

AN ABSTRACT OF THE THESIS OF

Nicole Amanda Dzialowy for the degree of Bachelor of Arts in International Studies in Microbiology presented on June 2, 2008. Title: Acquired Immunodeficiency Syndrome (AIDS) Epidemic and Human Immunodeficiency Virus (HIV) Treatments in France and the United States

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For the past twenty-seven years, Human Immunodeficiency Virus (HIV)/Acquired Immunodeficiency Syndrome (AIDS) has become a worldwide pandemic. Due to the properties of HIV, such as its fast replication rate and error-prone reverse transcriptase, researchers have been unsuccessful in finding a cure or vaccine. Researchers have, however, developed a treatment regimen that has been successful in prolonging the lives of thousands. Two first world countries where this disease continues to be a problem are France and the United States (U.S.). Both countries have had major breakthroughs with research since the 1980's, but how is each country responding to treating their patients? Results show that around thirty percent of HIV/AIDS patients of HIV/AIDS patients in France, and thirty percent of HIV/AIDS patients in the U.S. do not receive HAART. This is due to the cost of the treatment, healthcare problems, and social stigma still attached to being seropositive. Therefore, there is room for improvement in both countries in the way they manage treatment for HIV patients.

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Acquired Immunodeficiency Syndrome (AIDS) Epidemic and Human Immunodeficiency Virus
(HIV) Treatments in France and the United States

by

Nicole Amanda Dzialowy

A THESIS

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Approved:

Thesis Advisor (Microbiology Department)

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I understand that my thesis will become part of the collection of Oregon State University. My signature below authorizes release of my thesis to any reader upon request. I also affirm that the work represented in this thesis is my own work.

Nicole Amanda Dzialowy, Author

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Dedication

I would like to dedicate this thesis to all of those families and friends who have been touched by HIV/AIDS. With all the hopes in finding a cure!

Introduction

“The drama of AIDS threatens not just some nations or societies, but the whole of humanity. It knows no frontiers of geography, race, age or social condition (calling) for a supreme effort of international cooperation on the part of government, the world medical and scientific community and all those who exercise influence in developing a sense of more responsibility in society.”
Pope John Paul II, Visit to Tanzania, 1990

In the 1980's, Acquired Immunodeficiency Syndrome (AIDS) hit the world by storm. Due to the social stigma associated with AIDS (mainly sexual orientation) at that time, research and funds were not considered a priority for this emerging disease. However, a breakthrough came in 1983 with the discovery of the pathogen that causes AIDS, Human Immunodeficiency Virus (HIV) accredited to both Dr. Robert Gallo, director of the National Cancer Institute in the United States of America, and Dr. Luc Montagnier, leading virologist from the Pasteur Institute in France. AIDS occurs as the result of deterioration of the immune system due to HIV infection, which can remain dormant within the patient for many years.

HIV/AIDS has not left any country untouched. This disease, through either contracting the virus or knowing a friend or family member with the disease, has affected millions of people throughout the world. Due to the virus' global distribution and lack of a vaccine or cure research has become a hot topic. Today two first world countries contribute to the ongoing field of HIV/AIDS research, France and the U.S., but HIV still a major health concern. These two countries have very different social and political avenues, such as healthcare, in combating this virus within their respective borders. By exploring the policies, systems, and social stigmas governing HIV/AIDS treatment between France and the U.S., one can see how each country has managed to respond to the AIDS epidemic.

Background

Before understanding how the treatment is effective and if the system for treatment works, it is necessary to know more about the virus itself, the history of HIV/AIDS in both France and the U.S., and history of HIV/AIDS treatment. With this background knowledge, it will be easy to comprehend the efficacy and/or problems of the current treatment in these two countries and apply the best approach to those who lack a system of treatment.

Human Immunodeficiency Virus (HIV)

HIV is a retrovirus in the family *Retroviridae*, and contains dual single-stranded ribonucleic acid (RNA) genomes that replicate through a deoxyribonucleic acid (DNA) intermediate using reverse transcriptase (RT). HIV is in a subcategory known as lentivirus, or slow virus (Matthews, 2003). In general, the course of infection with lentiviruses is characterized by a long interval between infection and the onset of symptoms, averaging about seven to eight years (Matthews, 2003).

Although the virus was not discovered until the early 1980's, there are reports that show HIV infecting humans in central Africa in the late 1950's, or even as far back as the 1930's (Prescott et al., 2005). Researchers believe that HIV is the result of a zoonotic transfer from African monkeys to humans. Genomic evidence from a study conducted by Dr. Beatrice Hahn and colleagues in 1999 reveals that the Simian Immunodeficiency Virus (SIV) found in chimpanzees in West Africa is genetically related to HIV-1 (Doepel, 1999). The current belief among researchers as to the first human contraction of HIV is through exposure to infected chimpanzee blood while hunting bush meat (Doepel, 1999).

AIDS is caused by two distinct, but related, viruses, HIV-1 and HIV-2. HIV-1 is more prevalent in the world than HIV-2 and contains three known subgroups. Group M (major) is the predominant form of HIV-1, group N (new) was discovered in Cameroon in 1998 and is extremely rare, and the last subtype, Group O (outlier) is restricted to west-central Africa (Noble, 2008).

While HIV-1 is genetically related to SIV from chimpanzees, SIV from sooty mangabeys is similar to HIV-2. This subtype of HIV is predominantly found in West Africa, closely associated with the habitat of the sooty mangabeys (Strauss et al., 2008). For patients with HIV-2, immunodeficiency seems to develop more slowly and to be milder compared with persons infected with HIV-1 (CDC, 2007). There is no current way to test the viral load¹ of patients with HIV-2 (Cichoki, 2007). Because HIV-2 has presented a far lower public health concern than HIV-1, this thesis will focus on AIDS caused by HIV-1.

Structure of HIV-1

There are two copies of the single-stranded viral RNA in the core, along with RT (seen in orange of Figure 1) and integrase (Prescott et al., 2005). RT is important in converting the single-stranded RNA genome into a DNA intermediate while integrase is involved in integrating the viral DNA into the host genome in the nucleus resulting in the provirus form of the genome (Strauss et al., 2008).

¹The number of viral particles in a sample of blood plasma. HIV viral load is increasingly employed as a surrogate marker for disease progression (Bio-online, 2005).

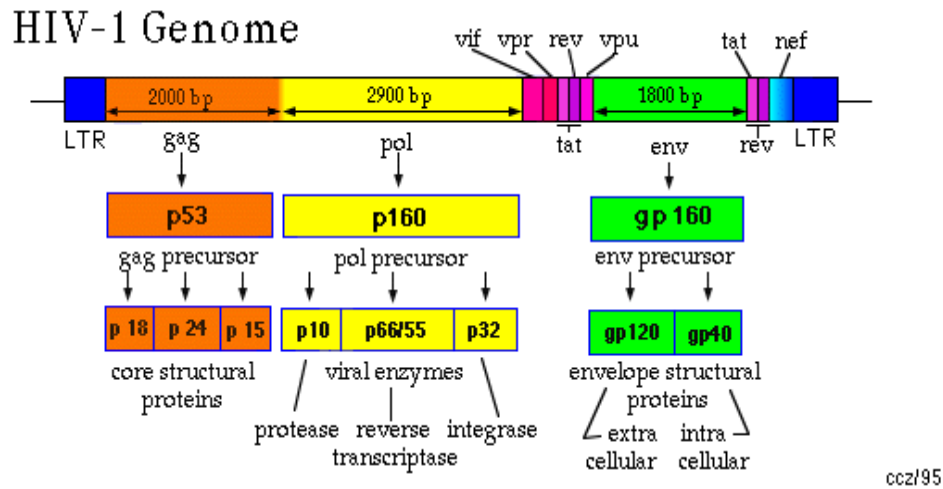


Figure 2. Structure of HIV-1 genome (Yale University, 1998)

HIV-1 needs four genes in order to properly function, *gag*, *env*, *pro*, and *pol*. *Gag* (group-specific antigens) codes for proteins that make up the structural core of the virion. Also located in the core, the nucleocapsid is comprised of four proteins, p25 (capsid protein), p17 (matrix protein), p9, and p7 that surround the RNA. *Env* (envelope) codes for glycoproteins gp 120 and gp41 found on the surface of the viral envelope (Strauss et al. 2008). The two other genes are *pro*, which codes for the protease responsible for cleaving the *gag/pol* complex to produce mature proteins, and *pol*, needed to encode for the RT, integrase and RNase H (Strauss et al., 2008). After replication of the RNA genome into double-stranded DNA, both ends contain a sequence known as long terminal repeat (LTR). This sequence acts as a switch to control the production of new viruses and can be triggered by proteins from either HIV or the host cell (Matthews, 2003). Accessory proteins (Vif, Vpr, Tat, Rev, Vpu, and Nef) are also expressed in the viral genome. *Vif* codes for the viral infectivity factor, needed for the spread in macrophages, and *vpr* augments replication. *Tat* is required for replication, *rev* regulates splicing/RNA transport, *vpu* helps virion assembly and release from host cell (CD4⁺ T-helper cells), and *nef*

down regulates $CD4^+$ T-helper cells. The T-helper cells are key players in both cell-mediated and humoral immune response (Strauss et al., 2008).

The virus is coated by gp 120 and gp41, which facilitate entry into the host cell. Gp 120 protrudes from the viral envelope and is a surface protein, while gp 41 is a transmembrane protein, embedded in the lipid membrane (Figure 2; Strauss et al., 2008).

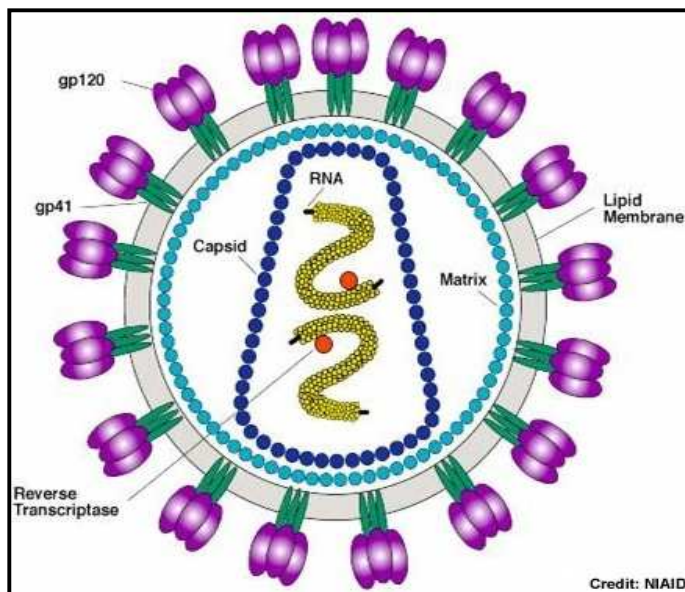


Figure 2: Structure of HIV-1 (National Institute of Allergies and Infectious Disease, 2007)

Replication Cycle

Like every virus, HIV needs a host to survive. It is an obligate parasite because it cannot replicate or reproduce on its own (Strauss et al., 2008). HIV uses the host cell's machinery to go through transcription (DNA-directed RNA synthesis) and translation (RNA-directed protein synthesis), in order to make progeny (daughter cells). The virus attacks the immune system, slowly decreasing the number of $CD4^+$ T-helper cells as the infection progresses. $CD4^+$ T-helper cells specifically express the CD4 receptor that gp 120 of the virion targets (Prescott et al., 2005).

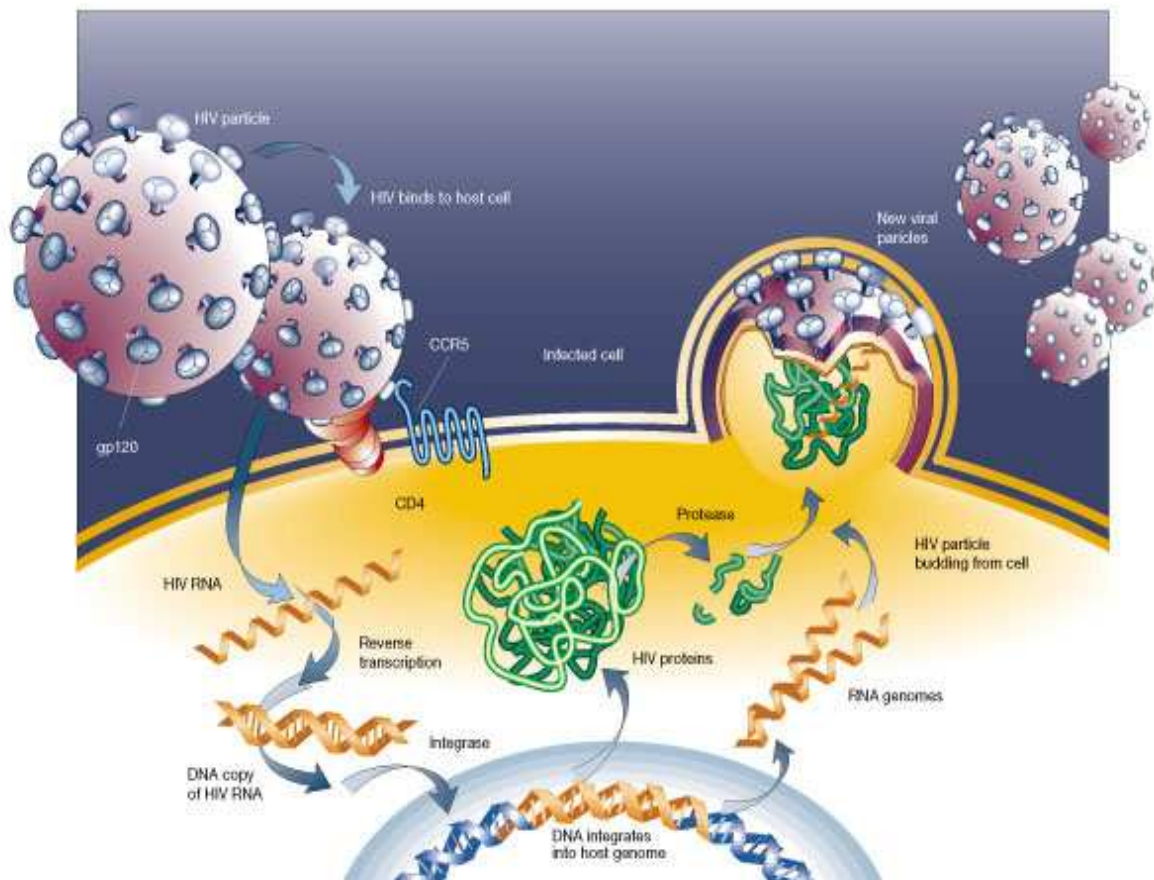


Figure 3: HIV Replication Cycle in Host Cell (Weiss, 2001)

Gp41 fuses viral and host cell membranes together by binding the CD4⁺ receptor (host cell) to gp 120 (virus). A co-receptor is also needed for fusion, either CXCR4 found on T-helper cells, or CCR5 found on dendritic or macrophage cells (Figure 3). Once the viral RNA is in the interior of the newly infected cell, reverse transcription of the RNA begins, with RT. The double-stranded DNA product is then transported to the nucleus where it is integrated into the host genome with the aid of the viral enzyme integrase. The form of HIV embedded in the host genome containing the viral DNA is termed a provirus (Prescott et al., 2005). The virus can now be replicated, using the host cell's transcription process (Figure 3).

Messenger RNAs (mRNA), including the full-length genomic RNA, are produced, and then transported from the nucleus to the cytoplasm. In the cytoplasm, translation occurs, producing new viral proteins and enzymes (Matthews, 2003). Assembly of the virions follows, and the newly packed, newly replicated virions are ready to exit the cell. The virus buds and is ejected outside the cell, furthering infection. Viral budding is the process in which a newly replicated virus is ejected from the host cell in search of new host cells to infect (Prescott et al., 2005).

Immune Response

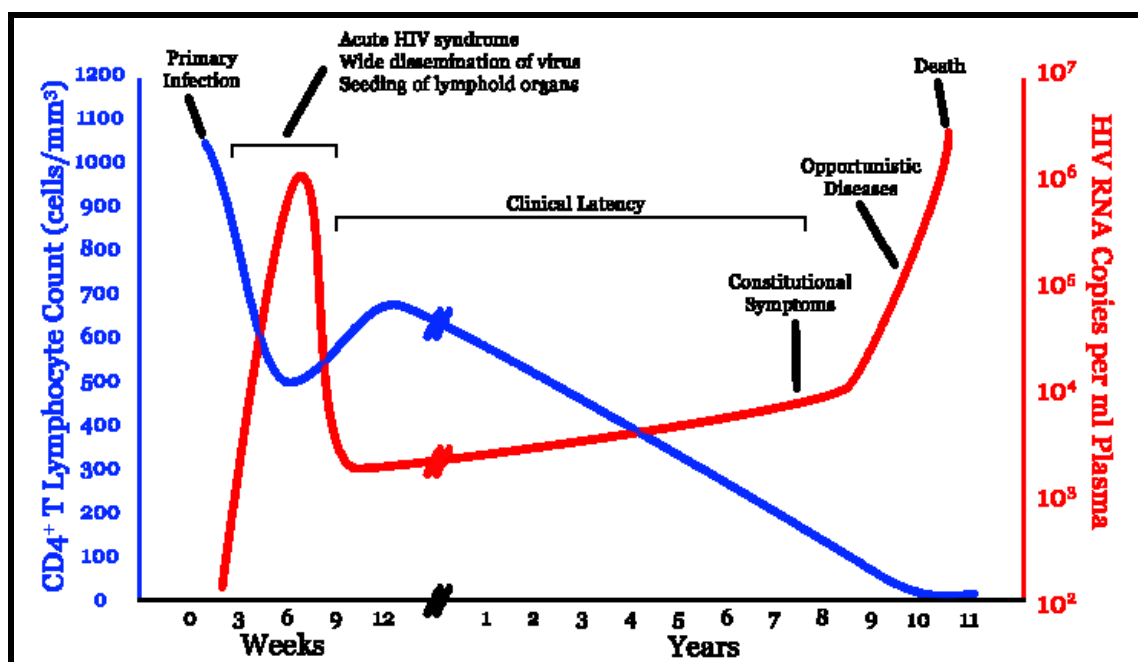


Figure 4: Course of HIV-1 Infection (Biotechnology Encyclopedia, 2005)

What will be described in this section is the course of infection with no interference from antiretroviral treatments. With the antiretroviral treatment, which prolongs the infection process by interrupting the viral processes in the host cell, the time of infection is different. There are four distinct stages of HIV infection (Figure 4). The first stage is known as primary HIV

infection and lasts anywhere from two to eight weeks. During this stage, the virus infects a CD4⁺ T-helper cell, dendritic cell, or macrophage. The viral load of HIV is extremely high, around 10⁶ copies/ml, and the host cells infected are dying, leading to a decrease in CD4⁺ T-helper cells. However, the host's immune system fights off the initial infection. By week twelve, the levels of CD4⁺ T-helper cells begin to increase, as the copies/ml of HIV decrease and remain around 10³ (Figure 4).

The next stage is the subclinical infection, also known as the asymptomatic stage, and can last on average seven to eight years (Figure 4). There are no symptoms of infection, and the virus levels are low, but one can still be tested for HIV during this stage. Even though the immune system fought off the primary infection, the virus remains in the lymph nodes, replicating and inducing swollen lymph nodes (Prescott et al., 2005).

Pre-AIDS is the third stage of infection. This stage is predominant for a couple of years (Figure 4). The virus leaves the lymph nodes, enters the blood stream, and infects more CD4⁺ T-helper cells. Only mild symptoms present themselves, such as fever, diarrhea, and weight loss (Prescott et al., 2005). However, the immune system is not working properly, and one can become susceptible to opportunistic infections, such as certain bacterial infections, Kaposi's sarcoma, cytomegalovirus (CMV), and *Pneumocystis carinii* (Strauss et al., 2008).

The fourth and final stage of infection is AIDS. This is defined by having less than 200 CD4⁺ T-cells/ μ l of blood. An AIDS patient continues to contract opportunistic infections because of the malfunctioning immune system, and normally dies from these infections, which a healthy immune system would normally fight off. Death occurs around ten years after initial infection, when it goes untreated. Throughout all four stages, the patient is able to transmit HIV to another person.

Transmission

HIV is a blood-borne pathogen and can be transmitted by bodily fluids, including blood, semen, and breast milk. There are several ways HIV can be transmitted from one person to another. The ways one can become infected with HIV are exchange of bodily fluids through sexual contact with an infected person, sharing needles/syringes (occurring mostly with drug users), and through blood transfusions containing infected blood. Another common way HIV is transmitted is from mother to baby, during labor and breast feeding. There are myths concerning modes of transmission with HIV. Saliva and tears do contain a small amount of the virus in infected people, but too little to actually infect someone else (Matthews, 2003). Insects have also come into question in being potential carriers of the virus. Studies have been done to show that if an insect bites an infected person, it cannot pass on the virus.

Testing

Testing for HIV is very simple, accurate, and in most circumstances confidential and anonymous testing is available in both France and the U.S. (Le Vu et al., 2006; American Association for World Health, 1998). One can get tested at most hospitals, family planning clinics, county health departments, doctors' offices, and drug treatment facilities (American Association for World Health, 1998). Enzyme-linked immunosorbent assay (ELISA) is more than 99.9% accurate. The blood is added to a plate coated with HIV antigens, usually p24 and gp 41. If one is seropositive, the serum will contain antibodies, like IgG, against the antigens and binding will occur (Prescott et al., 2005). The Western blot is also used, after the ELISA test has been completed, to confirm that the blood is indeed positive. This is done by washing the

serum sample on a membrane, loaded with HIV antigens (p24 and/or gp 41). A visible band will appear if the HIV antibodies bind to the antigens, confirming that the patient is seropositive.

Just recently, the FDA approved four new tests that have been developed to have the results available in twenty minutes. The new test is known as the Rapid HIV test (Greenwald et al., 2006). “Providing greater access to testing, prevention, and care services for persons living with HIV can reduce the number of new infections and lead to reductions in HIV-associated morbidity and mortality” (Greenwald et al., 2006).

History of HIV/AIDS in France and the U.S.

1981-1986: The Early Years

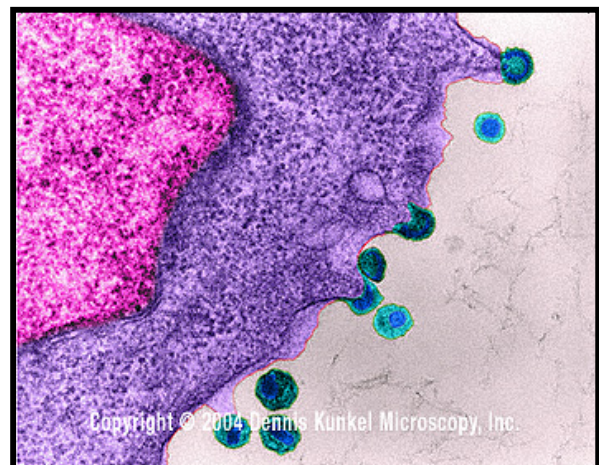
The first cases of AIDS were reported in the U.S in 1981. The Centers for Disease Control and Prevention (CDC) became aware of patients with strange cases of cancer, primarily in middle-aged homosexual men in New York and San Francisco. One thing in common with these patients was that their immune system deteriorated and their T-cell counts were very low (Behrman, 2004). The first article of the new disease was published by the CDC in their *Morbidity and Mortality Weekly Report* (MMWR) in June 1981 (Shilts, 1987). Between 1981 and 1982, nothing could be done for the patients. The doctors where unable to treat the patients, who were presenting themselves with rare diseases, and the CDC was not able to find out what was causing the T-cell decrease, how people were getting it, or how many people were infected (Behrman, 2004).

The first cases in Europe were reported in France. It was not initially seen as a problem because the syndrome wasn't well known in the country. Dr. William Rozenbaum read the CDC's MMWR from June 1981 that reported information of a new disease turning up in San

Francisco and New York. He was treating a few patients who showed similar symptoms (Shilts, 1987). Out of the seven patients showing these mysterious symptoms, two of them were women. This first showed that this new disease was not only in the male homosexual population (Shilts, 1987). He went to the Pasteur Institute in Paris to ask for their help to research this unknown disease. Through the Department of Retroviruses and Cancer, the team, led by Dr. Luc Montagnier, began to research this mysterious disease (Shilts, 1987).

In 1982, this new infection was labeled the “gay plague.” The CDC wondered if the outbreak was related to the homosexual lifestyle, such as intravenous drugs and multiple sexual partners (Shilts, 1987). The homosexual community was already seen differently, but this just added to the social stigma. With the conservative President Ronald Reagan administration, this new disease, Gay Related Immunodeficiency Disease (GRID), was not a favorite target for support or something that was readily acknowledged (Shilts, 1987).

After numerous non-homosexuals, including hemophiliacs and intravenous drug users, showed the same symptoms as the patients with GRID, the CDC renamed the syndrome AIDS in August 1982. Later that year, the CDC was able to identify that blood was the medium for transmission of the still



HIV (light blue/dark blue) budding from lymph cell membranes (purple) (Hunt, 2007)

unknown pathogen that causes AIDS (Bayer, 1999). Although the CDC’s MMWR was reporting non-homosexual deaths by AIDS, such as of hemophiliacs, officials at the blood banks responded to the public with reassurance stating that the risk of contracting AIDS from blood in

the blood bank was minimal (Bayer, 1999). They also refused to exclude homosexual donors and screen for the pathogen causing AIDS. The blood banks reported that the test that existed lacked merit, and they did not even know what they would be looking for if they screened (Bayer, 1999).

President Reagan avoided talking about AIDS and even cut the budget for the Department of Health and Human Services (HHS) by twenty-five percent by 1983 (Behrman, 2004). President Reagan did not mention the disease until 1987, due to his conservative beliefs. This made it very difficult for the CDC to research AIDS. They were forced to borrow lab equipment from other labs in order to carry out certain tests that they needed to do to find the virus (Shilts, 1987). Most of the initial AIDS research occurred in two labs: Dr. Gallo's in the U.S. and Dr. Montagnier's in France. Dr. Montagnier received cell biopsies from Rozenbaum by the end of 1982. Rozenbaum thought to biopsy cells in the lymph nodes because it is a more accurate indicator of illness.

Researchers at the Pasteur Institute were having a difficult time keeping the cell cultures alive (Shilts, 1987). The virus was continuing to grow and taking over the culture destroying the cells. They tried to feed the culture, adding additional white blood cells to keep the culture alive.

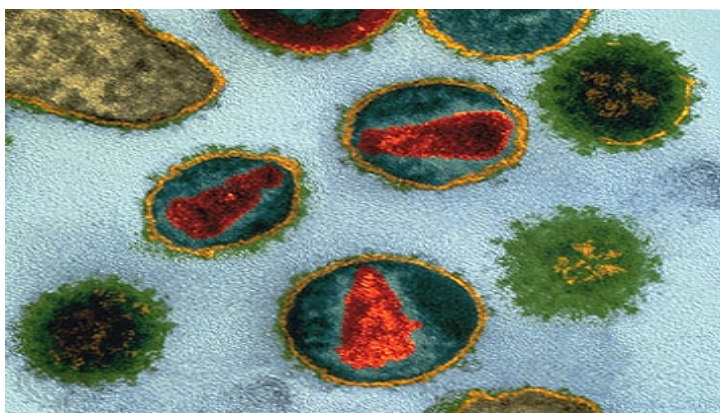


Figure 5: Electron Microscope picture of HIV-1 at 24,000x magnification (Encyclopedia Britannica Online, 2008)

Three weeks later, they finally had a successful culture and were able to isolate a virus and determine that it was in fact a retrovirus in January of 1983 (Shilts, 1987).

This was the first time the new virus that causes AIDS was

isolated (Shilts, 1987). After looking at it under an electron microscope, they soon realized that it was unlike any other virus that was known (Figure 5). Gallo thought that it would be related to of the Human T-Lymphotropic Virus (HTLV), a retrovirus that can cause certain types of leukemia, which he discovered this in 1980 (Shilts, 1987). Montagnier was hesitant to call it that, so they named it RUB which was a rearrangement of the initials of one of the AIDS patients (Shilts, 1987).

In June of 1983, the French team renamed the retrovirus they found Lymphadenopathy Associated Virus (LAV) (Shilts, 1987). They wanted to confirm their findings, so they sent the antibodies they had isolated to Gallo's lab in the U.S. At the same time, Dr. Gallo's team in the U.S. was working on isolating the unknown virus. By Christmas of 1983, Dr. Gallo's team had isolated a retrovirus. LAV and the virus Dr. Gallo isolated were very similar, but Dr. Gallo thought it was related to the HTLV he had discovered earlier in the decade, so he named it HTLV-III (Shilts, 1987).

In April 1984, Dr. Gallo announced the discovery of the virus that causes AIDS and named the virus HIV. This announcement did not give any credit to the Pasteur Institute and sparked a big debate about which lab discovered the virus first. To the French, it seemed as though Gallo made it sound like all of the work was done by his lab (Shilts, 1987). Up until this point, *le SIDA* (AIDS in French) was not nationally known, not even the French discovery of virus. When the debate of who discovered the virus first came about, the French population started learning more about the virus and new disease because their nation's pride was at stake (Steffen, 1993). The debate did not end until until former President Reagan and former French President Jacques Chirac met in person at the White House in 1987. It marked the first time in

science that the heads of state were called to resolve an issue. Today, both labs are “co-discoverers” of HIV (Shilts, 1987).

Gallo was able to grow more of the virus and develop an antibody test for testing blood in June of 1984 (Shilts, 1987). Later that month, the first international AIDS conference was held in Atlanta, Georgia and hosted around 2,000 scientists. After the discovery in 1983, France started setting up funds for more research. The European regional World Health Organization (WHO) Center for AIDS in late 1984 was established in Paris. After researchers found the virus causing AIDS, both governments in France and the U.S. were able to say that they were going to start testing the blood in the blood banks for antibodies (Bayer, 1999). The U.S. blood bank testing began in April 1985 and was a success in testing for HIV in the blood (Bayer, 1999). In France, the Pasteur blood test was developed experimentally during 1984 and large-scale screening started in the spring of 1985 (Steffen, 1993).

In February 1986, the Pasteur Institute isolated the second AIDS-like virus, which was later named HIV-2 (Matthews, 2003). The Second International Conference on AIDS was held in Paris in June 1986. It was here where the French and American researchers reached a compromise about naming the virus HIV (Steffen, 1993).

History of HIV/AIDS Treatment

As of 2006, there are thirty antiviral drugs that have been approved by the FDA (National Institute of Allergies and Infectious Diseases [NIAID], 2007). There are four major categories of antiviral drugs: protease inhibitors, reverse transcriptase (RT) inhibitors, integrase inhibitors, and fusion inhibitors (Figure 6).

Protease inhibitors interfere with protease, the enzyme responsible for cleaving the precursor polypeptide gag-pol. By inhibiting this enzyme, cleavage does not occur and viral particles cannot assemble correctly (Dolin et al., 1999). Some examples of protease inhibitors are: Saquinavir, Ritonavir, Indinavir, and Nelfinavir. Saquinavir was the first protease inhibitor approved by the Food and Drug Administration (FDA) in December 1995 (AIDSinfo, 2007).

RT inhibitors are divided into two sub-categories. The first category is nucleoside/nucleotide RT inhibitors (NRTI). NRTIs block the RNA genome from replicating by incorporating a nucleoside/nucleotide analog² in the newly replicated viral DNA. This does not allow for further elongation and replication is terminated (Dolin et al., 1999). A few NRTIs include Zidovudine, also known as AZT, didanosine, and zalcitabine (Dolin et al., 1999).

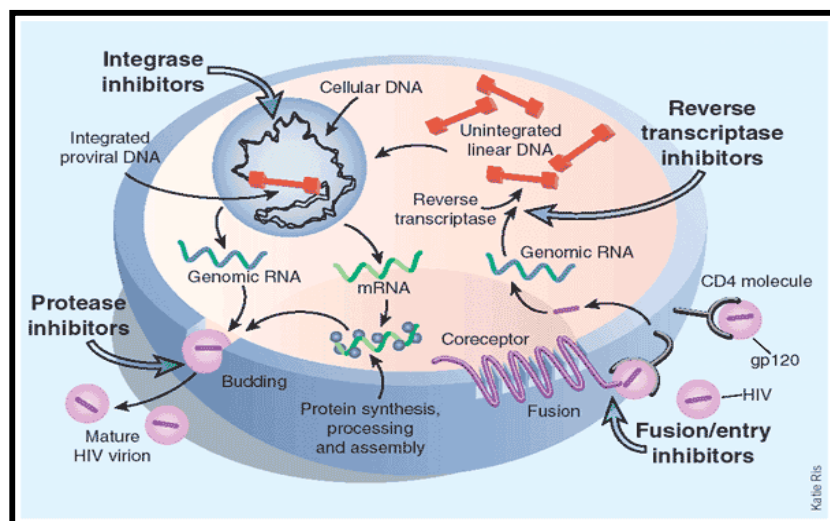


Figure 7: Four Different anti-HIV treatments and their targets (The Biology Project, 2000).

There are also non-nucleoside/nucleotide RT inhibitors (NNTRI) that bind to RT. These antiviral drugs bind directly to the RT in a hydrophobic pocket adjacent to the catalytic site of

² Analogs have similar molecular structures to nucleotides (deoxyribose or ribose sugar, a base (uracil, guanine, thymidine, adenine, and cytosine), and a phosphate group) or nucleosides (deoxyribose or ribose sugar and a base).

RT. This leads to a conformational change of RT, which is unable to copy the viral RNA to DNA (Dolin et al., 1999). Nevirapine, delavirdine, and abacavir are examples of NNRTIs (Dolin et al., 1999).

Integrase inhibitors and fusion inhibitors are fairly new discoveries. Integrase inhibitors are antivirals that block the enzyme integrase from incorporating viral DNA into host DNA. Fusion inhibitors do not allow the virus to fuse with the host cell's membrane to initiate infection (NIAID, 2007).

In 1995, there was a breakthrough in HIV/AIDS research. Rather than being the work of any single group, the development of highly active antiretroviral therapy (HAART) was seen to be attributed to a long string of discoveries by multiple groups and individuals of medications that worked against other retroviruses, beginning in the 1970's. Major contributions came from people working in basic science, biochemistry, drug development, and clinical testing in dozens of institutions and companies. It was only through these collective contributions that the success heralded in the mid-1990s came to be (Delaney, 2006). Instead of taking one drug such as AZT, to treat HIV, this treatment consisted of a combination of two to three antiviral drugs, known as triple therapy. It became approved by the U.S. Food and Drug Administration (FDA) that same year (Henkel, 1999). However, not everyone with HIV was able to access the treatment.

Material and Methods

The research for this thesis was done by using peer-reviewed journal articles, textbooks, reference books, and credible websites such as the WHO, CDC, and AIDES (a French non-profit organization). The sources were selected based on relevant content, publication year, and credibility.

The books were found by searching “HIV/AIDS,” either “U.S.” or “France,” and “HAART treatment” into the library databases at both the Benton County Library and the Valley Library at Oregon State University. Most of the books were used solely for the Background section, therefore some of these sources were over ten years old. The peer-reviewed journal articles were found by searching the online database EBSCO © through the library link at the Valley Library. The keywords that were searched here were “HIV/AIDS,” “Healthcare,” “Social Stigma,” “Medical Adherence,” and either “U.S.” or “France.” The articles were chosen based on content and also the most recent publication date and used for the Results, Analysis, and Conclusion sections.

The most current information concerning treatment was searched for using the search engine Google ©. Worldwide organizations like WHO and AIDES were used for the most up to date statistics of HIV/AIDS in both France and the U.S. The same keywords written above were used to search online. Images were also searched for using Google ©. Some information concerning France was difficult to find, and therefore the U.S. counterpart was omitted because this is a comparative thesis.

Results

Despite having over twenty-seven years of HIV/AIDS research and treatment, this disease remains prevalent in France and the U.S. Research is ongoing, yet there still remains no vaccine or cure. “Of the 40 million people worldwide infected with HIV, an estimated 6 million are in need of immediate, life-sustaining antiretroviral therapy. Yet, fewer than 400,000 people in low- and middle-income countries have access to such treatment” (Curran et al., 2005).

With regards to HIV/AIDS, there are similarities and differences when comparing the treatment regimens and monetary aid in both countries. The U.S. has a bigger population, a higher prevalence rate, more cases of HIV/AIDS, and more deaths per year than France (Table 1). The percentage written in the parentheses are the values of number of total number of cases, deaths per year, and number of new cases per year divided by the total population of each country. It is clear to see that the U.S. has higher incidences in all cases per total population. The subtype of HIV-1 prevalent in both countries is the same, however in recent years, more non-B subtypes have been documented (Infectious Disease Society of America, 2005; Couturier et al., 1998). There are about 1,120,000 cases of HIV/AIDS in the U.S., and 130,000 cases in France. There are more reported cases of HIV-2 in France than in the U.S. There are only seventy-nine total reported cases in the U.S., while there were between 3,000 and 4,000 cases of HIV-2 in France in 1996 (CDC, 2007; Cazein, 1996). In fact, France has the second highest prevalence rate of HIV-2 patients in Europe, the first being Portugal (Cazein et al., 1996). HIV-1 still remains the most dominant form of HIV in both countries.

Table 1: Present Data Concerning HIV/AIDS in the U.S. and France

	U.S.	France
Total Population (2007 estimate)	301,139,947 ¹	63,713,926 ¹
HIV/AIDS Prevalence (%)	0.6% ²	0.4% ³
Number of Cases of HIV/AIDS (2006 estimate)	1,120,000 ² (0.37%)*	130,000 ³ (0.20%)*
Death per Year (2006 est.)	16,000 ² (0.005%)*	1,500 ³ (0.002%)*
Number of New Cases/Year	39,000-42,000 ⁴ (0.00013%)*	6,000-7,000 ⁵ (0.000094%)*
Percentage taking Antiretroviral Therapy (ART) (2006)	70.1% ⁶	68.2% ⁷
Type of Health Care	Combination of public and private providers ⁸	Public Health Insurance (universal health care) ⁹
Number of HIV-2 Cases	79 ¹⁰	3,000-4,000 ¹¹
Subtype of HIV-1 Prevalence	HIV-1 B ¹²	HIV-1 B ¹³

*=percentage/total population

¹Central Intelligence Agency: The World Fact Book, 2007

²WHO Fact Sheet U.S., 2006a

³WHO Fact Sheet France, 2006b

⁴CDC, 2004

⁵AIDES, 2006

⁶Cunningham et al., 2000

⁷WHO, 2006c

⁸Chua, 2006

⁹Couffignal, 2001

¹⁰CDC, 2007

¹¹Cazein et al., 1996

¹²Infectious Disease Society of America, 2005

¹³Couturier et al., 1998

Healthcare

One important difference is each country's health care system, which plays a crucial role in a patient's treatment. The U.S. health care system is a combination of private and public entities that supply insurance as well as other medical needs (Chua, 2006). Unlike the U.S., France has a universal health care system regulated by the state (parliament, the government, and ministries) and the statutory health insurance funds (WHO, 2006d). Both systems provide monetary aid for HIV/AIDS patients, but which provides more for its people?

The U.S.

Health coverage is provided by a wide range of public and private sources. Public sources include Medicare, Medicaid, federal and state employee health plans, the military, and the Veterans Administration (Claxton, 2002). Private health care consists of two divisions, those that are state-licensed, and those that are purchased privately by the individual. The state-licensed include commercial insurers, Blue Cross/Blue Shield plans, and health maintenance organizations, also known as HMOs (Claxton, 2002). Around 162 million non-elderly Americans are insured through employer-sponsored health insurance, while 12 million Americans end up buying private insurance directly (Claxton, 2002). A study conducted by Bhattacharya et al. in 2003 stated that out of 2,466 HIV/AIDS patients, only thirty percent were privately insured. Of that thirty percent, only half of those patients received HAART treatment. However, HIV/AIDS patients with private insurance are more likely to be on HAART than patients with any public insurance coverage (Bhattacharya et al., 2003).

Medicaid and Medicare are the two leading programs of public insurance for HIV/AIDS patients. Medicaid received over \$6.3 billion from the federal government, making it the leading

plan for HIV/AIDS patients in the nation (Figure 7). Medicaid is a critical source of coverage for over 266,000 low-income Americans who have HIV/AIDS (Kates, 2006). Qualifying for Medicaid is restricted to those in the low-income bracket (family size of two making less than \$26, 000/year), and having a physical or mental disability (Kates, 2006; Animal Humane Association of New Mexico, 2008).

Patients with HIV/AIDS meeting the qualifications of Medicaid are usually in the advanced stages of disease (Bhattacharya et al., 2003). Medicaid requires states to cover certain services, which include: inpatient and outpatient hospital services, physician and laboratory services, and long-term care (nursing facilities and home health care for those entitled to nursing care). States receiving Medicaid funds must also provide aid for prescription drugs, including HAART therapies. Medicaid can also work with Medicare and help pay for Medicare premiums (Kates, 2006).

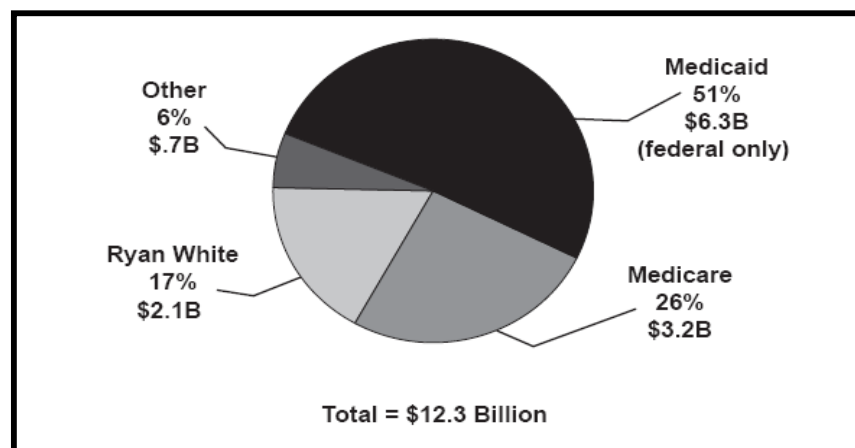


Figure 7: Federal Spending on HIV/AIDS by Program 2006 (Kates 2006)

Medicare is the second program that aids HIV/AIDS patients. In 2006, it received \$3.2 billion (twenty-six percent) of the federal spending allotted for HIV/AIDS programs, and approximately 100,000 people with HIV/AIDS are covered by Medicare (Kates, 2006). A study

found that more than eight in ten HIV/AIDS patients covered by Medicare were under the age of fifty, and approximately two-thirds were also covered by Medicaid (Kates, 2006).

Medicare was originally designed for those older than sixty-five, who automatically qualify for coverage. If an individual is under age, they can qualify if they are disabled, or have developed enough work credits to receive Social Security Disability Insurance (SSDI). Most people with HIV/AIDS are under sixty-five, have a disability (HIV/AIDS can be seen as a disability), and have received SSDI for two years (Kates, 2006). Medicare offers broad range of services through a four part system: part A covers inpatient and hospice expenses, part B helps pay the physician and outpatient fees, part C is primarily private plans, like HMOs, contracted with Medicare, and part D is the new outpatient prescription drug benefit (Kates, 2006).

There are also other public funds, besides Medicaid and Medicare that help patients with the medical costs of having HIV/AIDS. The Ryan White CARE Act developed in 1990, after the death of Ryan White, a thirteen year old who contracted HIV/AIDS through the nation's blood supply. The CARE Act funds primary health care and support services for people living with HIV/AIDS who lack health insurance and financial resources for their care (Ryan White, 2008). Another option is the AIDS Drug Assistance Program (ADAP). The programs vary from state to state, but generally help in paying for medication, screening, and with insurance premiums (The Network, 2007).

France

There are different programs designed to help Americans pay for medical costs, but France has a national program. In 2000, the WHO named France as having the best health care system in the world (Sandborn, 2006). “The fact that everyone is *prise en charge*³ by the French health care system acts as an expression of social values, a belief in basic health care as a right and that the state is responsible, rather than the corporate groups or individuals as in the U.S.” (Feldman, 1995). All legal French residents are covered by public health insurance, which is part of the *Securité Sociale* entitlement programs (Couffinhal, 2001). The *Securité Sociale* reimburses patients for seventy-five to one hundred percent of costs of care, including medication (Feldman, 1995).

Almost everyone in France is covered by one of three insurance schemes: general, agricultural or self-employed/non agricultural. Approximately eighty percent of the country's 60 million residents buy supplementary insurance to cover some or all of the remaining charges, while some low-income French residents get their co-payments covered by a free insurance scheme. Private payments cover around twenty-four percent of all health care spending (Sandborn, 2006).

As of 2002, the French system provided public payment for sixty-seven percent of pharmaceuticals prescribed, including HIV/AIDS medications (Sandborn, 2006). The French system has a more centralized control over health care and research resources, which is not the case in the U.S., where health care is decentralized and more in the private sector (Feldman, 1995). While France and the U.S. differ in their health care systems, treatment for HIV/AIDS is virtually the same.

³ *prise en charge* is French for taken in charge or taken in (Feldman, 1995)

Current HIV/AIDS Treatment

The WHO, alongside the United Nations (UN), provides evidence-based, technical support to member countries in order to enhance treatment, care, and prevention services with a broad health sector approach (WHO, 2008). Their main responsibilities are policy development, country support, securing adequate supply of HIV medicines, diagnostics, and other tools, monitoring the spread of HIV/AIDS on a global scale, and advocating for global commitment and attention to the HIV/AIDS pandemic (WHO, 2008). The WHO also provides a worldwide set of treatment guidelines for developed and developing countries combating HIV/AIDS. These countries must follow the treatment guidelines, but how they choose to implement them is left up to their central governments.

In the U.S., the CDC implements the regulations from the WHO and has its own regulations. As a part of its overall public health mission, the CDC programs work to improve treatment, care, and support for persons living with HIV/AIDS and to address the HIV/AIDS epidemic in the U.S. and around the world (CDC, 2008). In France, *l'Institut de veille sanitaire* (InVS) maintains surveillance of HIV/AIDS. Like the CDC, the InVS is responsible for the national surveillance of HIV in France, along with regulating treatment, care, testing, and blood bank surveillance (InVS, 2008).

Both the U.S. and France follow similar guidelines of types of therapies; however, there is a difference in the drugs chosen for the treatments. The most prescribed therapy consists either of one NNRTI and two NRTIs, or a PI and two NRTIs (Department of Health and Human Services [HHS], 2008). There are many factors that influence a specific treatment regimen. These include viral load, CD4⁺ T-helper cell count, drug resistance to treatment, and co-infection.

The French follow guidelines established by the European AIDS Clinical Society (EACS). The therapy consists of either an NNRTI or PI in combination with two NRTIs (Table 2). The two columns (A and B) represent the different categories of drugs, and in this figure, the drugs are named by their acronyms.

Table 2: European AIDS Clinical Society therapy recommendations for naïve HIV-infected patients (Clumeck et al., 2007)

Select 1 drug in A and 1 NRTI combination in B	Column A	Column B	Remarks
Recommended	<u>NNRTI</u>		
	Efavirenz	Abacavir/Lamivudine	Co-formulated
	Nevirapine	Tenofovir/Emtricitabine	Co-formulated
	<u>Ritonavir-boosted PI</u>		
	Fosamprenavir/Ritonavir		
	Lopinavir/Ritonavir		
	Saquinavir/Ritonavir		
Alternative	Atazanavir/Ritonavir	Zidovudine/Lamivudine Didanoside/Emtricitabine or Lamivudine	

Table 3: Recommended HAART therapies for naïve HIV-infected patient provided by the CDC (HHS, 2008)

To Construct an Antiretroviral Regimen, Select 1 from Column A + 1 from Column B			
	A		B
Recommended	<u>NNRTI</u>	Recommended	(Dual NRTI options)
	Efavirenz		Abacavir/Lamivudine (coformulated)
			Tenofovir/Emtricitabine
	<u>PI</u>		
	Atazanavir/Ritonavir		
	Fosamprenavir/ Ritonavir		
	Lopinavir/Ritonavir		
Alternative	<u>NNRTI</u>	Alternative (by preference)	Zidovudine/Lamivudine (coformulated)
	Nevirapine		Didanoside/Emtricitabine or Lamivudine
	<u>PI</u>		
	Atazanavir		
	Fosamprenavir/Ritonavir		
	Lopinavir/Ritonavir		
	Saquinavir/Ritonavir		

The CDC, along with the HHS, publishes the recommended therapies for the U.S. (Table 3). Like the French guidelines, there are two therapy options, using either a NNRTI or PI (column A) with NRTI (column B). The names of the drugs are listed under their respective categories, and the highlighted regions are additions made to the guidelines as of January 2008 (Table 3).

The success of the HAART therapy, since 1995, can be seen in both countries. In the

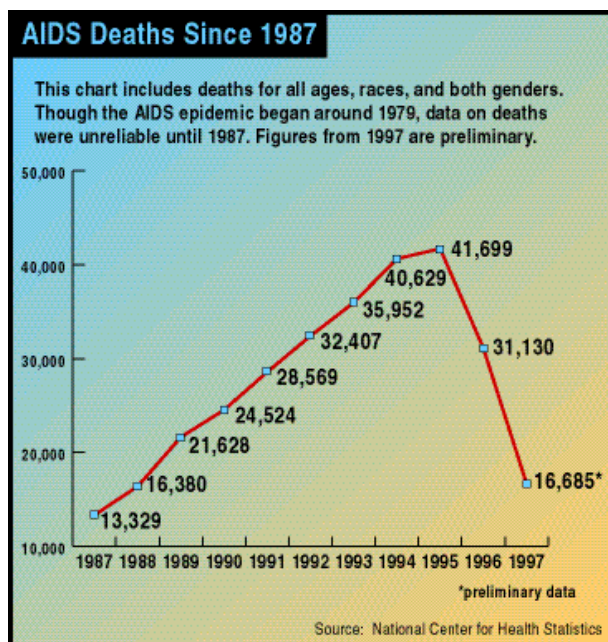


Figure 8: AIDS Deaths in the U.S. Since 1987 (Henkel, 1999)

U.S., AIDS death rates had dropped significantly, by forty-seven percent in 1997, a first since 1990 (Figure 8). Not even a year after it was introduced in the U.S., the death rates dropped by more than 10,000 people in 1996 (Figure 8).

HAART was not introduced in France until 1996, a year after it was introduced in the U.S. Factors that could explain the significant decreases in AIDS deaths were analyzed (under-reporting, new AIDS case definition,

HIV incidence), but the introduction of HAART has played the most important role.

Immunosuppression due to AIDS decreased by over thirty percent in late 1996 and by over twenty-three percent in 1997 (Cazein et al., 1998). The decline in AIDS deaths directly correlates to the introduction of HAART.

The evidence is overwhelming that the HAART therapies prolong the lives of HIV/AIDS patients. It's very effective in combating the virus, but with more than ten years on the market,

problems have begun to arise. Because of HIV's fast replication cycle and error-prone RT, the viral genome can mutate, leading to strains that can be resistant to the HAART.

HIV Resistance

The resistance of HIV to antiretroviral treatments, like HAART, is dependent on several factors, including patient adherence to therapy, mutation producing differences from the wild type) of the virus, and the efficacy of the antiretroviral treatment (Curran et al., 2005). Because HIV exists as a mixture of genomic sequences (quasi-species) rather than having a fixed genome, single mutants resistant to antiretroviral treatments can be present. Mutations become more frequent as the wild type continues to multiply, as the virus progresses in the host (AIDS, 2007).

This makes anti-HIV treatments ineffective in prolonging the onset of AIDS. Drug-resistant HIV-1 variants can still replicate well and be transmitted from person to person (Curran et al., 2005). Cross resistance, or HIV being resistant to one or more drug, does occasionally occur as well (AIDS, 2007).

Currently, there are two assays being used to test for HIV drug resistance. Phenotypic assays measure inhibition (or lack thereof) of viral replication in the presence of a given drug, while genotypic assays detect the presence of mutations in the viral genome. The genotypic assay is performed after the phenotypic assay to confirm the presence of mutations that lead to problems with drug inhibition of viral replication (Curran et al., 2005).

Because of the recent resistance to anti-HIV treatments, new drugs have been developed in the past few years to give doctors a bigger pool of drugs to choose from. Tipranavir (TPV) is a new protease inhibitor that was approved in 2005. It is effective against HIV that is resistant to many other protease inhibitors. When adding this new drug to an existing regimen, the viral load

was found to be undetectable (Tebas, 2007). Trials for the new drug were conducted all around the world. In France, a study was conducted to observe genetic mutations of HIV in response to TPV regimens. It was found that some mutations of the HIV genome do occur, and they are unique to TPV. This can explain the drug's activity against viruses that have protease-resistant mutations on the existing genome (Marcelin et al., 2007).

Even though resistance has occurred, HAART still remains the best solution for treating HIV/AIDS. New drugs are constantly being developed, and patients can live a fairly normal life being seropositive for HIV. The goal of developing a vaccine is still important in HIV/AIDS research, although researchers have been thus far unsuccessful.

Importance of a Vaccine

"Creating an HIV vaccine is one of the great scientific challenges of our time," says National Institute of Health (NIH) Director Dr. Elias A. Zerhouni (Ravilious, 2007).

Researchers have been working since the 1980's to develop a vaccine for HIV. A vaccine is a good long-term solution for HIV/AIDS (NIAID 2008). Vaccines work by stimulating the immune system to create antibodies and immune cells that recognize the pathogen, like HIV, and defend itself against it (Allen, 2007). The ideal vaccine for HIV would be less expensive than the current treatment, would be simpler to administer worldwide, and effective against all subtypes of HIV (NIAID, 2008).

In 2005, more than \$759 million were spent globally for a vaccine, eighty-eight percent of that coming from governments (Steinbrook, 2007). A vaccine has the potential to end the HIV/AIDS pandemic by preventing new cases each year, and having a big impact on economic development and political stability (NIAID, 2008). However, experiments have not been

successful in finding a potential non-toxic vaccine. There are many challenges that the scientists face when developing a vaccine for HIV. Genetic diversity and rapid changes of its viral envelope proteins is a major reason why vaccine development has been unsuccessful (Steinbrook, 2007). The surface protein, gp120 is heavily glycosylated, making the virus elude immune detection, and the destruction of the cells involved in the immune response are two other reasons why it has been so difficult (Strauss et al., 2008).

There is one hope for a successful vaccine, however. The only ongoing large study of an AIDS vaccine is being conducted in Thailand, where a strategy of "priming" the immune system with a live recombinant canary pox vector containing HIV genes and then "boosting" it with a recombinant gp120, thereby inducing an immune response both by CD8⁺ cells and CD4⁺. There are 16,400 HIV-negative adults involved in this study that started in 2003 and will continue until July 2009 (Steinbrook, 2007).

Most recently, two drug trials, STEP and Phambili, which used an adenovirus adjuvant, have been halted since September 2007. The trials were both stopped when researchers observed that the vaccine was more harmful than helpful (Brown, 2008). Over \$32 million were spent on these two programs, sponsored by Merck & Co. After moving into human trials, the potential vaccine that worked in mice became harmful to humans, and could have increased their risk for HIV (Brown, 2008).

Both France and the U.S. continue to fund vaccine research. However, the current HAART therapy has been successful in limiting the number of AIDS deaths around the world and has helped AIDS patients' quality of life. It might even be the only solution for the time being in treating HIV/AIDS patients because the vaccine trials have been so unsuccessful. According to Dr. Anthony Fauci, director of NIAID, "To be brutally honest with ourselves, we

have to leave open the possibility . . . that we might not ever get a vaccine for HIV. People are afraid to say that because they think it would then indicate that maybe we are giving up. We are not giving up. We are going to push this agenda as aggressively and energetically as we always have. But there is a possibility — a clear finite possibility — that that's the case" (Steinbrook, 2007).

Analysis

Despite the fact that successful development of a vaccine for HIV/AIDS is not in the near future, plenty of problems concerning current HIV/AIDS treatments need to be addressed.

About thirty percent of HIV/AIDS patients in both countries do not receive HAART therapies (Table 1). But, what are the factors that give rise to this number? There are many factors that could give rise to this alarming statistic: the cost of treatment, healthcare differences, and social stigma and patient adherence to medication.

Cost of HAART

How expensive is the current HAART and does that affect the percentage of people receiving treatment? Since HAART was introduced in 1995, it has prolonged the lives of many, and although there are many medications, the drug prices continue to increase. HIV/AIDS has become a treatable but expensive chronic disease, with annual expenditures per patient of \$19,400 in the U.S. and \$23,100 in France (Yasdanpanah, 2004). With these costs, it would be hard to afford living with HIV/AIDS without financial assistance. As a result, patients with health insurance or ready access to healthcare are more likely to be on HAART.

One would assume that since France is a country of universal health care, there would be 100% of HIV/AIDS patients receiving HAART. But data from Table 1 shows that that is not the case. Why are there people not receiving HAART in France? In the U.S., how does health care access and income affect treatment availability?

Affects of Healthcare on HAART Accessibility

According to an editorial in Le Monde, a dominant French newspaper, “all the reforms that are proposed in France today tend toward an American style ‘reform’” (Sandborn 2006). The reforms to the French healthcare started in 2004. Doctors Without Borders estimated in 2006 that over 300,000 Frenchmen were uninsured (Sandborn, 2006). These new reforms have emphasized cost containment, decentralization to the regions, reduced reimbursements from insurance schemes leading to higher co-payments by patients, changes in hospital planning, and a controversial move to require that every insured French resident be registered with a general practitioner (Sandborn, 2006).

In 1997, the HIV Cost and Services Utilization Study was the United States’ first study observing HIV/AIDS patients receiving care. Results showed that twenty percent of HIV/AIDS patients were uninsured, thirty-two percent had private insurance, and sixty-three percent were unemployed (Health Resources and Services Administration, 2002). Of those who have public insurance, most HIV/AIDS patients are in the advanced stages of the disease (Bhattacharya et al., 2003). Depending on how advanced HIV/AIDS is, medical practitioners may/may not start patients on HAART.

Both healthcare systems are different, but have similarities in their lack of accessibility to all those who need it. Neither healthcare system is superior then the other due to the fact that over thirty percent of HIV/AIDS patients in both France and the U.S. are unable to receive HAART.

Social Stigma Affects Adherence to HAART

Stigma and discrimination can undermine efforts to treat and care for persons with HIV/AIDS (Curran et al., 2005). Social class, race, age, and their association with the basic risks for transmission of HIV/AIDS (i.e. sexuality and drug use) form the context of this epidemic (Skinner et al., 1991). By those facts alone, social class is already integrated into the disease. Some feel by getting tested for HIV/AIDS and finding out they are seropositive only confirms social expectations. The social stigma associated with HIV/AIDS plays an important factor in patient adherence to medication and is a possible reason why so many HIV/AIDS patients in both countries are not taking HAART.

Studies of HIV/AIDS patients in the U.S. have demonstrated that there is a relationship

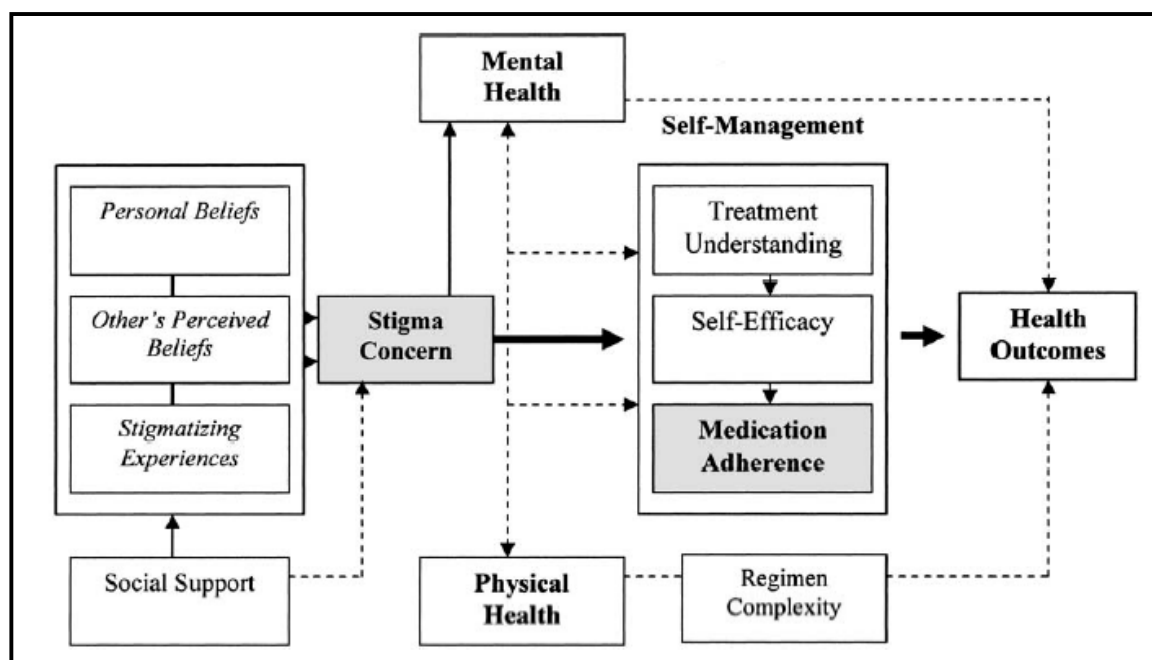


Figure 9: Conceptual model comparing social stigma to patient adherence (Rintamaki et al., 2006).

between stigma and multiple health-related outcomes, including poor adherence to ARV therapies (Sayles et al., 2007).

Other factors associated with patient adherence to HAART can be based on the patient (social or psychological), medication complexity of regimen, or access to treatment (Rintamaki et al., 2006). From a study conducted from June to September 2001 in Chicago and Louisiana, researchers were able to create a conceptual model of social stigma and patient adherence (Figure 9).

According to Rintamaki et al., social support and personal beliefs affect a person's stigma concern (Figure 9). In turn, their stigma concern will affect medical adherence, self-efficacy of treatment, and their understanding of the treatment (Figure 9). Those three factors together determine the health outcome of the patient. Although the study was conducted in the U.S., the general model that Rintamaki et al. created can be universal.

There is another factor that is incorporated in the social stigma of HIV/AIDS in France. In 2006, the majority of the 5,750 new cases of HIV were non-nationals. Between 1999 and 2006, the number of HIV/AIDS cases in Frenchmen has decreased, while the number of cases in immigrants from Haiti and sub-Saharan Africa has increased (WHO, 2006c). Immigrants might have limited access to medical care due to low-income, and therefore if they are infected with HIV, cannot afford to be on HAART. Some immigrants to France who are infected with HIV are infected with HIV-2 and account for the higher occurrence of this subtype in France.

Conclusion

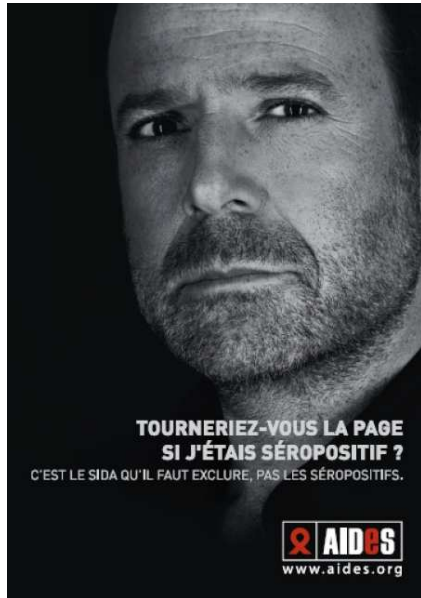
After exploring how both France and the U.S. treat HIV/AIDS patients, it can be said that there is room for improvement for both systems. The cost of HAART is expensive, and not everyone in either country has the means of supporting the medications. Only seventy percent of the 1,120,000 people with HIV/AIDS, in the U.S., receive the HAART therapies and most of those patients are privately insured. The U.S. healthcare system does not work well with patients who have HIV/AIDS because it seems that one must have private insurance before becoming infected, or wait until the disease advances that a disability claim can be made to get coverage through either Medicaid or Medicare. By that point, it may be too late to start treatment.

The French system was described as “Best Healthcare System in the World” by the WHO in 2000 because of its social universal healthcare. In theory, one hundred percent of HIV/AIDS patients should be receiving HAART therapies. But, in reality, only sixty-eight percent receive treatment. Current healthcare reforms are aiding in the increase in number of HIV/AIDS patients that cannot afford treatment.

Besides cost and healthcare, social stigma still plagues individuals even after twenty-seven years of the disease being around. Being seropositive for HIV or having AIDS can give rise to fear and anxiety in the individual which could cause the patient to get tested or stop taking their medications (Ritamaki et al., 2006). Social stigma of having HIV/AIDS directly relates to patient adherence (Figure 9), and is universal.

The difference in lifestyles in France and the U.S. would explain why France celebrates International AIDS Day on December 1 each year with a new campaign to educate the public.

“...French attitudes toward talk of money are quite similar in character to American responses to talk of sexuality” (Feldman, 1995).



In 2006, posters with celebrities, such as singer Johnny Hallyday and writer Marc Lévy, were on bus stops, metro stations, and on walls of buildings (Figure 10). Even on television, commercials would air with facts about HIV/AIDS and getting tested.

Figure 10: AIDES campaign for 2007. Marc Lévy, a writer in France is pictured. The quote says, “Would you turn the page if I was seropositive? It’s AIDS that one must exclude, not those who are seropositive.” (AIDES, 2007)

In the U.S., the public display of getting tested is present, but nowhere near the publicity level of France. Again, the U.S. is less likely to talk about sexuality than the French; it is just the American culture. However, any information needed concerning the U.S. was easily found. The French do not like to talk about money, which made it difficult to find information about healthcare reforms and how it affects the French.

Despite cultural differences and differences in healthcare, the HAART therapies each country used to treat HIV/AIDS patients are very similar. Even though the French and American relationship concerning HIV/AIDS started out rocky (discovery of the virus that causes AIDS), both countries have joined global organizations like the WHO and UNAIDS to fight the disease. Although neither of these systems are perfect, they do work in helping many of the HIV/AIDS patients live fairly normal lives through the HAART therapies. Perhaps if the French healthcare returned to where it was in 2000, if the U.S. found a way to have universal healthcare, and if the

ongoing social stigma of having HIV/AIDS changed for the better, more patients could have access to HAART therapies and adhere to them. More research would need to be done in order to make suggestions on how to change both systems of treating HIV/AIDS patients to encompass all those infected. Even after twenty-seven years after the first reported cases of HIV/AIDS, there is still difficulty treating patients, both medically and socially.

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