Role of Education in Controlling the HIV Epidemic in sub-Saharan Africa

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ABSTRACT

More than 40 years since the beginning, the HIV/AIDS epidemic continues to be one of the biggest global health challenges, with sub-Saharan Africa bearing the largest impact of this disease. This paper explores the potential role of lower levels of education in contributing to the HIV prevalence disparity between sub-Saharan Africa and other regions. Through a thorough review of the literature, and an analysis of published datasets, this paper investigates the relationship between education levels and HIV prevalence rates, illustrating the critical influence of education on health outcomes. The analysis reveals a compelling negative correlation between education levels and HIV prevalence, underscoring the urgency of targeted interventions to address educational inequalities and promote HIV literacy. This paper emphasizes the importance of addressing educational disparities as a key strategy in the fight against HIV/AIDS. It provides insights into potential pathways for intervention, advocating for approaches that combine education, healthcare, and community engagement to achieve progress. Ultimately, this research contributes to the broader discussion on public health interventions, offering recommendations to improve health outcomes and reduce the prevalence of HIV/AIDS in sub-Saharan Africa and the rest of the world.

Introduction

In the history of medicine, few diseases have wielded as significant an impact on global health as HIV/AIDS. Emerging from Central Africa, the human immunodeficiency virus (HIV) has traveled all over the world causing an epidemic. Originating from a strain found in chimpanzees, HIV made its fateful leap to humanity when humans came in contact with their infected blood, as early as the late 1800s (Centers for Disease Control and Prevention, 2022b). Since then, it has silently infiltrated populations, establishing itself as a formidable adversary to human health.

HIV is a virus that attacks the body's immune system, leading to the progressive breakdown of the body's immune defenses and resulting in acquired immunodeficiency syndrome (AIDS) if not treated. Currently, there is still no cure for HIV/AIDS, but preventive measures can be taken. With recent progress in the field of medicine, HIV can be controlled, and with treatment, it can become a manageable chronic condition (Centers for Disease Control and Prevention, 2022b).

The epidemiological landscape of HIV/AIDS has seen dramatic shifts over time. Notably, in 1995, the U.S. Centers for Disease Control and Prevention (CDC) tried to mitigate its impact by issuing the first guidelines to prevent opportunistic infections (pathogens that would not usually cause diseases do so when the immune system is already impaired) in people with HIV (HIV.gov, 2024). Since then, there has been a notable 38% decline in new HIV infections worldwide between 2010 and 2022, and a staggering 59% decline since the peak in 1995 compared to new infections in 2022 (HIV.gov, 2023).

However, the battle against HIV/AIDS is far from won. Despite these advances, the virus continues to exact a heavy toll, particularly in regions like sub-Saharan Africa, where prevalence remains disproportionately high. The World Health Organization (WHO) underscores the ongoing challenge, with an estimated 39 million individuals living with HIV globally, two-thirds of which, 25.6 million, reside in the African Region. HIV has claimed over 40 million

lives now, and with concerning trends persisting, some countries are witnessing an increase in new infections, signaling the persistent threat posed by HIV/AIDS to public health, especially in sub-Saharan Africa (World Health Organization, 2023).

Research Gap

While significant advances have been made in setting a downward trend for the annual number of people dying from AIDS, the number of people dying from AIDS is disproportionately high in sub-Saharan Africa. It is important to identify the factors leading to this disbalance. Education has typically been a weak link in the development of sub-Saharan Africa. Research is required to investigate if there is a link between education levels and the prevalence of AIDS in communities. Studying the relationship between level of education and AIDS in a global context as well as a sub-Saharan context will facilitate a better understanding of why this region alone contributes to more than 35% of the worldwide cases of this disease. A clearer understanding of the relationship could lead to development of interventions that can make a meaningful impact in the fight against this disease in this region.

Research Objective

This paper investigates the potential role of lower levels of education in contributing to the disparity in the prevalence of HIV in sub-Saharan Africa versus the rest of the world. Finding the relationship between education and HIV prevalence reveals the potential impact of increased HIV interventions and improving education to include sexual and reproductive health education in the fight against HIV. By prioritizing investments in education, we can create a future where every individual has the resources and knowledge to protect themselves and their communities from HIV. Ultimately, this research contributes to the broader discourse on public health interventions, offering recommendations to improve health outcomes and reduce the prevalence of HIV/AIDS in sub-Saharan Africa and the rest of the world.

Methods

This study investigates the trends of the spread of HIV in different parts of the world over the decades by performing a systematic review on the subjects of HIV/AIDS, global education levels, socioeconomic factors, and education levels in Africa . In addition to discussing existing papers on the topic, the study gathered evidence from reliable published data sources regarding the trend of infections and education levels in different parts of the world. The paper focuses on data regarding the change in the percentage of HIV positive cases in the different education substrata to present evidence of a relationship between the level of education and the prevalence of HIV in Sub-Saharan Africa. Additionally, the paper discusses some of the studies that have investigated the impacts of different interventions on the spread of HIV. The results section of the paper summarizes the results of the investigations. Finally, the conclusions section provides a discussion of the evidence observed regarding the existence of an inverse proportionality relationship between the level of education and the likelihood of spread of HIV infection in communities. The conclusions section also provides a brief summary of potential interventions that can help address the issue.

The HIV Epidemic: Trends in the Spread of HIV in Different Regions

With significant progress in advancing awareness and strides made in medical research in recent years, there has been a downward trend in HIV cases globally, signaling a significant shift in the trajectory of the epidemic. According to data published by the Centers for Disease Control and Prevention (CDC) in 2022, the occurrence of new cases of HIV have gone down globally by 38% since 2010, and 59% since 1995 (HIV.gov, 2023). A comparison of the number of cases in 2022 compared to just 6 years ago, in 2016, in the United States of America (USA) and Europe shows the

number of new diagnoses of HIV has been steadily decreasing over time (Figure 1) (Centers for Disease Control and Prevention, 2022c). A similar trend is observed for the global cases as well as sub-Saharan Africa's cases as well.

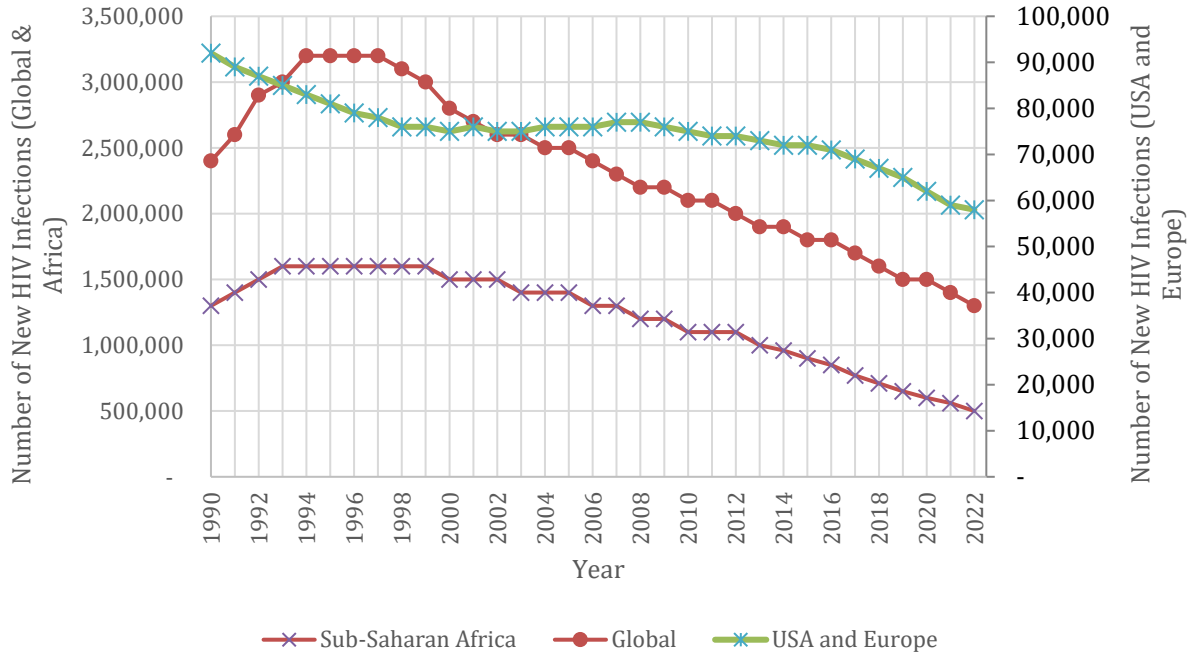


Figure 1: Trends in HIV Diagnoses in Different Regions of the World
Data source: Centers for Disease Control and Prevention (2022c)

The prevalence of HIV has been disproportionately high in Africa, to the extent that a region of Africa is referred to as the "AIDS-Belt". The curves for the new HIV infections in Figure 1 show clearly that sub-Saharan Africa accounts for close to 50% of the entire global cases while Europe and USA combined account for only 5% of the global cases. Table 1 shows the estimated numbers from 2001 for the number of people living with AIDS in the AIDS-Belt of Africa. At the end of 2001, the total number of cases in the region was 40 million. The problem is even more acute and concentrated in sub-Saharan Africa which accounts for 28.5 million, i.e. about 67% of the total cases in the region. While the adult HIV prevalence was 1.2% for the region, it was disproportionately high at 9.0 % in sub-Saharan Africa. There were five million new cases of HIV in 2001, and 3.5 million of them were from sub-Saharan Africa. 2.2 out of the three million AIDS-related deaths were in sub-Saharan Africa making AIDS the leading cause of death in sub-Saharan Africa. Mozambique, Malawi, Burundi, Rwanda, Kenya, Tanzania, and Ethiopia all have adult prevalence rates in the 6-15% range while in Uganda it is 5%, and Uganda is the only country in sub-Saharan Africa with a steady decline after their peak (12-13%) in the early 1990s. Somalia, Eritrea, Djibouti, Madagascar, and Sudan had little to no data on HIV prevalence (Goliber, 2002). It is important to put in place a means to estimate and monitor the prevalence in these countries, so it is possible to determine what needs to be done and whether the measures are effective.

Table 1: HIV Prevalence Statistics in 2001. Data source: UNAIDS (2002)

	HIV Prevalence	**HIV Prevalence Rate in Adults (%)**
Global	40 million	1.2
Sub-Saharan Africa	28.5 million	9.0

In Table 2, it can be observed that in 2022, HIV prevalence globally was 39.0 million, and in sub-Saharan Africa (eastern and southern Africa) it was 20.8 million, about 53% of the total global cases. In sub-Saharan Africa, more than 77% of new HIV cases found in people aged 15-24 years were found in adolescent girls and young women. They were more than three times more likely to get HIV than males of the same age group (UNAIDS, 2023). A comparison of the Global numbers in Table 1 and Table 2 show that the HIV prevalence numbers have stopped increasing and held steady around 40 million, with a significant decrease in the new infection rates between 2001 and 2022, as can be seen in Figure 1. In sub-Saharan Africa the HIV prevalence rate has decreased significantly from 28.5 million to 20.8 million between 2001 and 2022.

Table 2: HIV Prevalence and AIDS Related Death Statistics in 2022

	HIV Prevalence	**New HIV Infections**	**AIDS-related Deaths**
Global	39.0 million	1.3 million	630,000
Sub-Saharan Africa	20.8 million	500,000	260,000

Data source: UNAIDS (2023)

Role of Education: Trends in Education in Different Regions

In Figure 2, we can see that global literacy rates have been steadily increasing in the past 40 years (World Bank Open Data, 2023). With an increase in education, comes an increase in sexual and reproductive health (SRH) education. A similar relationship is observed in other parts of the world such as the USA. Figures 3 (a) and (b) illustrate that higher levels of education are associated with lower likelihood of HIV infection (Centers for Disease Control and Prevention, 2022a).

Data from 2018, presented in Table 3, show that the out-of-school rates in sub-Saharan Africa are significantly higher than those of other regions in the world for primary, lower secondary, and upper secondary school ages. According to UNESCO Institute for Statistics (UIS) data over one-third of students are out of school, one-fifth of children in primary, over one-third of lower secondary, and over half of upper secondary students are out of school (UNESCO UIS, 2019). Because of these high out-of-school rates, children in Africa are five times less likely to learn the basics (Global Education Monitoring Report Team, UNESCO, 2022).

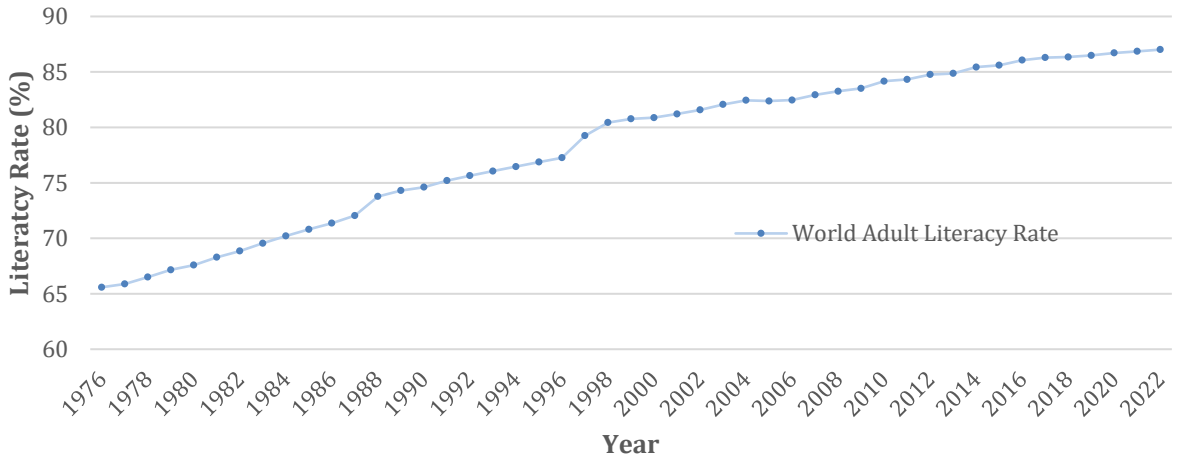
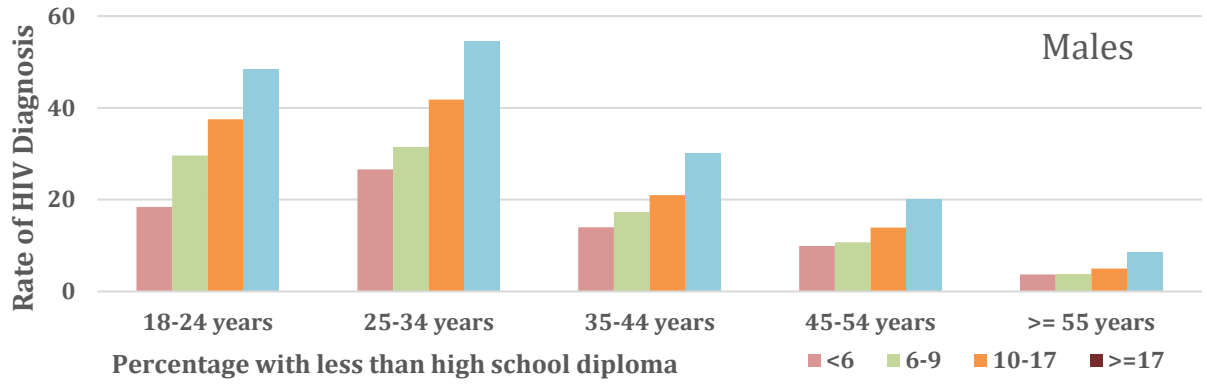


Figure 2: Global Literacy Rates 1976-2022
Data source: World Bank Open Data (2023)



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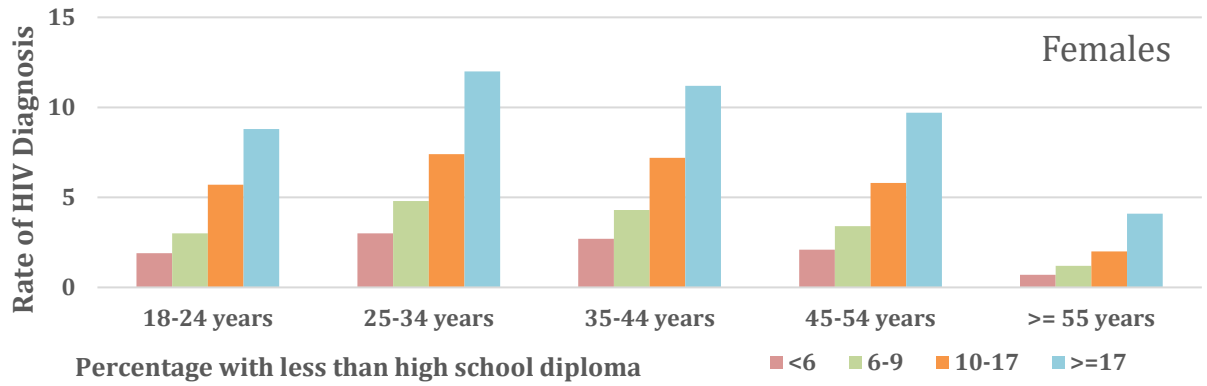

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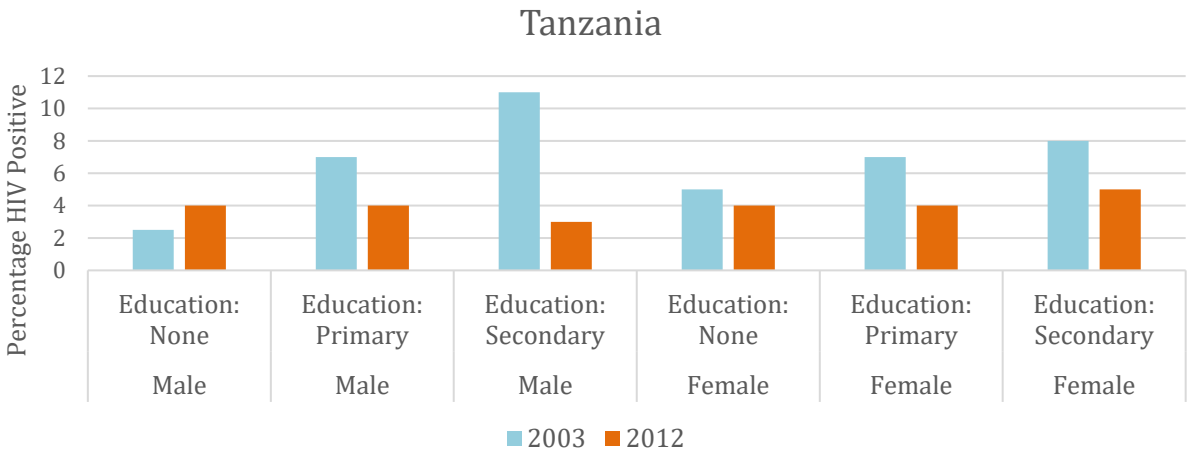
Figure 3: HIV Diagnoses and Education Status in the United States and Puerto Rico for: (a) Males, and (b) Females. Data source: Centers for Disease Control and Prevention (2022a)

Table 3: Out of School Rates in 2018. Data Source: UNESCO UIS (2019)

	Out-of-school rate (%)
Children of primary school age	18.8
Children of lower secondary school age	36.7
Children of upper secondary school age	57.5

In Figure 4 we can see the changes in HIV prevalence related to the level of education in different regions in Africa. In most regions, prevalence in individuals with primary or secondary education has decreased whereas prevalence in individuals with no education has increased. This illustrates that education is related to HIV prevalence, likely because most students are being exposed to SRH education.



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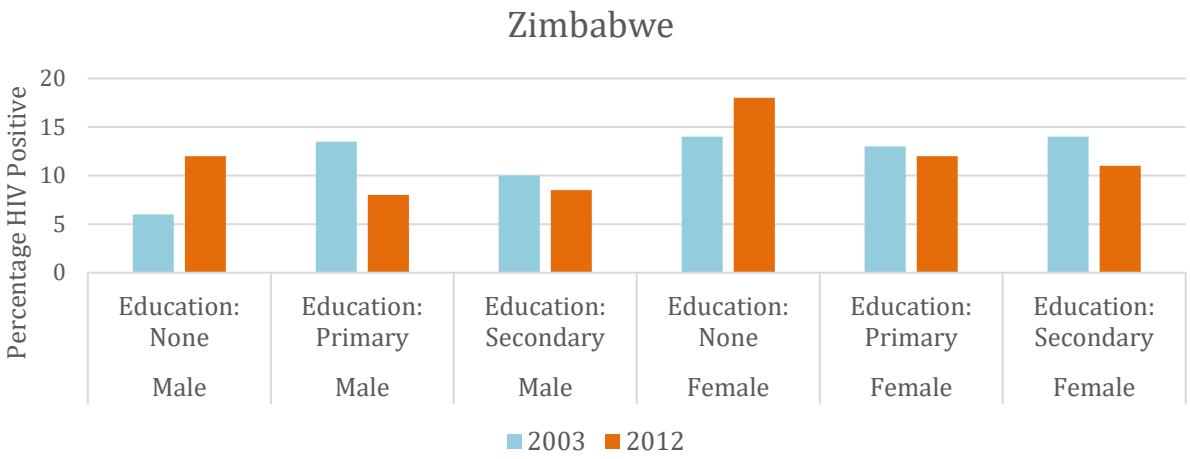

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Figure 4: Changes in HIV Prevalence with Different Educational Statuses from 2003-2012 in sub-Saharan Countries**.** Data source: Hargreaves et al. (2015)

African countries have made efforts to improve access to education since the 2000s. In 2000, 35% of primary school age children were out-of-school, and in 2019, that number halved to 17%. The proportion of lower secondary school age dropped from 43% in 2000 to 33% in 2019, and in upper secondary school age from 2000 to 2019 it dropped from 63% to 53% (UNICEF, 2021).

There have also been studies that have confirmed the associations between education and prevalent HIV infection. Among young women in sub-Saharan Africa, there were statistically significant associations in nine out of fourteen of their surveys in seven different countries.

HIV Interventions

A community-based cross-sectional study conducted in rural eastern Ethiopia found that comprehensive knowledge of HIV was present in only 14.84% of adolescent girls aged 13–17 years (Fasil et al., 2022). However, among girls who received sexual and reproductive health (SRH) education, the prevalence of comprehensive HIV knowledge was

higher at 16.78% compared to 14.01% among those who did not receive SRH education. The study also found that adolescent girls who received SRH education had 1.36 times greater odds of having comprehensive HIV knowledge. These findings underscore the importance of implementing SRH education in schools to enhance HIV prevention efforts.

In another study in Malawi, a peer group intervention implemented by community volunteers, known as the Mzake method (Friend-to-Friend), was found to increase HIV prevention knowledge (Kumbani et al., 2023). This intervention, enabled by regular community members, effectively improved HIV-related knowledge among participants.

Faust and Yaya (2018) performed a meta-analysis of 36 studies that used computer-based interventions, mass media campaigns, and peer education interventions. They found that these interventions were effective at improving HIV-related knowledge. Fifty-five percent of the studies reported a significant improvement in knowledge of risk reduction. Three of the studies reported incident cases at a follow-up and two of them reported a lower proportion of new HIV cases than in the control group. However, this study could not find conclusive evidence of education interventions on the actual transmission of HIV.

While HIV stigma has decreased over time in sub-Saharan Africa, it remains highly prevalent and contributes to discrimination and inequality in the region (Mbonu et al., 2009). Stigma and discrimination against HIV have been enhanced by beliefs about contamination, sexuality, etc. as well as attribution of immorality. Such stigma usually leads to public denial of HIV and can lead to further impediments in delivering social and medical care. Educational interventions are expected to break down the stigmatization barriers and can ultimately lead to a decrease in HIV infections.

Results

Education levels have been increasing globally over the years. The literacy rate has steadily increased from 68% in 1980 to 87% in 2022 as seen in Figure 2 (World Bank, 2023). In sub-Saharan Africa, the proportion of children out of school in primary school has decreased from 35% in 2000 to 17% in 2019. In lower secondary school it dropped from 43% in 2000 to 33% in 2019, and in upper secondary school from 63% in 2000 to 53% in 2019. The out of school rates have significantly decreased meaning the rates of educated students are increasing.

While education levels have been increasing, HIV prevalence has been on a downward trend in sub-Saharan Africa from 28.5 million people living with it in 2001 to 20.8 million in 2022 (Tables 1 and 2). The data presented in Figure 2, Tables 2 and 3, as well as the charts in Figure 4 clearly demonstrate that HIV prevalence and education levels are negatively correlated in sub-Saharan Africa.

In addition, the trend chart of new HIV infections in Figure 1 shows a steady decrease in the rate of new HIV infections over the years. While there are several factors, including a concerted global effort by several agencies around the world, that have contributed to this effect, there is evidence that shows that HIV interventions are effective methods of spreading knowledge about HIV. Some of the intervention studies have shown evidence that the intervention groups had fewer incidences of HIV in follow ups. The HIV infections trend data and the education trend data juxtaposed in Figure 5, clearly show a negative correlation between education and HIV incidence across the world.

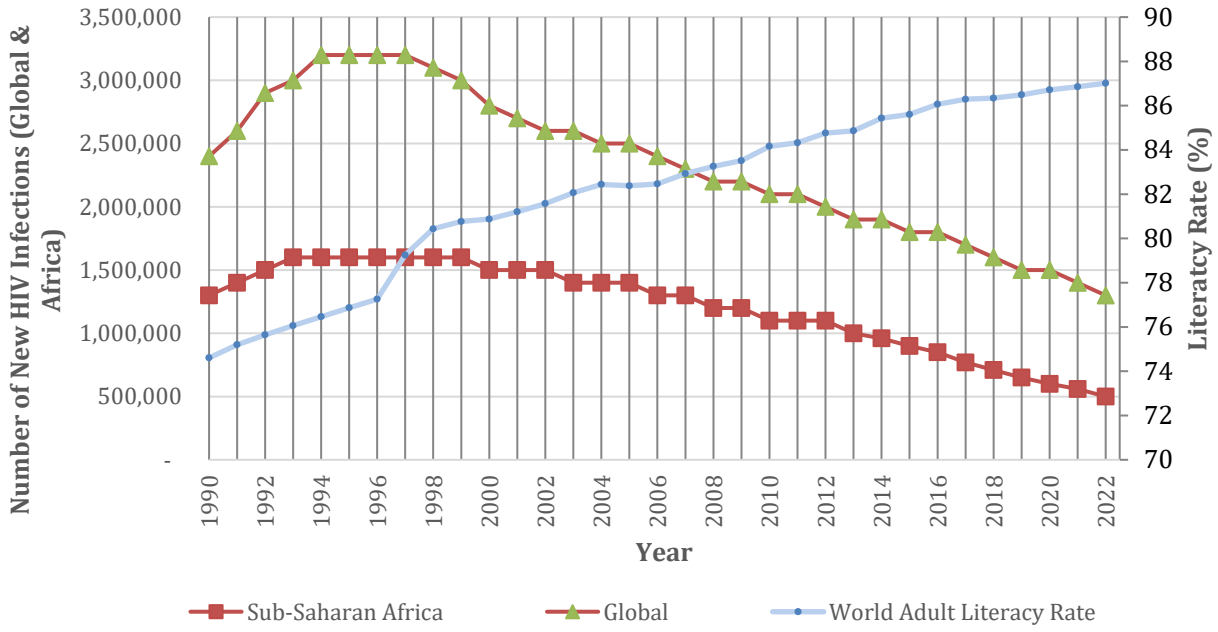

Figure 5: Changes in HIV Infection Rates and Changes in Literacy Rates between 1990-2022
Data sources: Centers for Disease Control and Prevention (2022c); World Bank Open Data (2023)

Conclusion

The intersection of HIV levels, education levels, and HIV education and interventions underscores the relatedness of health outcomes and socioeconomic factors. Studies have consistently demonstrated a correlation between lower education levels and higher HIV incidence rates and vice versa, particularly in regions with limited access to quality education.

In sub-Saharan Africa, where HIV prevalence remains disproportionately high, disparities in education exacerbate the extent of the epidemic, with individuals with lower levels of education often facing increased vulnerability to HIV infection. Recognizing the role of education in shaping health behaviors and outcomes, efforts to expand access to comprehensive SRH education have emerged as a basis of HIV prevention strategies. By providing individuals with the knowledge and skills to make informed decisions about their sexual health, these interventions contribute to the reduction of HIV transmission and incidence.

Community-based initiatives, such as peer education programs and mass media campaigns, have shown promise in improving HIV-related knowledge and promoting behavior change, particularly among vulnerable populations. Moreover, integrating HIV education into formal education curricula can help reach students at a young age, laying the foundation for healthy behaviors and attitudes. It has become increasingly evident that addressing the root causes of disparities in educational access and quality is essential for achieving sustainable progress in the fight against HIV/AIDS. By prioritizing investments in education and leveraging evidence-based interventions, we can create an environment where every individual has the knowledge and resources to protect themselves and their communities from HIV infection.

Limitations

This study is a correlation study between HIV incidence and education. The data by itself does not provide sufficient evidence of a causal relationship between these two variables, while a clear correlation between education and HIV incidence implies that they are deeply related. The intervention studies, however, do demonstrate a causal relationship. Most of these studies found that interventions are effective in spreading knowledge about HIV and some of them found evidence of a lower incidence of HIV in the group that received the intervention.

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