since surveillance data can only describe the diagnosed portion of the epidemic, modelling and additional

sources of information are required to describe the epidemic among both diagnosed and undiagnosed individuals. The method used here is very essential to estimate HIV incidence at the national level.

For the prevention, treatment and care, special commitments have been made to combat the HIV/AIDS epidemic at regional and national level by different countries and so does Nepal. Beside this, a high amount of budget has been allocated for HIV/AIDS every year. For prioritizing the mobilization of the resource in the correct way and to reduce the further exacerbation of HIV epidemic, it is important to note the transmission patterns that have been changing over time but not the strategies to prevent it. Beside this, most of the countries are targeted to the types of epidemic of HIV/AIDS rather than various mode of transmission taking place in their country. A careful analysis of the distribution of new infections, modes of transmission and the groups at highest risk of becoming infected with HIV in a particular country are to be considered for better planning of strategies and prevention efforts leading to the mobilization of the costed programmes in the right track. Various behavioral factors like frequency of high-risk sex and needle sharing, the proportion of the population engaged in high-risk behaviors, the mix of sex partners and the level of other STIs determine whether HIV will spread once introduced to a population. Here, in this estimation work, one of the most recent epidemiological tools has been taken into consideration and work with all those above mentioned factors.

Spreadsheet, a recent and new tool, has been using in most countries at present. It has been used in countries with low-level, concentrated as well as in countries with generalized epidemic. Spreadsheet is a simple tool endeavored for appraisal of incidence in coming years providing information about the planning of effective appropriately targeted, country specific intervention programmes. It allows the user identify those risk groups among whom most of the new HIV infections will occur and the relative magnitude of the incident infections between the different risk groups, which in turn will help countries to focus intervention strategies and to explore current coverage of interventions. The risk groups used in this study was as according to the

categorization present in the model. And, with these different categories all the population of the country are included directly or indirectly one or in the other way.

The epidemic in Nepal has evolved through different stages overtime. The epidemic has already entered into concentrated epidemic at present. As with virtually all other countries in Asia, the first cases of AIDS were detected during the late 1980s and early 1990s. The first HIV infection in Nepal was identified in 1988 (NDHS, 2001). During the early 1990s, HIV seroprevalence surveys detected HIV infections among STI patients and FSWs throughout the most regions of Nepal. As a result, there is great public health concern that extensive spread of HIV, similar to that documented in several neighboring countries (Cambodia, Myanmar, Thailand and parts of India) might occur. Injecting drug users in Nepal were initially believed to share injection equipment in relatively small and isolated networks. However, since mid-1990s, an explosive increase in HIV infection (infecting about one-half of all IDU throughout the country) has occurred (MAP, 2001). Nepal has also a unique situation with regard to number and mobility of FSW and young males who work in India. Large numbers of young Nepalese girls are recruited as FSW to Indian cities, and large numbers of young Nepalese males working in India frequently visit FSW there and within Nepal. Thus, in addition to the increasing number of HIV infections occurring among persons with high-risk HIV-risk behaviors in Nepal, there are also increasing numbers of Nepalese FSW and young male Nepalese workers who have been infected with HIV in India, and who have returned or will be returning to Nepal (STC, 2003).

As according to present model, the general-low risk heterosexual population accounted for 26.93% of all new infections in 2007 although the incidence rate in population was low (23 per 100,000 per year). The most striking estimate was found among MSM which accounted for a large proportion of new infections (17.33%) while sex workers, clients, and the partners of clients of sex workers explained a further 33.5%. IDUs and their partners accounted for a total of 7.16% of new infections. The incidence among IDUs was estimated to be 1,816 per 100,000 per year while in partners of IDUs, it was found to be 2,704 per 100,000 per year though incidence in these groups were just one-

half than that of IDUs. Besides this, the partners of clients accounted for 20.48% of new infection while those of sex workers and their clients accounted for 9.89% and 3.13% respectively. But the incidence rate was found to be 2,378, 376 and 35 per 100,000 per year of SW, partners of clients and clients respectively. Here, IDUS and clients of FSWs seem to play as the major bridging population between the high-risk group and the low risk population. CHS, with incidence percent 7.53%, is another important group to be considered for the transmission of HIV to their partners whose percent incidence was found to be 6.24%.

Regarding all these various sub-populations what it can be considered that the predominant mode of transmission of HIV infectionis heterosexual contact (77.5%) where FSWs acts as the main core group of risk factor of HIV/AIDS disease and transmitting it to the large numbers of individuals i.e. their partners or clients. Sex workers and their partners have played an important role in HIV epidemics of many countries across the world where heterosexual transmission is the main mode of transmission (Ghys *et al.*, 2001). FSWs are at high rise for infection with HIV and contribute disproportionately to the transmission of HIV due to their large number of their sexual partners.

In about two-thirds of all countries in the world, HIV prevalence attributable to heterosexual transmission is less than one infection for every thousand adolescents and adults 15-49 years of age. In almost all countries of South Africa, several regions in Caribbean region, and few countries of South and Southeast Asia, HIV prevalence in heterosexual population has been found in a range of 1-2% to over 35% (WHO, 2001). Also, according to NCASC, the predominant mode of transmission in Nepal is through heterosexual transmission has been documented in many studies which is also indicated by the presently used spreadsheet model. The HIV epidemic in Nepal has been appeared to be found beyond vulnerable groups to the general population. The model also confirms that sex workers and their clients are extremely vulnerable groups, not only for acquisition of HIV, but also for the transmission of STI infections and HIV.

As for the MSM, which is thought to be in increasing range of HIV prevalence, appears to be in much more higher proportion of new HIV infections after heterosexual transmission and the sub-population partners of clients. At present, MSM in Nepal are emerging as a group at risk of contracting HIV and other STIs, and are likely to bridge the infection to other population. In one of the study conducted by FHI in 2001 among MSM was found that there was a high prevalence of unprotected anal sex and frequent changes in male partners. It was also found that there was a low level of awareness of HIV/AIDS/STIs, safer sex and condom use. These factors may be the reason that resulted into high HIV incidence among MSM. Regarding the HIV incidence in IDUs, was estimated to be 4.91%. They also play a major role as a conduit to transmit HIV infections to their partners through their needle sharing behavior as well as other high-risk sexual activity. CHS is also another risk groups that contributes in the transmission of HIV to their partners. According to the 2006 NDHS reports, CHS has been found concentrated in some population sub groups and found highly in never married men. One of the survey study found that 3% of men aged 15-49 reported having had two or more sexual partners and, also in the same age group, 6% of men reported having had high-risk sex. This group may also act as a bridging group between high-risk and low risk population.

Beside all these risk groups, it was observed that the percentage of total incidence in partners of different risk groups was found to be three times more than that of the female sex workers. Similar result was reported by Subedi (in 2006). In his study, looking at the trend of HIV infections among women, it was seen that the ratio of housewives is gradually increasing and about $3/4^{th}$ of the total infected women were housewives. Moreover, the data from NCASC have also indicated the transition of HIV from “high-risk behavior group” to “low-risk behavior group” which signals the necessity to address aggressively the issue. Nepal has committed to the United Nations Millennium Development Goal (MDG). By this Nepal will have to halt and reverse the HIV infection by 2015. However, from result, it seems that HIV infection has already clutched a “silent” population.

The different adult risk behavior groups presented in this model shows strong and active networks between these different risk groups and their role in transmitting the disease within them and also to the general population. The model also presents how the changes in patterns of risk behavior of one risk group are interconnected with the change in incidence in other groups of adult risk behavior. Also, it shows how the protected acts in these risk population plays role in occurrence of future incidence.

As per the estimates from incidence per 100,000, risk groups like IDU, FSW and their clients, and MSM are the major risk groups to be taken into consideration first that are to be prevented for transmission of HIV infection to low risk groups. Prevention strategies must therefore be adapted to the changing patterns of risk behavior and situations involving all the above mentioned risk groups. More attention should be given to prevention strategies aimed at reducing HIV transmission between regular partners one of whom may have been exposed to HIV through unprotected sexual activity, while sustaining existing prevention efforts targeting sex work. Prevention programmes must be implemented as per the high incidence rate in specific risk groups but focusing to all those risk groups with high percent of incidence as well. Moreover, through out the reviews of different IBBS conducted, knowledge on prevention of HIV infection in people was high but the safe practice was low. It is an essential point to consider and implement such programmes convincing different sub-population to adopt safe act.

The Spreadsheet model does not take into account the distribution of all behaviors within the risk groups, the overlapping risk behaviors, the patterns of mixing demographic, social, geographic, and economic variables and the influence of specific sexually transmitted infections, and therefore cannot be used to generate the accurate predictions. However it should be pointed out that most countries lack the detailed data that accurate predictions require. Besides this, though it does not provide exact predictions, it gives the information and the way for effective predictions, it gives the information and the way for effective planning and intervention programmes which implies the fact that estimation is utmost need prior to the implementation of planning

procedure. Countries with generalized epidemic may have conducted Demographic and Health Surveys (DHS) that can provide useful information on sexual behavior in the general population but data on groups like MSM, SWs, IDUs that are particularly vulnerable, may often be limited. While countries with low-level or concentrated epidemics, information may be available from studies targeting specific groups with higher behavioral risk, lacking or less information on behavior among general population. Beside this, HIV epidemic is initially limited to vulnerable population such as IDUs, SWs and their clients, and MSM in countries with low-level or concentrated epidemics (UNAIDS and ADB, 2004). These groups are often hard to reach due to local laws and social stigma and interventions required to reach them will differ. However, as the epidemic progresses, the virus will spread to the sexual partners of vulnerable groups and the size and populations' composition to be targeted for effective intervention and care will change, as will the resources that are needed to control the epidemic (UNAIDS and ADB, 2004). The spreadsheet model presented here can help countries to assess the change in epidemic to prioritize target groups for interventions and to plan more effectively the resources required to implement these interventions, which will be much more helpful to control and prevent the growing epidemic in countries. So, government should have strong effort to strengthen the implementation of the national HIV/AIDS prevention and control strategies in technical section, STD section and prevention section including bio-behavioral surveillance systems.

In addition to the limited availability of data, the quality of data collection as well as measurement procedures are another important factor that is to be taken into consideration. These factors can affect the accuracy of the estimates. So, when undergoing and assessing the studies of behavior, attention should be paid to the measurement of key parameters and to the quality of data collection. Beside this, care should be taken when extrapolating information from different studies conducted in different specific parts of the country for example, number of FSWs found in the highway routes may be different from other parts of the country, IDUs' number in the borderline may be different from other region of the country. Also, presence of high level of risk behavior doesn't guarantee immediate growth though the potential for

growth still exists. Frequency of risk behavior and efficiency of the mode of transmission are also important factors (MAP, 2001).

As according to the reported cases by NCASC, a total of 1424 cases were found in year 2007 which is much lower than as that estimated by spreadsheet that may be due to the lack of sufficient surveillance systems and lack of access to quality voluntary counseling and testing services coupled with ART treatment. Besides this, the total incidence is only of ten months published by NCASC in 2007. This indicates the gross underestimation and is imperative to the real situation of HIV incidence in Nepal. The figure of estimation will be much more credible as it is based on mode of transmission and help in correct intervention programmes which, otherwise may lead to inapt interventions.

So, government should be more forward towards conducting different bio-behavioral surveillance in different parts of the country regularly so as to better implement the intervention programmes based on the necessity leading to the formulation of better prevention, control and treatment programmes. Therefore, there is an appeal of urgent need for improved biological and behavioral surveillance systems so as to provide more reliable data for planning effective interventions using a simple and effective tool like Spreadsheet.

Given the limited availability of relevant data, the model presented here provides a simple tool for estimating who are more likely to be infected with HIV in the coming year and the most significant point to be understood is that what behavior put them at risk of infection, which will provide governments and national AIDS programmes with the information needed to plan and focus intervention and prevention efforts so as to effectively address the epidemics in the country. However, in a developing country like Nepal, sustaining success in prevention efforts is a challenge.

6.2 Conclusion

From estimation of this study, a total of 7,265 incidence cases were found among the total adult population in 2007 which was 5 times higher than that of reported HIV incidence.

Based on the behavioral patterns on different risk groups, the highest incidence of HIV infection was found to be transmitted through heterosexual contact (77.5%) followed by the significant proportion of new infections by MSM (17.33%), while a small but significant number were related to IDUs (4.91%).

Of the heterosexual contact, the highest HIV infection incidence was predominant among general, low-risk heterosexual sex (26.93%) though low rate of incidence followed by partners of clients (20.48%) and then by FSWs (9.89%).

CHAPTER – VII

7. SUMMARY AND RECOMMENDATION

7.1 Summary

In this study, the number of new HIV infections was estimated using an epidemiological tool, spreadsheet that is used in most countries either with concentrated, low-level or generalized epidemic. This tool helps to predict the number of new infections in order to develop efficient programs tailored according to the importance of the different modes of exposure. A total incidence of 7,265 HIV infections in Nepal was found to occur in 2007, where as the HIV incidence rate was 48 cases per 100,000 per year. The low risk heterosexual sex sub-populations were the predominant group with the highest incidence (26.93%). This is an important finding that indicates the probability of transmission of HIV to general population from high-risk groups. The other risk groups that significantly contributes in HIV incidence were Partners of clients (20.48%), followed by MSM (17.33%) and finally by FSWs (9.89%). FSWs play as a core group for the explosion of HIV/AIDS to different population via different bridging groups. MSM, another high-risk and the least studied sub-group that suggests for a need for the immediate intervention as they contribute sizeable number of individuals in HIV incidence. Though the incidence in some groups like IDUs (4.91%), partners of IDUs (2.25%) is relatively low, the incidence rate is high indicating a need to initiate the sensible focus of interventions prioritizing the relative magnitude of mode of transmission. The subgroup like CHS (7.53%) was found to play the role in transmission of HIV infection to general population. Low percent of incidence of HIV infection is found to be contributed by medical injection and blood transfusion. The reported cases of HIV incidence by NCASC were found to be grossly understated when compared with that of estimated HIV cases.

Recommendation

- The continual and qualitative surveillance systems in different sub-populations should be carried on.
- Due to the epidemiological dynamics of HIV/AIDS which progresses at different rates and at different levels of intensity within different exposure groups, HIV should be projected for only short term as the estimation result may be misguided.
- Clients being the bridging group to transmit HIV infection from FSW to partners of clients, they should be focused for the intervention. Equal emphasis should be given for the intervention among FSW and partners of clients.
- The highest HIV incidence is among low-risk heterosexual sex. So the groups and the mode of transmission that put them at risk through heterosexual sex should be uncovered so as to make sensible focus of intervention.
- An extensive survey in MSM is important that suggests immediate intervention as they contribute sizeable number of individuals for HIV incidence.
- Extensive surveillance of STI should be carried out as it is interrelated with HIV infection.

REFERENCES

Abbas SS (2006) Knowledge of HIV/AIDS and perception of self risk among high- risk groups and its correlation with their risky behaviours: a study in two major cities of Pakistan. AIDS-XVI International AIDS Conference, Toronto Abstract CDC1836

ADRA and CREHPA (2005) Participatory evaluation of Nepal voluntary counseling testing linkage and referral project of ADRA Nepal. Adventist Development Relief Agency/ Center for Research Environment Health and Population Activities/ Family Health International, Kathmandu

AIDS Education and Prevention (2004) HIV surveillance, prevention, intervention and treatment in Asia. The Guilford press, New York, 16:3

Akwara PA, Fosu GB, Govindasamy P, Alayon S and Hyslop A (2005) An in-depth analysis of HIV prevalence in Ghana: further analysis of demographic and health surveys data. Calverton, Maryland, USA: ORC Macro

Anderson BA and Phillips HE (2006) Adult mortality (age 15–64) based on death notification data in South Africa: 1997–2004. Statistics South Africa Report No. 03–09–05

Anderson RM and Garnett GP (2000) Mathematical models of the transmission and the control of sexually transmitted diseases. Sexually Transmitted Diseases, 27:636-643

Bello GA, Chipeta J and Aberle-Grasse J (2006) Assessment of trends in biological and behavioural surveillance data: is there any evidence of declining HIV prevalence or incidence in Malawi? Sexually Transmitted Infections, 82:i9–i13

Bhatt P, Thapa S, Neupane S, Beaker J and Friedman M (1993) Commercial sex workers in Kathmandu valley: profile and prevalence of sexually transmitted diseases. Journal of Nepal Medical Association, 32:191-203

Boerma JT, Ghys PD and Walker N (2003) Estimates of HIV-1 prevalence from national population-based surveys as a new gold standard. Lancet, 362:1929–1931

Bradshaw D (2004) Unabated rise in number of adult deaths in South Africa. South African Medical Journal, 94:278–279

Buckingham R, Moraros J, Bird Y, Meister and Webb N (2005) Factors associated with condom use among brothel-based female sex workers in Thailand. AIDS Care, 17:640–647

Cheluget B, Marum L, Stover J, Baltazar G, Orege P and Ibrahim M (2006) Evidence for population-level declines in adult HIV prevalence in Kenya. Sexually Transmitted Infections, 82:i21-i26

Chin J, Bennet A and Mills S (1998) Primary determinants of HIV prevalence in Asia Pacific countries. AIDS, 12:S87-S91

Choi KH, Ning Z, Gregorich S and Pan Q (2006) Social and sexual network characteristics are associated with HIV risk among men who have sex with men (MSM) in Shanghai, China. AIDS-XVI International AIDS Conference, Toronto Abstract TUPE0470

CREHPA and FHI (2002) A situational assessment of sex workers and intravenous drug users in Kathmandu valley, a focused ethnographic study. Center for Research Environment Health and Population Activities/ Family Health International, Kathmandu

CREHPA/BDS/SACTS/FHI (2004) Integrated behavioral and biological survey among MSM population in Kathmandu valley. Center for Research Environment

Health and Population Activities/ Blue Diamond Society/ STD/AIDS Counseling and Testing Services/ Family Health International, Kathmandu, pp 58

CREHPA/FHI (2005) Size estimation and update of female sex workers population along east-west and north-south highways and major towns of Nepal. Center for Research Environment Health and Population Activities/Family Health International, Kathmandu

Crofts N (1998) Injecting drug use and HIV infection in Asia. AIDS, 12:S87-S91

Dandona R (2006) Demography and sex work characteristics of female sex workers in India. BMC International Health and Human Rights, 6:5

de Vincenzi I and Mertens T (1994) Male circumcision: a role in HIV prevention? AIDS, 8:153

Department of Health Philippines (2005) Consensus report on HIV and AIDS epidemiology 2005. Department of Health Philippines, Manila

Department of Health South Africa (2006) National HIV and syphilis prevalence survey South Africa 2005. Department of Health South Africa Fedlife Building, corner church and prinsloo street, Pretoria

Dewing S (2006) Review of injection drug use in six African countries: Egypt, Kenya, Mauritius, Nigeria, South Africa and Tanzania. Drugs: education, prevention and policy, 13:121–137

Dixon P (1999) Toward a public health response for preventing the spread of HIV amongst IDUs within Nepal and the development of a treatment rehabilitation and prevention program in Pokhara. International journal of drug policy, 10:375-383

Dorrington RE, Bourne D, Bradshaw D, Laubscher R and Timus IM (2001) The impact of HIV/AIDS on adult mortality in South Africa. Medical Research Council, Cape Town, Available at http://www.mrc.ac.za/bod/

Emmanuel F, Archibald C and Altaf A (2006) What drives the HIV epidemic among injecting drug users in Pakistan: A risk factor analysis. AIDS-XVI International AIDS Conference, Toronto Abstract MOPE0524

Furber A, Newell JN and Lubben MN (2002) A Systematic review of current knowledge of HIV epidemiology and of sexual Behavior in Nepal. Tropical Medicine and International Health, 7:140-148

Ghys PD, Walker N and Garnett GP (2006) Improving analysis of the size and dynamics of AIDS epidemics. Sexually Transmitted infections, 82:iii1-iii2

Ghys PD, Brown T and Grassly NC (2004) The UNAIDS estimation and projection package: a software package to estimate and project national HIV epidemics. Sexually Transmitted Infections, 80:i5–i9

Ghys PD, Jenkins C and Pisani E (2001) HIV surveillance among FSWs. AIDS, 15:S33-S40

Gomes do Espirato Santo ME and Etheredge GD (2005) Male clients of brothel prostitutes as a bridge for HIV infection between high risk groups and low risk groups of women in Senegal. Sexually Transmitted Infections, 81:342-344

Gorbach PM, Sopheab H, Chhorvann C, Weiss RE and Vun MC (2006) Changing behaviors and patterns among cambodian sex workers: 1997–2003. Journal of Acquired Immune Deficiency Syndromes, 42:242-247

Gorbach PM, Sopheab H, Phalla T, Leng HB, Mills S, Bennet A and Holmes KK (2000) Sexual bridging by cambodian men. Sexually Transmitted Diseases, 27:320-326

Gouws E, White P, Stover J and Brown T (2006) Short term estimates of adult HIV incidence by mode of transmission: Kenya and Thailand as examples. Sexually Transmitted Infections, 82:51-55

Goyle HD and Hill GL (2001) Global impact of HIV and AIDS. Clinical Microbiology Reviews, 14:327-335

Gray RH, Wawer MJ, Brookmeyer R, Sewankambo NK, Serwadda D, Wabwire-Mangen F, Lutalo T, Li X, vanCott T and Quinn TC (2001) Probability of HIV-1 transmission per coital act in monogamous heterosexual, HIV-1-discordant couples in Rakai, Uganda. Lancet, 357:1149-1153

Greenwood D, Slack R and Peutherer JF (2006) Medical microbiology, a guide to microbial infections: pathogenesis, immunity, laboratory diagnosis and control, 16th edition, Elsevier, New Delhi, India, pp 527-528

Hallett TB and Garnett GP (2006) Has global HIV peaked? Lancet, 368:116–117

Halperin DT and Bailey RC (1999) Male circumcision and HIV infection: 10 years and counting. Lancet, 354:1813-1815

Hesketh T (2006) HIV and syphilis in migrant workers in eastern China. Sexually Transmitted Infections, 82:11–14

Hien NT, Long NT and Huan TQ (2004) HIV/AIDS epidemics in Vietnam: evolution and responses. AIDS Education and Prevention, 16:137–154

Huang M and Hussein H (2004) The HIV/AIDS epidemic country paper: Malaysia. AIDS Education and Prevention, 16:101–109

Joshi AB, Banjara M R, Karki Y B, Subedi B K and Sharma M (2004) Status and trends of HIV/AIDS epidemic in Nepal. Journal of Nepal Medical Association, 43:272-276

Karki BB (2000) Rapid assessment among drug users in Nepal. AIDS Watch, 5:3-5

Kayirangwa E, Hanson J, Munyakazi L and Kabeja L (2006) Current trends in Rwanda's HIV/AIDS epidemic. Sexually Transmitted Infections, 82:i27–i31

KFF (2006) HIV/AIDS policy fact sheet: the global AIDS epidemic**.** The Henry J. Kaiser Family Foundation: 2400 Sand Hill Road, Washington DC

Kirungi WL, Musincguzi J, Madraa, Mulumba N, Callejja, Ghys P and Bessinger R (2006) Trends in antenatal HIV prevalence in urban Uganda associated with uptake of preventive sexual behaviour. Sexually Transmitted Infections, 82:i36–i41

Kumar R, Jha P, Arora P, Mony P, Bhatia P, Millson P, Dhingra N, Bhattacharya M, Remis R and Nagelkerke N (2006) Trends in HIV-1 in young adults in south India from 2000 to 2004: a prevalence study. Lancet, 367:1164–1172

Liu H, Zang L, Shao Y, Zang L and Wang N (2006) HIV prevalence and the risk behaviors among MSM in Beijing, China. AIDS-XVI International AIDS Conference, Toronto Abstract CDC1698

Longfield K, Zhiyong Z, Christian J, Inkochasan M, Punyacharoensin N, Apichaisiri T, Nauman B and Pritchard E (2006) Trends in needle-sharing among intravenous drug users in China, Thailand and Viet Nam AIDS-XVI International AIDS Conference, Toronto Abstract THPE0730

Lv F, Wang N, Wu Z, Wang L, Zang W, Pisani E, Wang Y and Poundstone K (2006) HIV/AIDS epidemic in China: increasing or decreasing? AIDS-XVI International AIDS Conference, Toronto Abstract MOPE0462

Lyerla R, Gouws E, Garcia-Calleja J M and Zaniewski E (2006) The 2005 workbook: an improved tool for estimating HIV prevalence in countries with low level and concentrated epidemics. Sexually Transmitted Infections, 82:41-44

Ma X**,** Zhang Q, Zhao J, Chen SY, Raymond HF, Sun W, Du H, He X, Li Y, Xu M, Zhang Q, Guo F, Zhao Y, Xia D, Liu G, Guo Y, Lu H, Pang X and Mcfarland

W (2006) Possible rise in HIV prevalence among men who have sex with men (MSM) in Beijing. AIDS-XVI International AIDS Conference, Toronto Abstract MOPE0526

Mahomva A, Greby S, Dube S, Mugurungi O, Hargrove J, Rosen D, Dehne KL, Gregson S, Louis M and Hader S (2006) HIV prevalence and trends from data in Zimbabwe, 1997–2004. Sexually Transmitted Infections, 82:i42-i47

MAP (2001) The status and trends of HIV/AIDS/STI epidemics in Asia and the Pacific. Provisional Report Melbourne, Australia

MAP (2005a) Drug injection and HIV/AIDS in Asia. Monitoring the AIDS Pandemic Network (MAP) Report 2005, Geneva

MAP (2005b) Sex work and HIV/AIDS in Asia. Monitoring the AIDS Pandemic Network (MAP) Report 2005, Geneva

Mateo R, Sarol JN and Poblete R (2004) HIV/AIDS in the Philippines. AIDS Education and Prevention, 16:43–52

McCurdy SA, Williams ML, Kilonzo GP, Ross MW and Leshabari MT (2005a) Heroin and HIV risk in Dar el Salaam, Tanzania: youth hangouts, magheto and injecting practices. AIDS Care, 17:S65-S76

McCurdy SA, Williams ML, Kilonzo GP, Ross MW and Leshabari MT (2005b) New injecting practice increases HIV risk among drug users in Tanzania. British Medical Journal, 331:778

MoH and Population Malawi (2005) HIV and syphilis sero survey and national HIV prevalence estimates report. Ministry of Health and Population Malawi, Lilongwe

MoH Botswana (2006) 2005 Botswana second generation HIV/AIDS surveillance: Technical report. Ministry of Health Botswana, Gaborone, 26-59

MoH China, UNAIDS, WHO (2006) 2005 update on the HIV/AIDS epidemic and response in China. Ministry of Health China, UNAIDS, WHO, Beijing, pp 6-24

MoH Eritrea (2006) Results from the 2005 round of HIV sentinel surveillance in pregnant women. Ministry of Health Eritrea, Asmara

MoH Indonesia (2006) HIV/AIDS surveillance report. Ministry of Health Indonesia, Jakarta

MoH Malaysia and WHO (2004) Consensus report on HIV and AIDS—epidemiology in 2004: Malaysia. Ministry of Health and WHO, Kuala Lumpur

MoH Uganda and ORC Macro (2006) Uganda HIV/AIDS Serobehavioral Survey 2004/2005. MoH Uganda and ORC Macro, Kampala and Calverton

MoH Viet Nam (2005) HIV/AIDS estimates and projections 2005–2010. General Department of Preventive Medicine and HIV/AIDS Control, Ministry of Health Vietnam, Hanoi

MoH Zambia (2005) Zambia Antenatal Clinic Sentinel Surveillance Report, 1994–2004. Ministry of Health Zambia, Lusaka

NACO (2005) An overview of the spread and prevalence of HIV/AIDS in India. National AIDS Control Organization (NACO), New Delhi, Available at http://www.nacoonline.org/facts_overview.htm

National AIDS Commission Malawi (2005) HIV and syphilis sero-survey and national HIV prevalence estimates report. National AIDS Commission Malawi

National AIDS Programme Myanmar (2006) Sentinel survey data for March- April 2006. National AIDS Programme Myanmar, Yangon

National Center for HIV/AIDS, Dermatology and STD (2004) HIV sentinel surveillance (HSS) 2003: results, trends and estimates. National Center for HIV/AIDS, Dermatology and STD (NCHADS), pp 44

National Statistical Office and ORC Macro (2005) Malawi demographic and health survey 2004. National Statistical Office and ORC Macro, Calverton

NCASC (1992) Cumulative HIV/AIDS situation of Nepal. Monthly report on cumulative HIV/AIDS statistics, National Centre for AIDS and STD Control, Kathmandu

NCASC (1999) Cumulative HIV/AIDS Situation of Nepal. Monthly report on cumulative HIV/AIDS statistics, Ministry of Health and Population, National Centre for AIDS and STD Control, Kathmandu

NCASC (2001) Draft report of HIV sentinel survey conducted by National Centre for AIDS and STD Control. Kathmandu

NCASC (2002) National HIV/AIDS strategy 2002-2006. Ministry of Health, National Centre for AIDS and STD Control, Kathmandu, Nepal

NCASC (2003) National estimates of adult HIV infections. National Centre for AIDS and STD Control, Kathmandu

NCASC (2005) National estimates of adult HIV infections. National Centre for AIDS and STD Control, Katmandu

NCASC and MoH (2007) Reported HIV/AIDS Cases of March 2007. National Centre for AIDS and STD Control and Ministry of Health, Kathmandu

NCASC/UoH/CREHPA (2001) Behavioral sentinel surveillance of sex workers in Pokhara. National Centre for AIDS and STD Control/University of Heidelberg/ Center for Research Environment Health and Population Activities/Family Health International, Kathmandu

NDHS (2001) Nepal 2001 demographic and health survey key findings. Department of Health Services, Ministry of Health, New ERA, ORC Macro, USAID, pp 14

New ERA (2000a) Behavioral Surveillance in the Highway Routes of Nepal: Round 2. New Era and Family Health International, Kathmandu

New ERA and FHI (2002) Rapid qualitative study of female sex workers in Pokhara. A Focused Ethnographic Study. New ERA/ Family Health International, Kathmandu

New ERA/SACTS/FHI (2000b) STD and HIV prevalence among female sex workers and truckers on highway routes in the Terai, Nepal. New ERA/ STD/AIDS Counseling and Testing Services/ Family Health International, Kathmandu

New ERA/SACTS/FHI (2002a) HIV/STI Prevalence and Risk Factors among Migrant and Non-Migrant Males of Achham District in Far-western Nepal. New ERA/ STD/AIDS Counseling and Testing Services/ Family Health International, Kathmandu

New ERA/SACTS/FHI (2002b) Behavioral and seroprevalence survey among injecting drug users in the Kathmandu valley. New ERA/ STD/AIDS Counseling and Testing Services/ Family Health International, Kathmandu

New ERA/SACTS/FHI (2003a) Behavioral and seroprevalence survey among male IDUs in Eastern Nepal. New ERA/ STD/AIDS Counseling and Testing Services/ Family Health International, Kathmandu

New ERA/SACTS/FHI (2003b) Behavioral and seroprevalence survey among IDUs in Pokhara valley. New ERA/ STD/AIDS Counseling and Testing Services/ Family Health International, Kathmandu

New ERA/SACTS/FHI (2004a) An integrated bio-behavioral survey among female sex workers and behavioral and seroprevalence survey among clients in Pokhara valley. New ERA/ STD/AIDS Counseling and Testing Services/ Family Health International, Kathmandu

New ERA/SACTS/FHI (2004b) STI/HIV prevalence and risk behavioral study among FSWs and Truckers along the Terai Highway routes covering 22 districts in Nepal. New ERA/ STD/AIDS Counseling and Testing Services/ Family Health International, Kathmandu

New ERA/SACTS/FHI (2005a) An integrated bio-behavioral survey among Injecting Drug Users (IDUs) in Kathmandu valley. New ERA/ STD/AIDS Counseling and Testing Services/ Family Health International, Kathmandu

New ERA/SACTS/FHI (2005b) An integrated bio-behavioral survey among Injectimg drug users in Pokhara. New ERA/ STD/AIDS Counseling and Testing Services/ Family Health International, Kathmandu

NRCS (2005) Annual progress report. Blood transfusion service, Central blood bank, Nepal Red Cross Society, Kathmandu

NRCS (2006/07) Annual progress report. Blood transfusion service, Central blood bank, Nepal Red Cross Society, Kathmandu

Padian NS, Shiboski S, Glass S and Vittinghoff E (1997) Heterosexual transmission of HIV in northern California: results from ten- year study. American Journal of Epidemiology, 146:350-357

Pant S (2001) Report on the outreach training workshop for men to men sex in Nepal. Blue Diamond Society, Kathmandu

Phal S (2006) Low rate of known HIV status among pregnant women in Cambodia AIDS-XVI International AIDS Conference, Toronto Abstract CDD1376

Pike L (1999) Innocence, danger and desire: representations of sex workers in Nepal. Reproductions, 2:18

Pisani E (2003) Sexual behavior among injection drug users in three indonesian cities carries a high potential for HIV spread to noninjectors. Journal of Acquired Immune Deficiency Syndromes, 34:403–406

Pisani E (2006) Estimating the number of drug injectors in Indonesia. International Journal of Drug Policy, 17:35–40

Plipat T, Teeraratkul A, Chalermchan W, Areechokchai D, Sriburi A, Pobkeeree V, Danyothapolchai J, Parekh B, Fox K, Thanprasertsuk SS, Tappero J and Ungchusak K (2006) National HIV incidence surveillance using BED capture immunoassay among pregnant women. AIDS-XVI International AIDS Conference, Toronto Abstract CDC0356

Plummer FA and Simonsen JN (1991) Cofactors in male female transmission of HIV type 1. Journal of Infectious Disease, 163:233-239

PRB (2005) China confronts HIV/AIDS. Population Reference Bureau

Price RW (1996) Neurological complications of HIV infection. Lancet 348: 445-452

Puri M and Busza J (2004) In forests and factories: sexual behavior among young migrant workers in Nepal. Culture Health and Sexuality, 6:145-158

Ramon JS, Alvarenga M, Walker N, Garcia-Calleja JM and Zacarias F (2002) Estimating HIV/AIDS prevalence in countries with low-level and concentrated epidemics: the example of Honduras. AIDS, 16:S18–S22

Rao CN and Srivenkatatamana T (2001) Projection of HIV infections in India: an alternative to back calculation. Current Science, 81:1302

SACTS and FHI (2001) Kathmandu female sex worker HIV/STI prevalence study. STD/AIDS Counseling and Testing Services/ Family Health International, Kathmandu

Schupbach J (2003) Human Immunodeficiency Viruses. In Murray PR, Baron EJ, Jorgensen JH, Pfaller M, Yolken RH (eds) Manual of Clinical Microbiology, 8th edn. Vol 2. ASM Press

Schwartlander B, Stanecki KA, Brown T (1999) Country specific estimates and models of HIV and AIDS: methods and limitations. AIDS, 13:2445-2458

Seddon D (1998) HIV/AIDS in Nepal: the coming crisis. Bulletin of the concerned Asian Scholars, 30:35-45

Shimada K, Fujibe A, Hatogai H, Ota S, Miyachika K, Niimi H, Kashiwazaki M and Kawaguchi K (2006) How to respond to gay/MSM infection in Japan: local governments need help. AIDS-XVI International AIDS Conference, Toronto Abstract CFF0715

Shisana O, Rehle T, Simbayi LC, Parker W, Zuma K, Bhana A, Connolly C, Jooste S and Pollayet V (2005) South african national HIV prevalence, HIV incidence, behaviorand communication survey. HSRC Press, Cape Town

Singh S, Mills E, Honeyman S, Suvedi BK, Pant NP (2005) HIV in Nepal: is the violent conflict fuelling the epidemic? PLoS Medicine, 2:705-708

Soman CR and Mathew A (2006) HIV-1 prevalence in young adults in south India. Lancet, 368:113–114

Somi GR, Matee M, Swai RO, Lyamuya EF, Killewo J, Kwesigabo G, Tulli T, Kabalimu TK, Nganga L, Isingo R and Ndayongeje J (2006) Estimating and projecting HIV prevalence and AIDS deaths in Tanzania using antenatal surveillance data. BMC Public Health, 6:120-126

Sopheab H (2006) HIV-related risk behaviors in Cambodia and effects of mobility. Journal of Acquired Immune Deficiency Syndromes, 41:81–86

STC (2003) HIV/AIDS in the SAARC Region. A publication by SAARC-Canada Regional Project, SAARC Tuberculosis and HIV/AIDS Centre, Bhaktapur, pp 9

STC (2004) HIV/AIDS in the SAARC Region an update. SAARC Tuberculosis and HIV/AIDS Centre, Bhaktapur, pp 4

STC (2006) HIV/AIDS in the SAARC Region an update. SAARC Tuberculosis and HIV/AIDS Centre (STC), Bhaktapur, pp 30-34

Stover J (2004) Projecting the demographic consequences of adult HIV prevalence trends: the spectrum projection package. Sexually Transmitted Infections, 80:i4-i8

Subedi BK (2003) HIV/AIDS in Asia: overcoming the challenge. Journal of Health Management, 5:206-212

Subedi BK (2006) Transition of HIV epidemic in Nepal. Kathmandu Medical University Journal, 4:115-118

Suvedi BK, Gurubacharya VL and Thapa K (1994) Seasonal migration and its relation to HIV transmission in western Nepal. International Conference on AIDS, 10:7-12

The World Bank (2005) AIDS in South Asia: understanding and responding to heterogeneous epidemic. The World Bank, Washington, DC

The World Bank group (2004) Issue brief-South Asia Region Nepal. World Bank, Kathmandu

The World Health Report (2006) Changing history; UN, Declaration of Commitment on HIV/AIDS: Five Years Later. Report No. 06-28416 (E)

Thwe M, Soe AM and Aung T (2005) Behavioural surveillance survey 2003: general population and youth. Ministry of Health, Department of Health, National AIDS Control Programme, Myanmar, pp 13

Tuang NA (2007) Human immunodeficiency virus infection patterns and risk behaviors in different population groups and provinces in Viet Nam. Bulletin of WHO, 85:35-41

UNAIDS (2005) Evidence for HIV decline in Zimbabwe: a comprehensive review of the epidemiological data. UNAIDS, Geneva

UNAIDS (2006c) Report on the global AIDS epidemic. Joint United Nations programmes of HIV/AIDS, Geneva

UNAIDS and ADB (2004) Costing guidelines for HIV/AIDS intervention strategies. Joint United Nations programmes of HIV/AIDS and Asian Development Bank, Geneva, pp 1-24

UNAIDS Reference Group on estimates, modelling and projections (2002) Improved methods and assumptions for estimation of the HIV/AIDS epidemic and its impact: recommendations of the UNAIDS reference group on estimates, modelling and projections. AIDS, 16:W1–W14

UNAIDS Reference Group on estimates, modelling and projections (2005) Modelling the expected short term distribution of incidence of HIV infections by exposure group. UNAIDS, pp 1-13

UNAIDS/NCASC (2004) The HIV/AIDS/STD situation and the national response in Nepal. Joint United Nations programmes of HIV/AIDS, Kathmandu, pp 2-10

UNAIDS/WHO (2004) Case study on estimating HIV infection in a concentrated epidemic: lessons from Indonesia/UNAIDS/WHO working group on HIV/AIDS/STI surveillance. UNAIDS, Geneva, pp 5-8

UNAIDS/WHO (2005) A guided tour of the estimation and projection package to make HIV/AIDS estimates in countries with generalized or concentrated epidemics. WHO, Geneva, pp 1-8

UNAIDS/WHO (2006a) AIDS epidemic update. UNAIDS, Geneva, pp 3-36

UNAIDS/WHO (2006b) Epidemiological fact sheets on HIV/AIDS and STIs. UNAIDS/WHO, Geneva

UNAIDS/WHO (2007) AIDS epidemic update. UNAIDS, Geneva, pp 3-40

Urassa W (2006) Evidence of a substantial decline in prevalence of HIV-1 infection among pregnant women: data from 1995 to 2003 in Dar es Salaam, Tanzania. Scandinavian Journal of Public Health, 34:272–278

USAID (2005) Health profile: Nepal HIV/AIDS. U.S. Agency for International Development, Kathmandu, Available at http://www.usaid.gov/np/

Van Griensven F (2006) HIV prevalence among populations of men who have sex with men—Thailand, 2003 and 2005. Morbidity and Mortality Weekly Report, 55: 844–848

Vivian FG (2004) High HIV prevalence and risk behaviors in men who have sex with men in Chennai, India. Epidemiology and social science, 35:314-319

Wade AS, Kane CT, Diallo PAN, Diop AK, Gueye K, Mboup S, Ndoye I and Lagarde E (2005) HIV infection and sexually transmitted infections among men who have sex with men in Senegal. AIDS, 19:2133–2140

Walker N, Stover J and Stanecki K (2004) The workbook approach to making estimates and projecting future scenarios of HIV/AIDS in countries with low-level and concentrated epidemics. Sexually Transmitted Infections, 80:i10–i13

WHO (2001) HIV/AIDS in Asia and Pacific region. Regional Office for South-East Asia, World Health Organization, pp 79-86

WHO/CDC (2006) Report from the expert consultation on drug-resistant tuberculosis, Johannesburg, 7–8 September. World Health Organization, Geneva, Available at http://www.who.int/tb/kg1/en/index.html

WHO/UNAIDS/CDC (2003) Guidelines for conducting HIV sentinel sero surveys among pregnant women and other groups. Geneva, Switzerland, WHO, UNAIDS, CDC, pp 4-26

WHO-SEARO (2007) HIV/AIDS in south-east Asia region. WHO Regional Office for South-East Asia, New Delhi, pp 2, 16

World Bank (2005) AIDS in South Asia. World Bank, Washington DC

World Health Organization (2005) A technical report: the 2004 first national second generation HIV/AIDS/STI sentinel surveillance survey among antenatal care women attending maternity and child health clinics, tuberculosis and STD patients in Somaliland, pp 28

Xu H, Zhang B, Zeng Y and Li X (2006) HIV epidemic status and behavioral surveillance among MSM in China. AIDS-XVI International AIDS Conference, Toronto Abstract WEAC0304

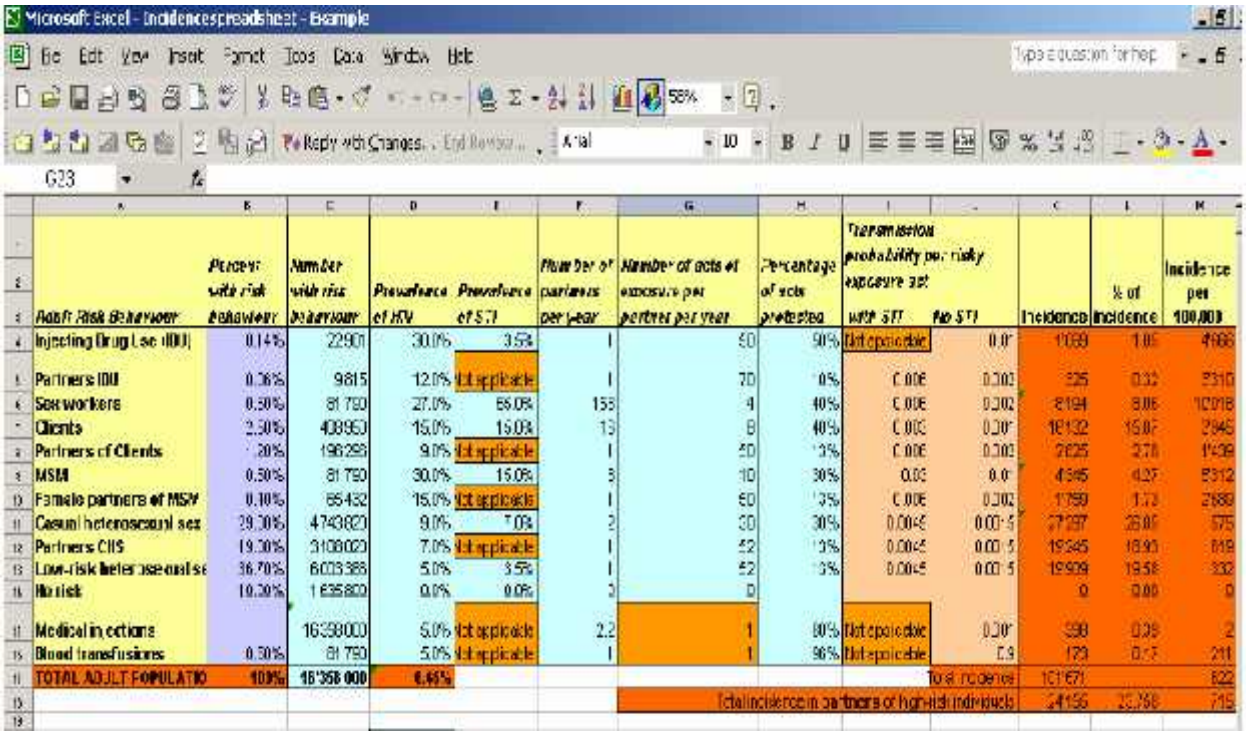
Zhang L, Yin L, Qin G, Qian HZ, Zhu Y, Hu W, Chen K, Wang Y, Liu S, Zhou F, Xing H, Ruan Y, Wang N and Shao Y (2006) Continued spread of HIV among injecting drug users in southern Sichuan province, China. Harm Reduction Journal, 4:1-7

Zhao M, Du J, Lu GH, Wang QY, Xu H, Zhu M and McCoy CB (2006) HIV sexual risk behaviors among injection drug users in Shanghai. Drug and Alcohol Dependence, 82:S43–S47

LIST OF APPENDICES

Appendix - I

Model of the spreadsheet for estimating incidence of HIV infection by 'risk' group



Microsoft Excel - Incidencespreadsheet - Example

Adult Risk Behaviour	Percent with risk behaviour	Number with risk behaviour	Prevalence of HIV	Prevalence of STI	Number of partners per year	Number of acts of exposure per partner per year	Percentage of acts protected	Transmission probability per risky exposure act: with STI	Transmission probability per risky exposure act: no STI	Incidence	% of Incidence	Incidence per 100,000
Injecting Drug Use (IDU)	0.14%	22901	30.0%	3.5%	1	50	90%	Not applicable	0.01	1069	1.0%	4666
Partners IDU	0.36%	9815	12.0%	Not applicable	1	70	0%	0.005	0.001	525	0.5%	5310
Sex workers	0.50%	81 750	27.0%	65.0%	155	4	40%	0.005	0.001	8194	8.0%	10018
Clients	2.50%	408950	15.0%	15.0%	13	8	40%	0.005	0.001	16132	15.8%	3945
Partners of Clients	1.20%	196296	9.0%	Not applicable	1	50	0%	0.005	0.001	2625	2.6%	1338
MSM	0.50%	81 750	30.0%	15.0%	5	10	30%	0.03	0.01	4345	4.2%	5312
Female partners of MSW	0.10%	65432	15.0%	Not applicable	1	50	0%	0.005	0.001	1759	1.7%	2689
Casual heterosexual sex	29.30%	4743823	9.0%	7.0%	2	30	30%	0.0045	0.0015	27197	26.6%	575
Partners CHS	19.30%	3108023	7.0%	Not applicable	1	52	0%	0.0045	0.0015	19345	18.9%	619
Low-risk heterosexual sex	36.70%	6003386	5.0%	3.5%	1	52	0%	0.0045	0.0015	19939	19.5%	332
No risk	10.20%	1635800	0.0%	0.0%	0	0				0	0.0%	0
Medical injections		1635800	5.0%	Not applicable	2.2	1	80%	Not applicable	0.01	338	0.3%	2
Blood transfusions	0.50%	81 750	5.0%	Not applicable	1	1	96%	Not applicable	0.9	173	0.2%	211
TOTAL ADULT POPULATIO	100%	16'358 000	6.65%						Total incidence	101671		622
								Total incidence in partners of high-risk individuals		24156	23.76%	715

Appendix - II

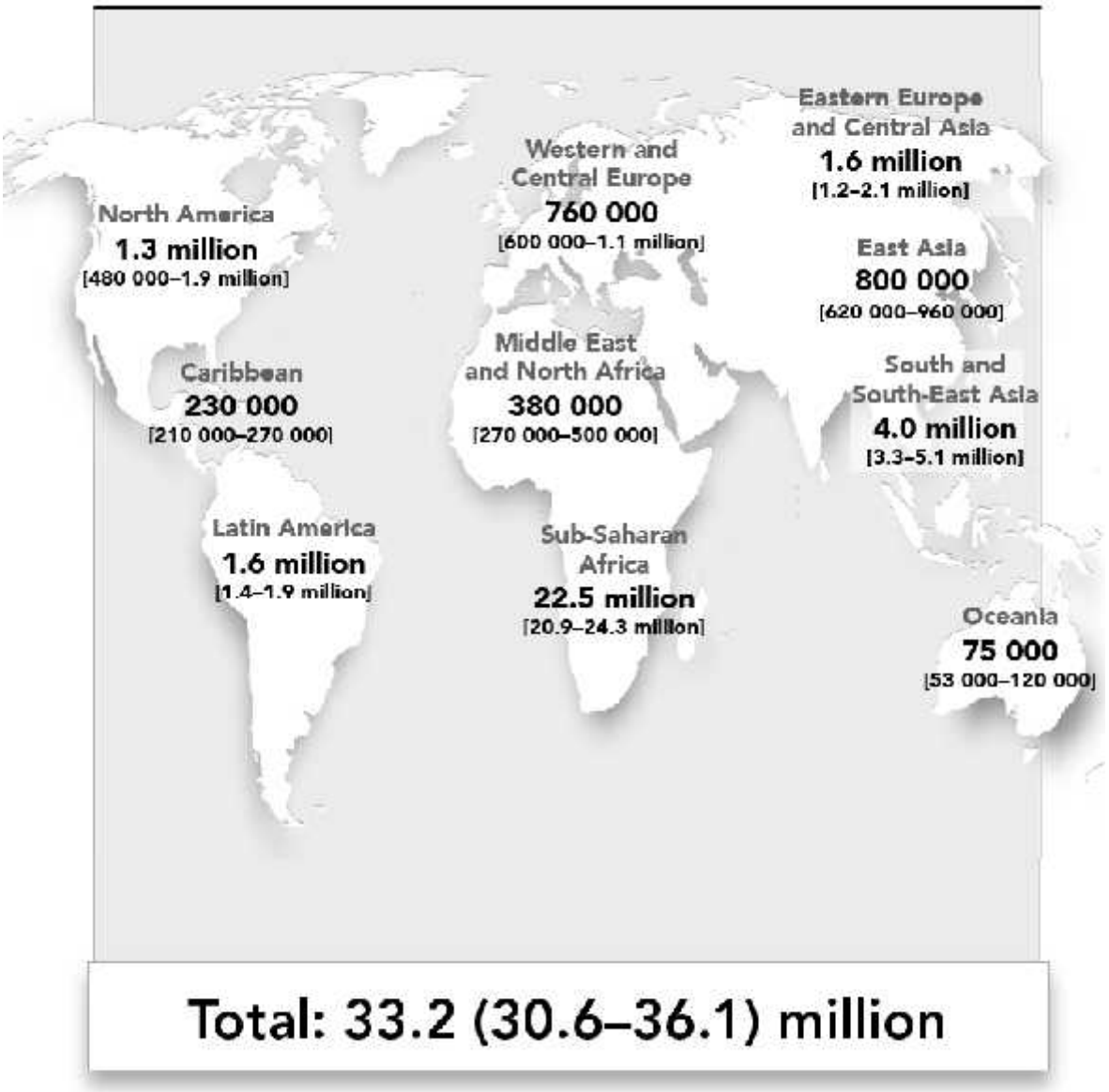
National estimates of adult HIV infections in Nepal (2005) in different risk groups

Names of higher risk population groups	Size estimate		HIV prevalence	
	low	high	low	high
IDU	16,500	23,200	21.93%	43.49%
MSM	64,000	193,000	1.58%	2.34%
FSW	25,400	34,100	1.37%	6.14%
Clients	564,000	754,000	0.96%	3.16%
Seasonal labor migrant	967,000	1,511,000	0.37%	3.85%
Urban female low-risk population	942,784	944,114	0.10%	0.30%
Rural female low-risk population	5,367,650	5,375,020	0.12%	0.34%

Adapted from NCASC, 2005

Appendix – III

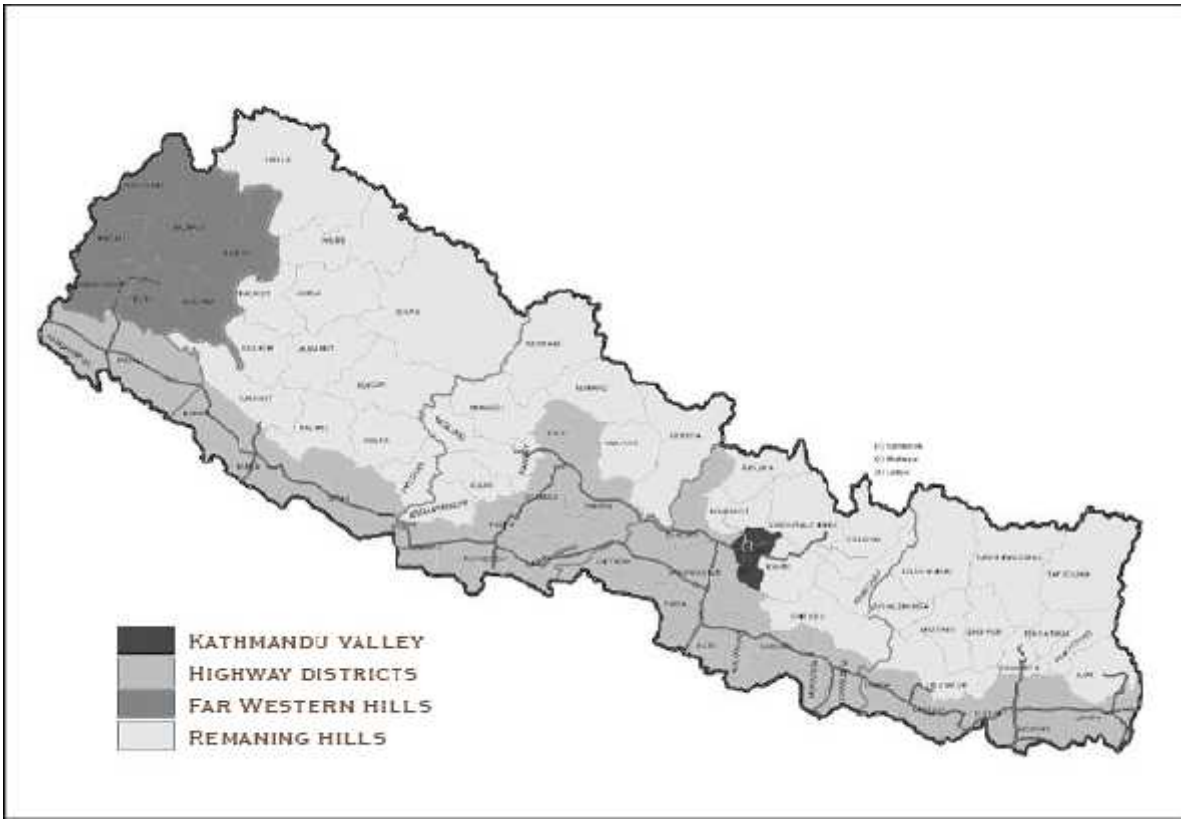
Map showing the HIV cases by various regions 2007



Adapted from UNAIDS/WHO, 2007

Appendix – IV

Map showing different epidemic zones in Nepal 2005



Adapted from NCASC, 2005

	A	B	C	D	E	F	G	
	Adult Risk Behavior Group	Percent with risk behavior	No. with risk behavior	Prevalence of HIV	Prevalence of STI	No. of partners per year	No. of acts of exposure per partner per year	Perc of ac prote
4	IDU							
5	Partners of IDU				N/A			
6	Sex workers							
7	Clients of sex workers							
8	Partners of clients				N/A			
9	MSM							
10	Female partners of MSM				N/A			
11	Casual hetorosexual Sex							
12	Partners of CHS				N/A			
13	Low risk heterosexual sex							
14	No risk							
15	Medical Injections				N/A			
16	Blood transfusions				N/A			
17	**Total Adult Population**							

Table 2: Data required by risk groups for the estimation of HIV incidence. Default transmission prob
column I and J of the spread sheet.