



THE PROGRESSION OF HIV AND AIDS

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ABSTRACT: Since HIV was contracted by a human from a chimpanzee in the 1800s, more than 84.2 million people have been infected with HIV and 40.1 million have died from AIDS (5). Though this virus is powerful and has shown its ability to take over a portion of the population around the world with continuously increasing rates, different steps like PrEP and PEP have been shown to decrease the rates as a preventive step. PrEP and PEP are both medications that can be taken for either pre-exposure or post exposure to HIV. With the evolution of medicine and the virus continuing to shift with science over time, the goal is to one day create a cure to prevent HIV and AIDS.

Introduction

HIV began with the cross contamination of blood between a chimpanzee and a human, known as the cut hunter hypothesis (4). SIV, also known as Simian Immunodeficiency Virus, is a zoonotic disease that spread from chimpanzees to humans in Central Africa in the late 1800s (4). It has been hypothesized that a hunter in Africa killed an infected chimpanzee and its blood passed into the hunter creating HIV, or Human Immunodeficiency Virus (4). As time progressed, the virus eventually spread throughout other humans in the continent of Africa before making its way overseas to the United States in the 1970s (4). HIV and AIDS has spread all around the world from chimpanzees to humans in the late 1800s and migrated to the US in the 1970s.

HIV and AIDS does not discriminate against ethnicity or gender; if someone has the virus and both parties are not practicing safe sex, anyone can transmit the virus. It can also be transmitted by accident through the transmission of blood from a site as small as a paper cut to an accidental needle prick. It is very important that people who do have HIV or AIDS and are aware of their diagnosis inform people when doing anything that could possibly transfer the disease, like in healthcare settings, when sharing needles, and with sexual partners. Being able to educate people on HIV and AIDS and all the different

ways that the disease can be transmitted is very important for all community levels.

What is HIV and AIDS?

HIV is a disease that affects the immune system and is vital to be followed by a doctor to keep track of a patient's CD4 levels and viral load. A CD4 is a glycoprotein that works in the bloodstream as a receptor to T-cells. The viral load is important to track because it looks at how much of the virus is in a single drop of blood, while the CD4 cell level tests help gauge a person's stage in HIV depending how low the levels are. As CD4 levels continue to drop, it becomes harder for the body to protect itself and fight off infections. Someone who has a normal range of CD4 levels would normally be able to fight off infections easier with the assistance of their helper T cells. As the virus progresses it can stage into what is clinically diagnosed as AIDS or Acquired Immunodeficiency Syndrome, which usually occurs when the CD4 level drops below 200 cells per milliliter of blood (2).

Epidemiology

HIV and AIDS has spread all around the world from when it was first spread from chimpanzee to humans in the late 1800s and migrated its way to the US in the 1970s. HIV and AIDS has increased around the world so much, for example in 1990 the world population of people living with HIV was 7,828,846 versus



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in 2019 the population of people living with the virus grew approximately 371%, to 36,848,154 people (11). The areas that saw the most growth would be the continent of Africa by 20 million plus people throughout each country between the 29 years, which is a change of 371%, and the United States which saw a growth of just over 820,000 people which is a change of 89% (11). With a lot of the people globally eventually progressing to AIDS within the first 10 years of living with their HIV diagnosis (9). These rates over time have proven to show a steady increase in large spikes throughout the world and continue to grow by the second.

Health Disparities

HIV is a disease that tends to affect some demographics more than others while another part of it has to do with lack of education and resources. Though these two diseases do not discriminate it does have a higher rate of infection among African Americans followed by Hispanics, more than other ethnicities infection rate (14). For perspective, the rate of infection in the year of 2020 had African Americans make up 12% of the population in the United States while at the same time making up 42% of the population who were infected with HIV, with 51% of the infections coming from the Southern states in the United States (14). Risk for developing either diagnosis is amplified depending on your geographical location.

Demographics and Gender

As mentioned earlier, HIV and AIDS does not discriminate against ethnicity or gender. However in the Southern states a spike in the rate of minorities who have shown an increase of HIV contraction has to do with the resources that are provided. A large portion of African Americans that live throughout the South are living in poverty stricken areas and these areas are also lacking proper education and medical access to provide proper resources. Though this is the case for Southern states, as well as throughout the United States and different parts

of the world, the advances in science continue everyday. The average life expectancy for people living with HIV and AIDS has continued to increase more and more over time. In fact, in 2010 the death rate for people living with AIDS decreased for women by 57% and 47% for men (5).

Healthcare

Immunocompromised

Connections are made in so many different ways in relation to HIV and AIDS, whether it be in relation to other medical disorders, demographically, looked at in a statistical standpoint, or geographic location. Autoimmune disorders work in the body by attacking healthy cells or tissue in the body until the virus/disease has won the battle in over taking the body and weakening the immune system from being able to fight other illnesses. HIV and AIDS are both immune disorders that affect the immune system by attacking itself, which defeats their ability to fight off other infections for diseases. For instance people who live everyday with HIV or AIDS are more susceptible to TB, also known as Tuberculosis, which is a medical condition that affects the lungs (1). TB is a germ that is spread through the air by someone that is already infected with the disease (1). With HIV and AIDS patients already having a weakened immune system, getting medical treatment for TB is crucial. Not only can other medical diagnoses be a risk for people with HIV and AIDS but demographically they could be more at risk.

History of HIV Treatment

Though HIV and AIDS continues to spread and grow throughout the world, it has progressed from when it first came out in the United States in the 1970s. Medicine and science has done its best to keep up with the virus creating different treatment options through all stages of the virus, whether it be HIV or AIDS. Though medications have not always been available,



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one of the medication options they have now for someone who lives with HIV, has the ability to make their viral load undetectable to decrease the rate of transmission of HIV to others (14). Antiretroviral therapy, which can make your HIV cell replication suppressed, has advanced so much with medicine over time that in 2019 it was reported that in the United States, 56.8% of HIV patients were undetectable or showed a suppressed viral load (14).

Treatment Access

Access to these treatment options continues to expand into different areas and communities around the world. In 2021 28.7 million people were able to access different assistance programs for antiviral treatment (5). One resource that people can use is the Ryan White HIV/AIDS program; which is used to support people who live in lower income areas with HIV to assist financially with prescriptions, medical treatments, and different support options for people (7). Programs like Ryan White have helped assist over 500 million people each year living with HIV and AIDS (7). New programs to help with assistance and progression in medicine are happening everyday and have helped with how HIV and AIDS has evolved around the world.

Treatment as Prevention

Treatment options are very important to have when partaking in behavior that puts oneself at greater risk for contracting HIV infection. An option for treatment for people who are HIV negative but partake in sexual activity that might increase their chances of contracting HIV is called PrEP. PrEP, also known as Pre-Exposure Prophylaxis, has a 99% reduction rate against HIV contracted sexually and a 74% reduction rate from intravenous drug use contraction (3). For people who may have been exposed to someone who does have HIV there is an antiretroviral drug called PEP, which is Post-Exposure Prophylaxis, and works only within 72 hours of exposure to HIV (3).

What the Future Holds

Recent Advancements & Research Priorities

The decrease in the rates of deaths, as mentioned earlier, goes hand in hand with the continuous research that is being conducted everyday to improve medicine and the lives for people living with HIV and AIDS. In conjunction with the National Institute of Allergy and Infectious Diseases, current research is being conducted looking into making a vaccine to prevent HIV (12). Another set of research being conducted is run by the National Institutes of Health looking into developing immune cells that are resistant to HIV and an immunotherapy that would induce HIV cure (13). Research is also being conducted looking into the HeLa cell line to see how the HIV virus interacts with T cells to fight off infection and show resistance (8). As research continues to improve the lives of people with HIV and AIDS, their lives will continue to grow longer.

Can HIV be Cured?

As research continues to advance over time there has been a case where someone has been cured of HIV. Known as the Berlin patient, Timothy Ray Brown, he was a Seattle native and was currently living in Berlin and with HIV for 11 years. While living abroad he was diagnosed with acute myeloid leukemia with no resolution with chemotherapy he received a bone marrow transplant (6). Brown's oncologist, Dr. Hütter, was able to find a transplant donor that carried a mutation gene that damages a receptor on the white blood cell; with the donor's mutation after the transplant Brown's white blood cell level went back to normal as someone who did not have HIV (6). What Dr. Hütter found is very important for someone like Timothy who lives with HIV because a damaging link to the white blood cell receptor essentially shuts off Brown's HIV cells which make him cured. Research like this is very hard to replicate for other HIV patients because of how much it costs to perform the procedure and the testing



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that would be involved to find people who also carry this genetic mutation of the white blood cell. Though Timothy's case was rare it was a look into how advanced medicine and research has come over time to make him no longer HIV positive.

Possibilities with Gene Therapy

He Jiankui, a biophysicist from China, was found to have reworked the genomes on a set of twins which deactivated the cells ability to contract the HIV receptor. However, this edit raises the risk of development for other infections (10). This study is problematic with ethics because it not only puts the babies at risk for later health issues, but also for the mother carrying the baby. An ethical issue that has to be taken into place is the risks that it places on the mother of these children while she's carrying and also the long term effect post pregnancy of editing these babies embryos. The babies already are at a higher risk for developing other infections, but they could also have a long term effect with their immune system. Being able to provide patients or participants complete information of possible risks and what the research is about is very important so people have the ability to accept or decline their participation in the study.

Moving Forward

HIV and AIDS has played a role in so many people's lives all around the world from either being diagnosed with it or knowing someone who has been diagnosed with the disease. While the disease does not discriminate against who it infects, it does show an increase with African American men. Different resources like the Ryan White Project and medicine like antiretroviral therapy in the world have helped increase the life expectancy for people living with HIV and AIDS over the years around the world. With medicine continuing to grow with new advancements everyday to hopefully find a cure or some type of medicine to stop the infection of HIV, some of the research pushes

some boundaries with the proper practice of ethics.

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