Time Series Analysis on the Prevalence of Global HIV Cases

Abstract

Human Immunodeficiency Virus (HIV) epidemic is a serious health and social problem, which impacts people worldwide. Over years, its progression has well-documented. This paper determines the incidence of HIV across globe on ages 15 to 49 from 1990 to 2012 and identifies the continents that HIV disease is mostly prevalent. Moreover, since its occurrence is inevitable, the paper projects the prevalence of global HIV cases in 2050. The percentage of people ages 15 to 49 who are infected with HIV is lifted from Catalog Sources World Development Indicators updated in 2012 as baseline data for time series analysis. Results reveal an abrupt increase of HIV infected from 108.4 million in 1990 which reaches its peak in 2001 with 308.1 million HIV-infected. However, it is found out that starting 2001, 52% decrease in new HIV infections from 308.1 million to 265.8 million in 2012 is observed. Nevertheless, this will increase dramatically in 2050 due to several factors like health disparities which include differences that occur by gender, race or ethnicity, education or income, disability, geographic location or sexual orientation. Furthermore, HIV epidemic is mostly prevalent in Sub-Saharan Africa with 25 million cases that comprise 5% of the world total HIV victims.

Keywords: prevalence, HIV epidemic, trend, time series

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Introduction
Nowadays numerous people around the world are infected with one of the deadliest diseases called HIV (Human Immunodeficiency Virus). HIV sees no race, no color, no gender, no economic background and nor even a specific age group. It can affect anyone, at any time if they put themselves in a situation where they could be at risk. As a result, the disease is apparently significant social problem which impacts people worldwide. According to research by Center for Disease Control and Prevention (2003), the amount of HIV cases have tripled in the United States and other parts of the world, hence, determining the spread of this disease and projecting its occurrence in the future is a worthy research endeavor. This paper determines the incidence of HIV across globe on ages 15 to 49 from 1990 to 2012 and identifies the continents that HIV disease is mostly prevalent. Moreover, since its occurrence is inevitable, the authors intend to project the prevalence of global HIV cases in 2050.

HIV is a virus spread through body fluids that affect specific cells of the immune system, called CD4 cells, or T cells. Over time, HIV can destroy so many of these cells that the body can’t fight off infections and diseases. When this happens, HIV infection leads to AIDS. Scientists identified a type of chimpanzee in West Africa as the source of HIV infection in humans. They believe that the chimpanzee version of the immunodeficiency virus (called simian immunodeficiency virus, or SIV) most likely was transmitted to humans and mutated into HIV when humans hunted these chimpanzees for meat and came into contact with their infected blood. Studies show that HIV may have jumped from apes to humans as far back as the late 1800s. Over decades, the virus slowly spread across Africa and later into other parts of the world. Then later it is known that the virus has existed in the United States since at least the mid-to late 1970s. http://www.iavireport.org/Back-Issues/Pages/IAVI-Report12

Despite the technology advancement, information dissemination, preventive movements of various health departments and concerned individuals and even well-documented progression of HIV, yet it remains untreatable and led to many deaths. Subsequently, there is a dearth of studies conducted relative to this dangerous virus.

Determining the spread of HIV cases and projecting its occurrence over years is very essential to World Health Organization to provide more awareness and prevention programs on the possible solutions to the spread of HIV. At the same time, the study would afford governments to scheme and implement policies and programs that cater HIV patients.

Methodology
This study provides an in-depth analysis on the prevalence of HIV cases across nations from 1990-2012 through time series analysis. The percentage of people ages 15 to 49 who are infected with HIV is lifted from Catalog Sources World Development Indicators updated in 2012 with the use of data mining strategy. The mined data are summed up using MS excel to reflect the number of HIV victims each year. After establishing the trend of HIV occurrence from 1990-2012, the study projects further its movement in the next 38 years using Minitab Software.

Results And Discussion
HIV stigma and discrimination have been seen all over the world, although they manifest themselves differently among countries, communities, religious groups and individuals. The trend on the prevalence of HIV cases from 1990 to 2013 is presented in figure 1.

![Figure 1. Prevalence of HIV Cases from 1990 to 2012](https://ssrn.com/abstract=3137052)

The model resulting time and the HIV cases is:

\[
y = 0.044118273x^2 - 265.875508x^2 + 534087.3042x - 357618463.2
\]

\[R^2 = 0.98484561\]

Result reveals an upward slopping movement of HIV epidemic over years that signifies an abrupt increase of HIV-infected from 108.4 million in 1990 which reaches its peak in 2001 with 308.1 million HIV infected. However, starting 2001, 33% decrease in new HIV infections is observed from 308.1 million to 265.8 million in 2012. The drop in new HIV infections is most pronounced among children. From 2001 to 2012 the number of children newly infected with HIV dropped by 52%—from 550 000 [500 000–620 000] in 2001 to 260 000 [230 000–320 000] in 2012 (UNAIDS, 2012). This gradual decrease of HIV cases is accorded to the access to treatment. The cost of antiretroviral therapy in some low-and middle-income...
countries has been reduced to around US$ 140 per person per year. In the mid-1990’s when this therapy was made available, the cost was around US$ 10,000 per person per year.

The increased political commitment to effective HIV prevention efforts which include inadequate access to high-quality, youth-friendly HIV and sexual and reproductive education and health services, and sexual violence against young women and girls lead to an effective decrease of HIV cases. Another is the smarter investments of the government, together with more strategic programming and massive reductions in the cost of treatment have led to a record 9.7 million people in low-and middle-income countries having access to antiretroviral therapy at the end of 2012 (UNAIDS 2013).

Figure 2 shows the map of the world that reflects HIV infected countries.

![Map of HIV infected countries](source: WHO/UNAIDS, 2008)

The map reveals that HIV epidemic is mostly prevalent in Sub-Saharan Africa with 25 million cases that comprise 5% of the world total HIV victims. This phenomenon can be explained because the source of HIV infection started in Africa. Historically, scientists identified a type of chimpanzee in West Africa as the carrier of closely related virus called simian immunodeficiency virus (SIV). At some point, the disease made the jump to human by infected monkeys that are later known as HIV infections (South African Department of Health, 2006). On the other hand, Oceania has the least number of HIV infected with 34,000 cases because geographically speaking, Oceania is an isolated continent. One study has shown that in one remote area, the number of people infected has remained low due to limited outside contact (Auvert, et al., 2005).

Untreated HIV disease could lead to serious and more complicated health problems, and worst, is death. The projected HIV cases are presented in figure 3.

![Projected HIV Cases in 2050](source: National Center for HIV/AIDS, 2007)

The figure illustrates a considerable upward movement of HIV cases which denotes a dramatic increase in the year 2050. Despite the strengthened political commitments and HIV prevention efforts which include inadequate access to high-quality, youth-friendly HIV and sexual and reproductive education, together with major advances in scientific discovery that initiate affordable and accessible HIV treatment and other health-related services, the stigma and spread of HIV remain to be a big threat to human beings. National Center for HIV/AIDS (2007) in the United States reports that HIV infections remain inevitable in spite of comprehensive interventions because of several factors contributing to health disparities which include poverty, unequal access to health care and lower educational attainment. Intertwined with these factors are dynamics such as racism and homophobia. People’s physical location such as urban vs. rural and living situation- in addition to social network and social stigma, also contributes.

**Conclusion**

Despite substantial improvement in the prevention of human immunodeficiency virus (HIV), some populations continue to be disproportionately affected by this disease.

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