

# Describe global distribution of hiv health and social care essay



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Human Immunodeficiency Virus (HIV) is an enveloped positive single stranded lentivirus of the retroviridae family. Infection with HIV is associated with a progressive weakening of immune responses (Grossman et al. 2006). Ultimately diminishing levels of CD4+ T cells result in Acquired Immunodeficiency Syndrome (AIDS) whereby a host is susceptible to a wide range of opportunistic infections. In 2006 it was theorised that in the previous 25 years AIDS had been responsible for over 25 million deaths (UNAIDS, 2006). Currently it is estimated that approximately 33.9 million individuals are infected with HIV/AIDS (UNAIDS, 2010). However there are wide discrepancies in the global distribution of the virus. With 68% of the burden of disease the highest levels of infection are detectable in Sub-Saharan Africa (AVERT, 2010). In 2009 over 70% of worldwide HIV/AIDS deaths occurred in this region (UNAIDS, 2010). In heavily afflicted countries consequences of the pandemic include stunted economic growth, social unrest and governmental volatility (UNAIDS, 2001). Recently numbers of new infections in Sub-Saharan Africa have stabilised. In contrast HIV prevalence is increasing in Eastern Europe, Central and South East Asia (UNAIDS, 2010). HIV proliferates via sexual, parenteral and mother to child vertical transmission (WHO, 2010). Decreases in HIV-related fatalities have been observed in many nations with the introduction of effective antiretroviral therapy. Other preventative measures include harm reduction, prophylaxis, structural and social strategies. Nevertheless there are numerous obstacles that continue to hinder elimination of the virus.

## **Figure 1: The HIV Virion and Life Cycle**

HIV is an enveloped virus containing double stranded RNA. 2 species exist – HIV-1 and HIV-2. HIV infects CD4+ cells utilising CCR5 and CXCR4 as chemokine co-receptors. gp120 binds to the host cell producing a conformational change which allows gp41 to fuse with the host cell. Reverse transcriptase mediated synthesis (ssRNA to dsDNA) occurs in the cytoplasm. In the nucleus integrase combines host and viral DNA. Transcription to mRNA precedes assembly and budding of new virion particles from the host cell membrane (NIAID, 2010). Image adapted from NIAID (2010) HIV Virion <http://www.niaid.nih.gov/topics/hivaids/understanding/biology/pages/hivvirionlargeimage.aspx>

## **SIV Zoonosis – The Initial Mode of Transmission**

Both species of HIV are genetically interrelated to Simian Immunodeficiency Virus (SIV) and emerged via zoonotic transmission (Keele et al. 2006). HIV-1 groups M and N have a common ancestor in SIVcpz. This virus is present amongst populations of Pan troglodytes troglodytes in Southern Cameroon (Keele et al. 2006). In this region 29-35% chimpanzee populations test positive for SIVcpz antibodies (Keele et al. 2006). HIV-1 group N appears most likely to have descended from a Cameroonian strain of gorilla immunodeficiency virus (Plantier et al. 2009). The primate lentivirus SIVssm that infects sooty mangabeys has been identified as the most probable source of HIV-2 (Hirsch et al.. 1989). Phylogenetic time analyses reveal that HIV-1 group M emerged at the turn of the 20th century (Worobey et al. 2008). Considerable genetic diversification had already occurred within Western Africa before the advent of the worldwide AIDS pandemic in the

1980s (Worobey et al. 2008). Many theories have attempted to explain the origins of HIV. The most credible of these is the Cut Hunter hypothesis (AVERT 3, 2010). It proposes that bushmeat hunters occasionally became infected with SIV parenterally. Natural selective pressures prompted SIV to evolve within its human host. These changes gave rise to the different subtypes of HIV observable today. Today primate retroviruses are still actively transmitting into human populations (Wolfe et al. 2004). In 2004 studies demonstrated that 1% of Central African hunters tested positive for Simian Foamy Virus antibodies (Wolfe et al. 2004).

## **Historical Transmission Patterns of HIV – Out of Africa and Beyond**

Historical patterns of transmission must be considered to fully understand the current global distribution of HIV/AIDS. It is likely that various factors contributed to the virus' early spread in Africa (AVERT 3, 2010). In countries such as the Belgian Congo the native population had been exploited by colonial powers. Poor living conditions rendered many inhabitants immunocompromised and susceptible to infection (AVERT 3, 2010). Rapid urbanisation and increased geographic mobility of the Central African population coincided with growth of the epidemic. It was only after 1910 that cities in the region of zoonotic transmission attained populaces above 10,000 individuals (Worobey et al. 2008). Kinshasa had been established in 1881 whilst Yaounde was founded in 1889 (Worobey et al. 2008). More infectious contacts were inevitable under these conditions. Reviews of medical literature by de Sousa et al. (2010) revealed high levels of genital ulcers and sexual promiscuity in these burgeoning urban zones. Computer

simulations of Kinshasa suggest that ulcerative diseases were the most significant factor in assisting the spread of HIV (de Sousa et al. 2010). In the presence of genital ulcers the transmissibility of HIV is amplified and ranges from 3-43% (de Sousa et al. 2010). Global distribution of HIV altered dramatically in the 1960's. During this time many Haitians were infected with HIV whilst working in Mobutu's Zairian development plans (Gilbert et al. 2007). HIV-1 M subtype B subsequently migrated from Haiti to the USA around 1969 (Gilbert et al. 2007). Yet it wasn't until 1981 that the first signs of disease became apparent in America (CDC, 1981). In that year numerous cases of homosexual men infected with *Pneumocystis carinii* pneumonia and Kaposi's sarcoma were reported (CDC, 1981). The disorder was initially identified as Gay Related Immunodeficiency Disorder before being renamed AIDS. From the USA the virus travelled onwards to the rest of the world. By February 1985 there had already been 132 AIDS cases and 58 AIDS related mortalities in the UK (Scottish Home and Health Department, 1985). In developed countries the virion's passage was assisted by international travel, intravenous drug use and blood transfusions (AVERT 3, 2010).

### **Figure 3 – Population of Urban Areas of Central West Africa (1880-1970)**

**The founding dates of the cities of Central West Africa are displayed in Figure 2. Most of the municipalities were established at the end of the 19th century (e. g. Yaounde, 1889). This immediately precedes Worobey et al. (2008) estimated date of original zoonotic transmission. The increased contacts available in urban areas would have allowed HIV to proliferate.**

**Image adapted from Worobey et al. 2008**

### **Current Global Distribution of HIV/AIDS – Epidemiological Analysis**

Recent epidemiological data indicates a global downturn in diagnoses of HIV/AIDS. Generally growth of the epidemic appears to have stabilised since 1999 (WHO, 2007). There were an estimated 2. 6 million infections discovered in 2009 (UNAIDS, 2010). In 1997 the frequency of new cases had been 20% greater (UNAIDS 2010). Nevertheless the numbers of people living with HIV/AIDS continues to increase. Currently 33. 9 million individuals are living with HIV (WHO 2, 2010). HIV-2 is mostly restricted to Western Africa (Lemey et al. 2003). HIV-1 exhibits higher levels of infectivity and causes the majority of infections worldwide (Kancki et al. 1994). HIV-1 is classified into distinctive M, N, O and P groups. Group M is found in approximately 90% of all seropositive patients (AVERT 2, 2010). Group M viruses are subdivided into nine clades (A-K)(Lemey et al. 2003).

## **Figure 2 – The Global Distribution of HIV-1 Subtypes**

Subtype C causes the majority of infections worldwide (47. 2%). However B predominates in the Western world. Subtype B reached America via Haiti in the 1960s. Image adapted from Wikimedia (2010) [http://en.wikipedia.org/wiki/File: HIV-1\\_subtype\\_prevalence\\_in\\_2002. png](http://en.wikipedia.org/wiki/File:HIV-1_subtype_prevalence_in_2002.png)

### **Sub-Saharan Africa**

Sub-Saharan Africa is still considered to be the epicentre of the HIV/AIDS epidemic. In 2009 1. 3 million AIDS-related deaths occurred within this region (WHO 2, 2010). More positively there has been a recent stabilisation in the number of new infections (UNAIDS, 2010). Furthermore in the last decade 22 countries in Sub-Saharan Africa have witnessed more than a 25% reduction in HIV incidence (UNAIDS, 2010). Thirty four percent of the global HIV positive population live in Southern Africa (UNAIDS, 2010). This region also contains two fifths of all infected women (UNAIDS, 2010). The world's largest outbreak is located in South Africa which has 5. 6 million HIV positive citizens (UNAIDS, 2010). Gender-based violence and male relationship control correlate strongly with female infection in this area (Dunkle et al. 2004). A survey of South African males revealed 27. 6% had previously committed rape and 4. 6% had raped in the past 12 months (Jewkes et al. 2009)Swaziland has the highest national prevalence of HIV seropositivity. The virus has spread to 190, 000 individuals within the country since its emergence in 1986 (USAID, 2010). Currently 34. 9% of the adult population is infected (USAID, 2010). The majority of transmissions arise via heterosexual sex and most deaths occur amongst young people (Henry J Kaiser Family Foundation, 2005). Swaziland's government founded the

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National AIDS programme in 1987 and classified the epidemic as a "natural disaster" in 1999 (Henry J Kaiser Family Foundation, 2005). The socio-economic impact of the virus has been devastating. Diminishing levels of productivity and tax revenues are coupled with increasing absenteeism and illness (Whiteside et al. 2006). Annually the virus is thought to reduce national GDP by up to 3% (Whiteside et al. 2006). The prevalence of infection has remained relatively low amongst the predominantly Islamic nations of Western and Central Africa. The proportion of Muslims within these countries is negatively associated with HIV/AIDS levels (Gray, 2004).

### **South, East and South East Asia**

HIV was relatively slow to spread to South, East and South East Asia however outbreaks were clearly visible in the 1990s (AVERT 4, 2010). Currently 4.9 million people are living with HIV in this region (UNAIDS, 2010). Although recently the epidemic appears to have levelled off. There are no widespread epidemiological patterns within this geographic area. Outbreaks tend to be localised and vast diversity exists within countries. For example Papua province in Indonesia has prevalence rates up to fifteen times greater than the national average (UNAIDS, 2010). Heterogeneity is also evident in India where there is a large population of injecting drug users (IDU's) in the North Eastern territories (National AIDS Control Organisation, 2008). India displays a type 4 pattern of transmission where the virus has travelled from vulnerable groups via bridge populations into the general populace (National AIDS Control Organisation, 2008). In Thailand a sustained decrease in HIV incidence has been observed since the early 1990s. The Thai government created an innovative programme providing condoms for the nation's



brothels. In 1989 just 14% of prostitutes had practised safe sex. By 1994 this statistic had risen to over 90% (WHO, 2000).

## **Eastern Europe and Central Asia**

Despite a global trend for decline, rates continue to rise in Eastern Europe and Central Asia (WHO, 2010). The number of individuals living with HIV in this region has almost tripled since 2000 (UNAIDS, 2010). The primary cause of this increase is disintegration of the USSR which had heralded a period of hedonism amongst the youth in this region. They rebelled against outdated institutions and a lack of opportunity (Grund, 1996). Unfortunately this rebellion often took the form of intravenous drug use. The socio-economic upheavals associated with the fall of communism have become known as "transition trauma" (Altiani et al. 2000). Decreased access to healthcare providers and changing sexual behaviours facilitated the epidemic's development (Altiani et al. 2000). In 1995 in St. Petersburg Afanasyev and Skorobogatov reported that 46% of prostitutes had tested positive for an STD in the previous twelve months. The proliferation of ulcerative diseases coincided with an explosion of HIV in Central Asia and Eastern Europe. Ukrainian syphilis diagnoses increased from 3, 000 in 1990 to 77, 000 in 1996 (Hamers, 2000). Today over 90% of HIV/AIDS in the region is located within Russia and Ukraine (UNAIDS, 2010). Prior to 1994 Ukraine reported less than 50 infections annually. Yet in 1996 over 12, 000 new cases were detected (Hamers, 2000). The seroprevalence rate in Ukraine is currently estimated to be 1. 63%; the highest in Europe (Krulgllov et al. 2008). As the epidemic progresses the proportion of women affected is rapidly increasing.

Nearly half of those living with HIV in the Ukraine are now female (Kruglov et al. 2008).

## **Figure 4 – Global Figures for People Living with HIV (1990-2009)**

The number of people living with HIV has increased by 25. 9 million since 1990. There has been a recent stabilisation in the global burden of HIV/AIDS.

Image courtesy of Avert (2010) <http://www.avert.org/worldstats.htm>

### **South and Central America**

In Central and South America HIV is mainly restricted to the vulnerable groups in society (USAID, 2009). Incidence of infection is highest amongst promiscuous homosexual men (2. 0-27. 8%) and commercial sex workers (0-6. 3%)(Montano et al. 2005). Surprisingly over a quarter of MSM in Central America also have sex with women (AVERT 5, 2010). Therefore in the future the epidemic may become more generalised in this region. There were 53, 000 AIDS-related mortalities in 2001. By 2009 this figure had slightly increased to 58, 000 indicating that a degree of stabilisation (UNAIDS 2, 2010). Belize and Honduras exhibit the highest prevalence rates in the region. Brazil accounts for over a third of the South and Central American infectious cases (USAID, 2009). Within Brazilian urban areas up to three fifths of all intravenous drug users are infected (AVERT 4, 2010).

### **North America, Western Europe and Central Europe**

In North America, Western and Central Europe it is estimated there are currently 2. 3 million people living with HIV (UNAIDS, 2010). The proportion of heterosexual infections in these regions rose from 20% in 1995 to 42% in

2003 (ART Cohort Collaboration, 2006). A large proportion of heterosexual diagnoses originate from Sub-Saharan African immigrant populations (UNAIDS, 2008). Recently there has been an escalation in infections amongst men who have with sex with men (MSM). In North America and Western Europe MSM seropositivity increased by 86% during the years 2000-2006 (UNAIDS, 2010). As the epidemic has progressed the epidemiological trends in these countries have deviated from each other (UNAIDS, 2008). Western European and North American IDU transmission is decreasing yet it is still the primary mode of acquisition in many Central European states (UNAIDS, 2008). There are 85, 000 people currently living with HIV in the UK. Numbers of new cases have been declining since 2005 due to a reduction in imported infections (HPA, 2010). In England and Wales approximately a third of infections are heterosexually transmitted (HPA, 2010).

### **Figure 5 – The Current Global Distribution of HIV**

**Sub-Saharan Africa has 68% of the world's burden of HIV/AIDS infection (AVERT, 2010). In 2009 over 70% of AID-related mortalities occurred in this region (UNAIDS, 2010). The epidemic has expanded by more than 25% in 7 countries during the years 2000-2009. Five of these countries are located in Eastern Europe and Central Asia (UNAIDS, 2010).**

**Image adapted from [http://upload.wikimedia.org/wikipedia/commons/d/d7/HIV\\_Epidem.png](http://upload.wikimedia.org/wikipedia/commons/d/d7/HIV_Epidem.png)**

### **Other Regions**

The Middle East and North Africa have a low HIV seroprevalence of approximately 0. 2% (Obermeyer, 2006). The emergence of the virus in the

Middle East and North Africa was characterised by denialism. In this region imprecise diagnosis and inconsistent reporting of HIV infections still persist (Obermeyer, 2006). Djibouti and Southern Sudan possess the highest prevalence rates as a result of armed conflict and migration (Jenkins and Robalino, 2003). Islamic conventions have somewhat restricted the proliferation of HIV. Customs inhibiting viral spread include male circumcision, low alcohol intake and few extramarital affairs (Obermeyer, 2006). Nevertheless there is a possibility that a hidden epidemic exists in many nations amongst marginalised groups (Jenkins and Robalino, 2003). Only Sub-Saharan Africa has a larger proportion of persons living with HIV than the Caribbean (WHO, 2010). Prevalence rates within this region exhibit great diversity ranging from 3% in the Bahamas to under 1% in Cuba (UNAIDS, 2008). Unprotected heterosexual sex is the main mode of transmission. Tourism-reliant nations such as the Dominican Republic are among the most effected and often contain thriving sex industries (Allen et al. 2004). Prisoners, intra-regional migration and socio-economic instability have also contributed to the infectious burden (Allen et al. 2004). HIV in Oceania is generally rare with just 74, 000 seropositive individuals (UNAIDS, 2010). Papa New Guinea displays Oceania's only generalised epidemic (WHO, 2005). In Port Moresby low condom use and sexual inequalities have resulted in a HIV prevalence rate of 1. 7% (WHO, 2005).

## **Sexually Transmitted HIV Infection – A Biological Overview**

A sexual route of transmission is implicated in 75-85% of all HIV infections (Royce et al. 1997). This is in spite of the fact that there is a lower risk associated with sexual exposure than other modes of acquisition (Royce et

al. 1997). Heterosexual transmission risk can be up to 0.05 per coital act (Shattock and Moore, 2003). There is a greater probability of sexual transmission amongst MSM (0.000625-0.1 per coital act) (Shattock and Moore, 2003). However these rates alone would not be capable of sustaining the worldwide epidemic (Pilcher et al. 2004). Transmissibility can be increased by a number of significant variables including infection stage, immune status and viral load (Royce et al. 1997). Infectivity varies dramatically between populations. Ecological analysis of African urban areas has revealed that these differences are attributable to biological dynamics as well as behavioural reasons (Buvet et al. 2001). For the duration of acute infection hosts exhibit a state of "transiently high viraemia" (Pilcher et al. 2004). In acute phase HIV there is an eight to ten fold greater risk of male to female sexual transmission (Pilcher et al. 2004). Non-syncytium inducing R5 viruses predominate over X4 isolates in acute infection (Locher et al. 2005). This could influence transmissibility as R5 viruses enhance cellular activation levels (Locher et al. 2005). Individuals are often unaware of their seropositivity status during the early stages of HIV and therefore may unknowingly transmit to susceptible partners. Seminal super shedders with greater viral loads may also pose an increased transmission risk (Shattock and Moore, 2003).

## **Figure 6 – Possible Biological Mechanisms for Sexual Transmission of HIV-1**

In sexual transmission the HIV virus may be able to infect the epithelium of susceptible hosts via the following methods: Infection of the epithelium Epithelial cells are transcytosed thus importing

HIV Transmigration Stratified epithelium is located in many exposed genital regions. The numerous strata of this epithelium confer a considerable degree of protection against pathogens. The virion associates itself with Langerhans cells Physical tears of the stratified epithelium may occur during intercourse. HIV can subsequently directly cross the mucosal epithelium Image courtesy of Pilcher et al. 2004 (Nature) 189: 10, 1785-1792

## **Methods for Preventing Sexual Transmission of HIV**

Surveillance networks monitoring the sexual health of populations are a necessary component of comprehensive HIV prevention. Genital ulcers impair mucosal stability and can haemorrhage during intercourse increasing the probability of viral acquisition (Fleming and Wasserheit, 1999). Non-ulcerative diseases such as gonorrhoea also promote infectivity through the recruitment of HIV-infected inflammatory cells to the genital tract (Fleming and Wasserheit, 1999). In Nigerian hospital studies 22.8% of HIV positive patients have been found to be co-infected with another STI (Kahinde and Lawoyin, 2005). In the presence of a sexually transmitted infection, HIV transmission risk is multiplied 2.0-23.5 fold (Fleming and Wasserheit, 1999). Therefore early recognition and treatment of HIV and other STDs is a critical element in decreasing transmission events. The use of condoms during coitus reduces the frequency of HIV infection by 80% (Weller and Davis-Beatty, 2002). This figure would be even higher if condoms were correctly worn during each act of intercourse (Weller and Davis-Beatty, 2002). Increased condom utilisation is a key indicator of improved risk behaviour during health interventions (Sangani et al. 2004). Condom prevalence is influenced by an individual's perceptions of their susceptibility to infection,

ability to use prophylaxis and societal barriers (Adih and Alexander, 1999). Healthcare systems should aim to make condoms available to all high risk groups. A strategy aimed at empowering commercial sex workers in Mpumulanga province, South Africa supplied women with free female condoms (Marseille et al. 2001). Annually the distribution of just six thousand condoms within the province resulted in a \$12, 090 (US \$) reduction in AIDS-associated expenditure (Marseille et al. 2001). In contrast Indian prostitutes have expressed a reluctance to participate in safe sex programmes fearing a loss of clients (Bhave et al. 1995). Behavioural strategies are often utilised to improve sexual habits. ABC is a harm reduction policy which has been exploited by UNAIDS and the US President's Plan for Emergency Plan for AIDS Relief. ABC consists of a concise triumvirate: Abstinence, Be Faithful and Condom Use (PEPFAR, 2010). A Ugandan ABC programme is credited with producing a ten per cent reduction in infection rates during the 1990s (Murphy et al. 2006). However ABC neglects to address the socio-economic factors forcing young women to become commercial sex workers (Murphy et al. 2006). In Africa there is widespread promiscuity amongst married men (Ntozi et al. 2003). Through its blind endorsement of marriage ABC neglects wives in unfaithful relationships. A majority of women in Uganda still see it as their duty to provide their husbands with sex (Shelton et al. 2004). Critics claim that ABC over-simplifies the epidemic and more comprehensive prevention methods are needed (Gage and Ali, 2005).

### **Image 1 – Easy as ABC**

The image displays an advertisement from a Botswanan ABC campaign of the late 1990s. Image courtesy of AVERT (2010) <http://www.avert.org/abc->

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hiv. htmThe benefits of abstinence-only policies are frequently espoused, particularly in the USA (Jemmott III et al. 1998). However a Cochrane review of abstinence-only interventions in high income countries surmised there is no reduction in HIV risk associated with this programme type (Underhill et al. 2007). Similarly incidence of intercourse and partner quantity fails to express a decline as a result of these strategies (Underhill et al. 2007). Microbiocides consist of a vast array of pharmacological compounds which aim to prevent HIV transmission when applied to vaginal and rectal areas (Lederman et al. 2006). The increasing incidence of HIV infected women provided impetus for the development of microbiocides (D'Cruz et al. 2004). These topical agents ultimately strive to provide a cost effective and female controlled method of inhibiting sexually transmitted infections (Stone, 2002). However nonoxynol-9, a spermicide was found to have no effect on HIV transmission. In fact recurrent use of nonoxynol-9 produced genital sores thus increasing the possibility of infection (Wilkinson et al. 2002). More positively a vaginal gel containing 1% tenofovir was recently reported to be 39% effective in decreasing female HIV acquisition (CAPRISA, 2010).

### **Figure 7 – The Action of Microbiocides**

Microbiocides reduce abrasions with lubrication and maintain normal pH levels. Topical agents also decrease the risk of HIV-1 infection through inhibition of reverse transcriptase, co-receptor antagonism and anti-DC signalling. Image courtesy of Pilcher et al. 2004 (Nature) 189: 10, 1785-1792 Male circumcision is capable of reducing uptake of heterosexually transmitted HIV by up to 60% (WHO 3, 2010). The WHO advises that the procedure is implemented in countries with generalisable epidemics and a



rare frequency of circumcised men (WHO 3, 2010). In 2002-2006 three large scale randomised controlled trials analysed the effects of circumcision in Uganda, Kenya and South Africa (Siegfried et al. 2009). All three trials were ended prematurely after demonstrating substantial effects during mid-project evaluation (Siegfried et al. 2009). Twelve months post-circumcision a 50% decreased risk of HIV acquisition was observable in the male cohort (Siegfried et al. 2009). Conversely female genital cutting actually increases a woman's likelihood of acquiring HIV (Maslovskaya et al. 2009). Behavioural interventions should aim to increase knowledge and lower risk-taking amongst participants. UNAIDS educational policy had previously been focused on ensuring comprehensive HIV knowledge in developing countries by the year 2001 (UNAIDS, 2010). Yet by 2009 less than half of young people in these nations could correctly answer five simple questions regarding viral transmission (UNAIDS, 2010). Antiretroviral therapy has been proposed as another strategy to avert sexually transmitted HIV (Cohen et al. 2007). Theoretically these drugs should decrease viral loads to negligible amounts conferring pre-exposure prophylaxis (Vernazza et al. 2008). Mathematical modelling estimates that universal HIV testing and immediate antiretroviral therapy could decrease mortality rates to less than 1 per 1, 000 infections within ten years (Granich et al. 2009). A recent Cochrane review maintains there is currently not enough evidence to demonstrate the effectiveness of antiretrovirals as chemoprophylaxis (Okwundu and Okoromah, 2009). More clinical trials are required before pre-exposure prophylaxis can become widely accepted. A study in rural South African is attempting prove the universal treatment hypothesis in an experiment due to run from 2011-2015 (University of Kwazulu Natal, 2010). During this time all HIV positive

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individuals participating will be provided with antiretrovirals regardless of their clinical symptoms (University of Kwazulu Natal, 2010). In an environment where a low prevalence of HIV exists there is sparse evidence supporting the treatment of all community members (Sangani et al. 2004). In these regions strategies to limit the effect of sexually transmissions should preferentially target high risk groups such as commercial sex workers and MSM. Community outreach programmes are effective at reaching high risk groups. Dialogue with MSM in American gay bars increased condom use by 22% within two months (Kelly et al. 1997). In the UK homosexual men are the cohort most at risk of becoming HIV positive (HPA, 2004). In 2003 MSM accounted for 84% of all new HIV infections (HPA, 2004). The Health Protection Agency attempts to prevent homosexual transmission via safe sex education, HIV testing, and monitoring the needs of positive individuals (HPA, 2004). Other possible targets for behavioural change in MSM include reducing unprotected anal sex and serodiscordant relationships (Johnson et al. 2008). International examples of good practice include the Tais Plus strategy in Kyrgyzstan which was established by CSW's and their pimps to prevent HIV. Tai Plus receives governmental support and has developed a code of conduct in conjunction with police (UNAIDS 2, 2006). Through these efforts sex workers have de-stigmatised and re-integrated into society. Uniquely the programme emphasises peer education for CSW's by other sex workers. The TADA scheme in Poland offers sex workers the chance to rejoin the labour force with occupational training workshops (SWAN, 2010). Other noteworthy elements of HIV prevention programmes for sex workers include free medical care, condom provision and drop in centres (UNAIDS 2, 2006).

## **Image 2 – The Tai Plus Programme**

Displayed to the left is an example of a peer educator's identification card from the Tai Plus strategy in Kyrgyzstan. Peer educators are charged with monitoring their fellow CSW's at a designated pyatak (pick-up point). As well as educational workshop peers also organise parties and picnics for their CSW's. Image courtesy of UNAIDS 2, 2006

## **Ideal Prevention for Sexual HIV Transmission**

In summary sexual health prevention should consist of a multi-faceted and comprehensive approach. Surveillance networks must be implemented for early detection of HIV infection. Testing should attempt to identify super shedders, STI infections and acutely infected individuals. Post-exposure prophylaxis should be offered to patients. Extended services including free condom provision, advice and medical care should be provided to at risk populations. Behavioural interventions must be localised and recognise the unique dynamics of each epidemic. Educational initiatives may improve sexual behaviour within target populations. Efforts should focus on harm reduction rather than abstinence-only. In the future microbiocides and pre-exposure prophylaxis could become more widespread however more research is needed.

## **Preventing Parenteral HIV Transmission**

Parenteral transmission events are those which occur outside the alimentary canal. Instead HIV infects via an "intravenous, intramuscular or intrasternal" route (Berkeley, 1991). The frequency of each of these modes of transmission depends upon the sexual and health characteristics present in

a population (Berkeley, 1991). Haemophiliacs, intravenous drug users and occupational health workers are all at an increased risk of parenteral transmission. Excluding Sub-Saharan African data almost a third of all novel HIV cases can be attributed to injecting drug use (UNAIDS, 2007). Although the virus is highly transmissible within contaminated injection apparatus there are a number of other factors affecting IDUs to address. These include prohibitive laws, misinformation and a lack of sterile equipment (Des Jarlais and Semann, 2008). Globally just under eight per cent of drug users have access to adequate healthcare services (UNAIDS, 2007). It has been argued that criminalisation of drug users exacerbates the HIV epidemic (Day, 2010). To prevent viral proliferation society must regard addicts with dignity thus decreasing their sense of marginalisation and risk taking behaviour (IHRD, 2008). Public nonchalance often results in IDU's becoming reliant on "shooting galleries" and "hit doctors" for their needle supply (Des Jarlais and Semann, 2008). HIV incidence rates of 10/100 to 50/100 person years have been recorded with needle re-use (Des Jarlais and Semann, 2008). Annually the incidence of infection amongst participants in an American needle exchange programme was estimated to be 1.63 new infections per 100 individuals (Kaplan and Heimer, 1995). Drug users often have specific injecting rituals and are most likely to share needles with sexual partners and those who they rely on emotionally (Unger et al. 2006) Vulnerable subpopulations including MSM and CSWs are at an elevated risk of IDU transmission (Parry, 2008). Virion incidence has been kept low in countries which provide outreach strategies (Brette, 1991). Harm reduction policies do not favour abstention and instead promote safer drug use (Brette, 1991).

The implementation of needle exchanges and the prescription of opiate  
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substitutes reduces HIV transmission in IDU's (IHRD, 2008). In America attending a heroin harm reduction programme results in a six fold decrease in an individual's likelihood of developing HIV (Des Jarlais and Semaan, 2008). Drug users may sometimes be willing to form secondary syringe exchanges hence extending a programme's reach to clinical non-attendees (Des Jarlais and Semaan, 2008). Other examples of harm reduction include tin foil distribution to discourage intravenous drug taking and the provision of safe injection areas (AVERT 6, 2010). Increased knowledge amongst IDUs can lead to ninety per cent reductions in risk taking behaviour (Des Jarlais et al. 1994). Eastern Europe, Central Asia and South East Asia have the greatest incidence of HIV amongst IDUs (IHRD, 2008). Extremely high seroprevalence rates of 73% are found amongst Ukrainian drug users (Vlasenko, 2004). In Ukraine prohibitive laws with draconian sentences for narcotics possession force addicts to inject as soon as possible; often via a dealer's contaminated needle (Vlasenko, 2004). Furthermore there is a widespread availability of homemade opiates in the community and within prisons (Vlasenko, 2004). However Ukraine has finally been able to confront its epidemic and NGOs now increasingly influence national drug policy. Recent initiatives to combat HIV in Ukraine include 24 hour pharmacy exchanges and home visits by peer educators (IHRD, 2008).

### **Image 3 – Anti-Drug Poster in Tajikistan**

Image 3 is taken from a Tajik anti-drugs programme. Like other Central Asian countries Tajikistan deals with the interrelated burden of HIV/IDU use. In Tajikistan 60% of all HIV cases are as a result of intravenous drug use (IHRD, 2008). The pace of harm reduction development has been alarmingly slow.

In 2007 no opiate replacement programmes were offered in the country's hospitals (IHRD, 2007)Image adapted from IHRD, 2007Human immunodeficiency virus is capable of persisting on inanimate nosocomial surfaces such as syringes for over seven days (Kramer et al. 2006). In this manner HIV can transmit via medical injections and has the ability to reach people outside of the normal range of transmission (Reid, 2009). Modelling suggests that the proportion of HIV cases caused by clinical injections in Sub-Saharan Africa is between 12-47% (Reid 2, 2009). Annually it is estimated that 260, 000 HIV infections emanate from unsafe injection practices with the greatest risk in Rwanda (Hauri et al. 2004). A Nigerian study revealed that 36. 3% of healthcare institutions discarded their refuse at local dumps accessible to the public (AFF All Africa, 2010). Additionally none of the hospitals surveyed segregated their sharps (AFF All Africa, 2010). Therefore untreated waste also represents another significant source of parenteral HIV infection. Sufficient hygiene and disposal processes must be implemented in healthcare institutes to prevent further viral transmissions. Ninety per cent of patients who receive HIV-positive blood transfusions will subsequently become seropositive (Donegan et al. 2000). From 1985 onwards blood given in the USA has been subject to compulsory screening (Ward et al. 1988) Currently forty one nations still lack the basic health infrastructure to detect transfusion transmissible pathogens (WHO, 2009). In Sub-Saharan Africa approximately 5-10% of infections occur through contaminated blood products (Field and Allain, 2007). A one per cent donation rate amongst the populace is necessary to operate a sustainable national blood service (WHO, 2009). Yet seventy three countries are unable to meet this minimum threshold (WHO, 2009). In developing regions with high maternal and child

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mortality rates the demand for blood often exceeds supply (Field and Allain, 2007). To ensure safe transfusions a rural Malawian laboratory must allocate over half of its annual expenditure to screening (Lara et al. 2007). Often funds need to be diverted to other healthcare concerns. Economic constraints can severely limit a government's ability to provide a centralised, voluntary and laboratory based blood service (Lara et al. 2007). Nevertheless in resource poor settings decentralised systems must continue to function until a fully functioning co-ordinated alternative is provided (Field and Allain, 2007). Eighty per cent of Sub-Saharan African countries rely on blood obtained from family members and through payments (Field and Allain, 2007). However voluntary donations are always preferable (PCRS, 2007). Over one in twenty Pakistani IDUs have confessed to previously donating blood for money (UNGASS, 2010). The health implications of this admission are considerable as 20. 8% of Pakistani IDUs are HIV positive (UNGASS, 2010).

### **Figure 8 – Voluntary Blood Donations per 1000 population in 2007**

Countries should strive to achieve 100% voluntary blood donations. Thus ensuring blood is contributed out of genuine concern rather than for personal gain. Nations depicted in red have less than five per cent voluntary donations. The majority of these healthcare systems are situated in Sub-Saharan Africa. The dark green shading located predominantly in the developed world indicates that over 30% of a state's blood supply is voluntary. Image adapted from WHO (2009) In most developed nations diagnostic and legal measures have been implemented to prevent blood

product contamination. The advent of nucleic acid testing has reduced the chance of a patient receiving tainted blood to 1 in 2 million (Stramer et al. 2004). Additionally a directive within the European Union dictates that individuals who engage in risk-taking sexual behaviour are permanently prohibited from donating blood (NHS, 2010). Within the UK this decree is extends to all MSM (NHS, 2010). Hospital workers face a high risk of occupational exposure to HIV (Bell, 1997). There are an estimated 5, 000 contacts per annum with HIV positive blood amongst American healthcare employees (Bell, 1997). Needle prick injuries are most common (Singru and Banerjee, 2008). The danger posed by percutaneous transmission can be curtailed by workers' adherence to universal precautions (UNAIDS 3, 2010). These guidelines recommend the use of personal protective equipment and hygiene protocol. If contact with blood occurs healthcare workers should undergo a four week post-exposure prophylaxis (PEP) course of antiretrovirals (UNAIDS 3, 2010). However an Indian study demonstrated that only half of workers reported exposures and just a quarter completed PEP (Singru and Banerjee, 2008).

## **Ideal Prevention for Parenteral HIV Transmission**

To minimise parenteral HIV transmission there must be an end to the stigmatisation and isolation experienced by drug users in society. Healthcare systems ought to provide community outreach programmes for IDUs. These services should offer needle exchanges, safe injecting facilities and opiate substitutes. Additionally the provision of education and counselling allows individuals to address the problems underlying their addiction. Within hospitals syringes must not be re-used and immunisations ought to be



administered via auto-disable equipment. Medical waste should be segregated and incinerated as appropriate. Blood donations must be collected through voluntary, non-remunerated means and subject to coordinated nucleic acid testing. Those engaging in risk taking sexual practices ought to be prohibited from giving blood. The implementation of universal guidelines will protect healthcare workers. If exposure occurs PEP should be administered.

## **Preventing Vertical Transmission**

Each year approximately 760, 000 novel HIV infections are reported among children (Gumbo et al. 2010). Mother to child transmission (MTCT) is responsible for the majority of these events (Khoury et al. 1995). Annually 1.5 million HIV positive women become pregnant (ITPC, 2009). Without appropriate treatment an infected mother has a 15-20% chance of infecting her child (Lewell, 2006). Breastfeeding further increases this transmission risk to 35-40% (Lewell, 2006). Recently global provision of antiretroviral (ARV) prophylaxis for expectant mothers has been steadily improving (Khoury et al. 1995). In Sub-Saharan Africa it is estimated that 50-80% of HIV positive pregnant women now have access to ARV treatment (UNAIDS, 2010). Consequently the number of new cases among children decreased from 500, 000 in 2001 to 370, 000 in 2009 (UNAIDS, 2010). The presence of vaginal infections in HIV seropositive mothers enhances virion shedding and the secretion of inflammatory cytokines in the genital tract (Wafaie et al. 2001). Low maternal CD4+ counts and high viral replication rate positively correlate with an increased chance of MTCT (Wafaie et al. 2001). Other risk factors for transmission include genital ulcers, discharge and mastitis (Gumbo et al.

2010). The likelihood of in utero transmission is increased by low maternal haemoglobin levels and the development of chorioamnionitis in the foetal membrane (Bobat et al. 1996). HIV infectivity is further amplified by premature delivery and exposure to blood during the birthing process (Bobat et al. 1996). Antiretrovirals are extremely effective at preventing MTCT by reducing maternal viral load and providing prophylaxis to a child (Gumbo et al. 2010). Often in resource poor settings the non-nucleoside reverse transcriptase inhibitor nevirapine is administered at labour (Wafaie et al. 2001). Nevirapine (NVP) is a cost effective way of decreasing intrapartum transmission by 40% (Wafaie et al. 2001). However a single dose of NVP will provoke antiretroviral resistance in over half of children receiving treatment (Arive et al. 2007). For this reason it is currently recommended that zidovudine and lamivudine are taken in conjunction with nevirapine (WHO 4, 2010). In more developed healthcare systems triple combinations of antiretrovirals have contributed to lowering rates of MTCT to below 2% (WHO, 2004). Child mortality is highly dependent on maternal survival rates and therapy should be initiated 14 weeks into pregnancy (WHO 4, 2010). However if a mother's CD4+ count drops below 350 cells/mm<sup>3</sup> it is advisable to commence treatment immediately (WHO 4, 2010).

## **Figure 9 – Eliminating Mother to Child Vertical Transmission of HIV**

Figure 9 illustrates different scenarios for 25 developing countries where mother to child transmission is a public health concern. Incidence rates are measured as new infections in children aged 0-14. With no ARV prophylaxis the model predicts 450, 000 HIV mother to child transmissions in 2015.

However the incidence plummets to just above 6, 000 cases when WHO guidelines are obeyed and family planning eliminated. Restricted breastfeeding with ARV provision protects infants living in resource limited nations. Diagram adapted from Mahy et al. (2010) In Cambodia just 12% of HIV infected pregnant women receive prophylactic ARVs (ITPC, 2009). This is in stark contrast to England and Wales where the NHS introduced an opt-out treatment scheme in 2004. As a result of this strategy over 90% of HIV positive mothers now receive antiretrovirals (Moses et al. 2008). In 2001 the WHO endorsed replacement feeding hoping to nullify the risk of transmission after birth. Subsequently these guidelines were implemented by many Sub-Saharan MTCT programmes (Moland et al. 2010). However this policy deprived infants in developing countries of vital protective nutrition. It also risked disclosing maternal HIV status in communities which exclusively breastfeed (WHO Collaborative Study Team, 2000). The current WHO strategy released in 2010 advocates exclusive breastfeeding for 6 months in resource limited areas. ARV treatment should be continued during this time (Moland et al. 2010).

## **Ideal Prevention for Vertically Transmitted HIV**

Regular attendance at prenatal clinics is necessary to eliminate MTCT. The health status of expectant mothers and foetus' should be monitored closely and interventions performed when necessary. If blood tests confirm the presence of HIV antiretroviral treatment should be provided. Triple combination therapy is optimal in lowering viral loads. A caesarean section ought to be performed to limit blood exposure. Breastfeeding is preferable in low and middle income countries but not in industrialised nations.

## **Global Prevention of HIV Transmission – Final Thoughts and Future Prognosis**

Since the emergence of HIV as a major pathogen in the 1980s there have been over 25 million AIDS-related mortalities (UNAIDS, 2010). Encouragingly it appears that prevention efforts are finally beginning to inhibit growth of the epidemic and global incidence rates have recently stabilised (WHO, 2007). More effective treatment prolongs patient's lives but it also increases the worldwide burden of disease. This can have devastating consequences for the already fragile economies of many low income countries. A generalised HIV epidemic has serious implications for a nation's labour force, investment potential and GDP (The World Bank, 2010). To curtail the socioeconomic impact of HIV/AIDS governments should adopt policies which have previously demonstrated their effectiveness in other countries. The distribution of condoms to CSWs in Thailand led to dramatic decreases in transmission rates during the 1990s (WHO, 1990). A pragmatic approach would be to implement this strategy with local adaptations. The majority of viral acquisitions in Sub-Saharan Africa occur via sexual means. Human rights based approaches and the empowerment of women could help to significantly decrease incidence rates in this region. Ideally STD testing and medical care should be readily available to the populace. A highly active clinical detection system would minimise the transmission risk posed by super shedders, ulcerative diseases and acute infections. Male circumcision is recommended in areas with generalised epidemics. Resistance to antiretroviral therapy and associated administration costs will also challenge developing healthcare systems. Often 2nd line ARV treatment is up to ten times more expensive and less obtainable than first choice agents (WHO 2, <https://assignbuster.com/describe-global-distribution-of-hiv-health-and-social-care-essay/>

2008). Within Western Europe and North America there has been a recent resurgence in cases amongst homosexual men. High risk groups such as CSWs and MSM should be targeted for behavioural change and sustained educational interventions. Massive decreases in sexually transmitted HIV infections may soon be achievable with the development of microbicides and pre-exposure prophylaxis. Harm reduction policies must be applied across Central Asia and Eastern Europe to impede the world's fastest growing epidemic. In this region interventions to prevent IDU transmission should consist of needle exchanges, safe injection facilities and peer mentoring. Opiate substitutes and counselling would further diminish risk taking behaviour. A more generalised pattern of infectious cases will emerge of HIV transfer as the epidemic progresses in the region. Hospitals should follow strict hygiene protocol and universal precautions to avoid iatrogenic infection. Furthermore syringes must be sterile and medical waste appropriately disposed of. It is preferable that blood donations are non-remunerated and screened for transfusion transmissible pathogens. Currently 53% of HIV positive pregnant women in developing nations receive antiretroviral treatment (UNAIDS, 2010). Future global elimination of mother to child transmission is achievable with increased provision of triple combination therapy, caesarean sections and prenatal clinics (ITPC, 2009). Antiretroviral therapy has helped to convert HIV from a fatal condition to a lifelong morbidity. In the future the efficacy of these agents must be sustained and augmented by sensible structural policy. Further reductions in HIV incidence rates are entirely possible with the implementation of comprehensive evidence-based prevention programmes.