Temporal Patterns and Variations in HIV/AIDS detection: Notifications in Brazil (2013-2022)

Padrões temporais e variações na detecção de HIV/AIDS: Notificações no Brasil (2013-2022)

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ABSTRACT

Introduction: Acquired Immunodeficiency Syndrome (AIDS) is the advanced stage of Human Immunodeficiency Virus (HIV) infection, compromising the immune system and rendering the body vulnerable to various opportunistic infections. Since the 1970s, AIDS has posed a global challenge, impacting Brazil since 1982. Despite advancements, the disease's persistence necessitates comprehensive strategies and a deep understanding of transmission methods for effective management. **Objective:** This study aims to comprehend HIV/AIDS detection in Brazil (2013–2022). Analyzing temporal patterns, it guides future prevention and control strategies, emphasizing the need for effective approaches in the dynamic epidemic scenario. **Methods:** This cross-sectional study analyzes HIV case notifications in Brazil (2013-2022) utilizing data from the Unified Health System's Department of Information and Informatics (DATASUS), covering macro-regions, Federative Units, and capitals. Detection rate data are sourced from the Notifiable Diseases Information System (Sinan), Mortality Information System (SIM), Laboratory Exams Control System (Siscel), and Medication Logistic Control System (Siclom), considering sociodemographic variables and exposure categories. The analysis aims to understand the dynamics of HIV/AIDS in the country. **Results:** Between 2013 and 2022, AIDS cases in Brazil predominantly affect men, with an increase after 2020. The HIV detection rate by region reveals significant variations, highlighting fluctuations in the North and South. Educational data suggest a reduction in cases, indicating the impact of preventive programs. The analysis by race/color shows a consistent decline in cases among whites, blacks, and browns, while yellows and indigenous populations exhibit variations. **Conclusion:** The conducted analysis highlights the complexity of AIDS dissemination in Brazil, underscoring the need for regionally adapted strategies. Variations by region, education levels, and race/color emphasize the importance of multifaceted approaches, continuous prevention programs, and addressing social inequalities.

Keywords*:* HIV. Detection. Acquired immunodeficiency syndrome.

RESUMO

Introdução: A síndrome da imunodeficiência adquirida (AIDS) é o estágio avançado da infecção pelo vírus da imunodeficiência humana (HIV), comprometendo o sistema imunológico e tornando o organismo vulnerável a diversas infecções oportunísticas. Desde a década de 1970, a AIDS tem representado um desafio global, impactando o Brasil desde 1982. Apesar dos avanços, a persistência da doença requer estratégias abrangentes e profundo entendimento das formas de transmissão para enfrentá-la eficazmente. **Objetivo:** Este estudo visa compreender a taxa de detecção de HIV/AIDS no Brasil, de 2013 a 2022, bem como analisar padrões temporais, orientando estratégias futuras de prevenção e controle, destacando a necessidade de abordagens eficazes no cenário dinâmico da epidemia. **Métodos:** Este estudo transversal analisa notificações de casos de HIV no Brasil (2013–2022) utilizando dados do Departamento de Informação e Informática do Sistema Único de Saúde (DATASUS), abordando macrorregiões, unidades da federação e capitais. Os dados referentes à taxa de detecção são provenientes das bases relacionadas aos sistemas de informação sobre Agravos de Notificação (SINAN), Mortalidade (SIM), Controle de Exames Laboratoriais (SISCEL) e Controle Logístico de Medicamentos (SICLOM), considerando variáveis sociodemográficas e categorias de exposição. A análise visa compreender a dinâmica de HIV/AIDS no país. **Resultados:** Entre 2013 e 2022, os casos de AIDS no Brasil indicaram predominância em homens, com aumento depois de 2020. A taxa de detecção de HIV por região revela variações significativas, destacando oscilações nas regiões Norte e Sul. Dados educacionais sugeriram redução nos registros, evidenciando o impacto de programas preventivos. A análise por raça/cor mostrou queda consistente nos casos de brancos, pretos e pardos, enquanto amarelos e indígenas apresentaram variações. **Conclusão:** A análise evidenciou a complexidade da disseminação da AIDS no Brasil, destacando a necessidade de estratégias adaptadas regionalmente. Variações por região, níveis de escolaridade e raça/cor ressaltaram a importância de abordagens multifacetadas, programas contínuos de prevenção e enfrentamento das desigualdades sociais.

Palavras-chave: HIV. Detecção. Síndrome da imunodeficiência adquirida.

INTRODUCTION

Acquired Immunodeficiency Syndrome (AIDS) emerged as a significant global public health challenge in the late 1970s, evolving into a phenomenon that shaped the course of medicine and society. The earliest documented cases can be traced back to the United States, Haiti, and Central Africa, marking the beginning of an ongoing battle against the Human Immunodeficiency Virus (HIV)[1]. AIDS, the advanced stage of HIV infection, compromises the immune system, rendering the body vulnerable to a multitude of opportunistic infections[2-4].

In 1982, Brazil encountered its first cases of AIDS, joining the global narrative of the epidemic[5]. Since then, the spread of HIV has persisted as a complex and multifaceted challenge, demanding comprehensive strategies and a deep understanding of its transmission routes. On a global scale, it is estimated that approximately 4 million people were living with HIV in 2022, the last year of the study period, highlighting the persistent viral spread despite advances in treatments and prevention[6].

Understanding HIV transmission routes is crucial for guiding prevention and intervention policies. The main modes of infection include unprotected sexual intercourse, vertical transmission (pregnancy,

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childbirth, or breastfeeding), handling of sharp instruments, contact with biological materials such as blood, use of non-sterilized equipment, and blood transfusions[2,7].

Within the Latin American context, Brazil stands out negatively, leading in the incidence of new HIV infections, contributing to a striking 40% of the reported cases. The Southern Region of the country, particularly the state of Rio Grande do Sul, exhibits the highest rates of AIDS detection, reflecting the region's specific factors, which further complicate the analysis of the epidemic's landscape[2,8,9].

Contrary to expectations of a consistent decrease in HIV/AIDS prevalence, the data reveal an alarming persistence. In Brazil, the rates remain challenging, even more than 30 years after the first recorded cases (1982), considering the first year of the analyzed period (2013). Since 2011, the country has witnessed a steady increase in reported cases, surpassing 40,000 new cases annually, with no substantial reduction in sight[8].

Population-based studies, a cornerstone in understanding the epidemic, have played an essential role in identifying the determinants of infection and disease, shedding light on the underlying complexities[2].

This study aimed to deepen the understanding of the HIV/AIDS detection rate in Brazil, focusing on the period from 2013 to 2022. Using data from the Department of Informatics of the Unified Health System of Brazil (DATASUS), the study sought to describe and analyze the temporal evolution of the epidemic, identifying patterns and trends that could inform future prevention and control strategies. In an ever-evolving scenario, understanding the dynamics of the epidemic is crucial for developing effective and sustainable approaches to combating HIV/AIDS.

OBJECTIVE

The aim of this study was to analyze the HIV/AIDS detection rate in Brazil between 2013 and 2022, using DATASUS data to describe the temporal evolution of the epidemic.

METHODS

This descriptive study is based on the analysis of secondary data from national information systems to examine notifications of HIV cases across the country, segmented by macro-regions, with the respective federal units (UFs) and capitals. The analysis of the temporal evolution of HIV detection rates focuses on the period between 2013 and 2022.

Data on detection rates were obtained from national information systems, including the Notification of Diseases Information System (SINAN), the Mortality Information System (SIM), the Laboratory Test Control System (SISCEL), and the Medication Logistics Control System (SICLOM). These sources provide a wide range of crucial information for understanding the dynamics of HIV/AIDS in Brazil.

SINAN is primarily fed by the notification and investigation of cases of diseases and conditions included in the national list of compulsory notifiable diseases. Its effective use enables a dynamic diagnosis of the incidence of events in the population, providing crucial data to investigate the underlying causes of reported conditions. Additionally, it can reveal the risks faced by individuals, helping to identify the epidemiological situation in specific areas.

SISCEL is a system designed to simplify patient registration, manage the analytical process, and archive the history of CD4+ T lymphocyte counts and HIV viral load tests, as stipulated in the Clinical Protocol and Therapeutic Guidelines for the Management of HIV Infection in Adults and the Technical Manual for the Diagnosis of HIV Infection in Adults and Children.

All information is centralized in a database of the Ministry of Health, maintained by the Department of HIV/AIDS, Tuberculosis, Viral Hepatitis, and Sexually Transmitted Infections (DATHI), under the Secretariat of Health Surveillance and Environment. This data is digitally accessed, with security encryption, by laboratories that perform CD4+ T lymphocyte and HIV viral load tests, as well as state and municipal coordination of STIs and AIDS.

Since 1997, SISCEL has been an essential tool for monitoring CD4/CD8 count and viral load tests in people living with HIV and AIDS. Operating in all Brazilian states, the system centralizes all information in a database managed by DATHI.

SICLOM, in turn, plays a vital role in managing the logistics of antiretroviral medications nationwide, ensuring continuous and efficient access to necessary treatments for people infected with HIV.

Regarding the sociodemographic variables considered in this study, they included gender, age, and education level. As for exposure categories, sexual exposure, with a focus on homosexual and bisexual men, as well as injection drug users, was analyzed according to a hierarchical exposure criterion.

The tabulation and analysis of detection rates were conducted using Microsoft Excel software, providing a clear and detailed view of trends over the investigated period through the creation of graphs.

It is important to highlight that, as public data was remotely obtained via DATASUS, there was no need for submission to an ethics committee for research approval. The accessible and public nature of this information exempts the need for ethics committee approval.

By adopting this approach, the study aimed to contribute to a more comprehensive understanding of the dynamics of HIV/AIDS in the country, considering different geographical scales (North, South, Southeast, Midwest, and Northeast) and sociodemographic variables. The use of publicly available data accessed remotely optimizes the research process, allowing for detailed and reliable analysis of HIV detection over time without the need for additional ethical procedures.

RESULTS

During the study period (2013 to 2022), the majority of AIDS notification cases involved men, as shown in **Figure 1**. The year 2013 stood out with the highest number of notifications, followed by a decrease until 2020, and a subsequent increase in 2021 and 2022. A similar pattern was observed among women, with a significant reduction in notifications from 2014 to 2020, followed by an increase in the last two years analyzed.

Figure 1 presents the HIV detection rate in Brazil, expressed as the number of cases per 100,000 inhabitants, from 2013 to 2022, distributed by regions.

In the North Region, the detection rate fluctuated over the years, peaking in 2014 and showing a downward trend until 2021, followed by an increase in 2022. In contrast, the Northeast maintained

relatively stable rates over the years, with a slight decline until 2021 and a modest rise in 2022.

The Southeast Region exhibited a consistent downward trend in the detection rate throughout the period, with a steady reduction from 2013 to 2022. Meanwhile, the South had a higher detection rate compared to other regions, with a notable decline until 2021, followed by an increase in 2022. In the Central-West, the detection rate fluctuated, with a decline until 2018, an increase in 2019, another decrease until 2021, and a rise in 2022.

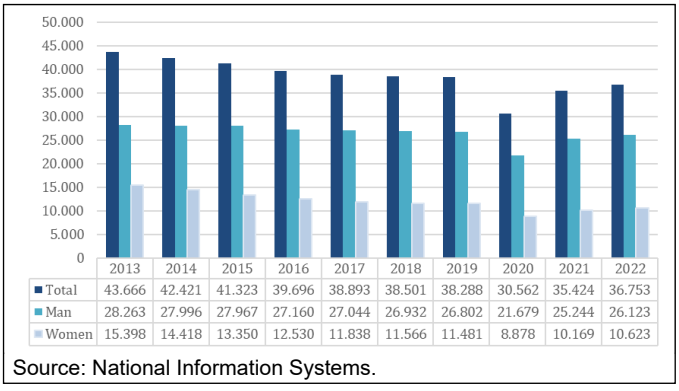
Overall, the analysis suggested more pronounced fluctuations in detection rates in the North and South regions, while the Northeast, Southeast, and Central-West showed more stable patterns throughout the analyzed period.

The AIDS cases reported in SINAN from 2013 to 2022 are presented in **Figure 2**, classified according to the individuals' educational level.

The data suggested that most educational levels experienced a reduction in AIDS cases over the analyzed period. This may reflect the success of educational programs and awareness campaigns regarding HIV transmission prevention across different educational groups.

Regarding the race/color variable, the AIDS cases reported in SINAN from 2013 to 2022 are detailed in **Figure 3**.

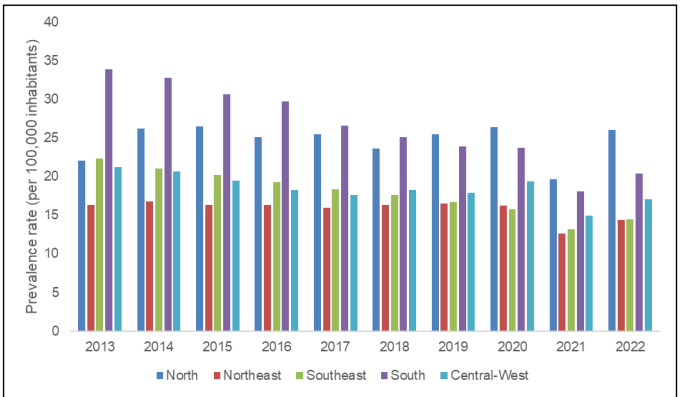
The cases reported in the White, Black, and Brown populations showed a consistent reduction over the period, with a sharp decline from 2013 to 2020, followed by less pronounced fluctuations until 2022. In contrast, the cases reported in the Asian and Indigenous populations showed variations throughout the period, with minor fluctuations and no clear trend of increase or decrease.



	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
Total	43.666	42.421	41.323	39.696	38.893	38.501	38.288	30.562	35.424	36.753
Man	28.263	27.996	27.967	27.160	27.044	26.932	26.802	21.679	25.244	26.123
Women	15.398	14.418	13.350	12.530	11.838	11.566	11.481	8.878	10.169	10.623

Source: National Information Systems.

Figure 1. AIDS cases notified and recorded by year of diagnosis.



Source: Own authorship, based on data available from national information systems.

Figure 2. HIV detection rate (per 100,000 inhabitants) by region of Brazil.

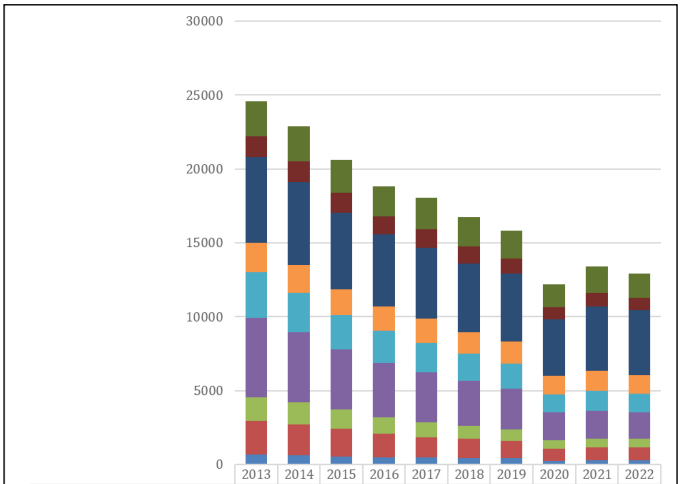
DISCUSSION

There were variations in HIV detection rates over the years across the regions of Brazil, with a predominant increase in cases in 2022. These results corroborate a recent study conducted by Andrade et al.[10].

According to information from the Ministry of Health, in 2020, the Northeast Region recorded the highest number of AIDS diagnoses in Brazil about 39%[11]. At the beginning of 2021, the situation remained concerning, with an increase in cases. The COVID-19 pandemic exacerbated social and economic inequalities, impacting the key populations affected by HIV[12]. These groups, which were already facing barriers to healthcare access, likely encountered even greater difficulties in maintaining HIV treatment during the pandemic[10].

Globally, disparities in HIV/AIDS control programs were evident even before the COVID-19 pandemic, reflecting long-standing inequalities. For example, many African countries still lack comprehensive plans to address the global AIDS pandemic.

Although Brazil had been experiencing a gradual reduction in the number of HIV/AIDS infections and deaths in recent years, with a declining or stable trend, in 2020, almost all states (except Sergipe) observed a sudden drop in HIV/AIDS diagnoses[13,14]. This reduction was likely due to difficulties in accessing healthcare services, fear of testing, and limited care resulting from social distancing measures caused by COVID-19[14]. Mobility restrictions in various Brazilian states may have hindered HIV diagnosis, as people were



	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
Complete higher education	2.387	2.351	2.243	2.046	2.132	1.997	1.857	1.572	1.823	1.650
Incomplete higher education	1.404	1.403	1.333	1.202	1.253	1.177	1.025	825	873	824
Complete secondary education	5.800	5.615	5.183	4.874	4.780	4.620	4.628	3.810	4.368	4.426
Incomplete secondary education	2.006	1.900	1.744	1.673	1.620	1.447	1.460	1.226	1.376	1.236
Complete primary education	3.078	2.670	2.321	2.169	2.013	1.852	1.700	1.220	1.332	1.287
5th to 8th grade incomplete	5.366	4.703	4.048	3.674	3.393	3.024	2.750	1.902	1.874	1.792
4th grade completed	1.594	1.512	1.335	1.109	977	902	777	573	613	555
1st to 4th grade incomplete	2.272	2.108	1.885	1.584	1.385	1.297	1.170	810	843	862
Illiterate	693	612	528	497	480	439	443	263	311	306

Source: Own authorship, based on data available from national information systems.

Figure 3. AIDS cases reported in SINAN, by educational level, per year of diagnosis.

discouraged or prevented from traveling to locations offering testing and treatment[15].

On the other hand, it is noteworthy that higher rates of HIV/AIDS have been identified among males (**Figure 4**). This observation may be attributed to reluctance to use condoms, which is associated with the perception of decreased sensitivity for both men and women[16-18].

The notion that condom use may make sexual intercourse less pleasurable for women is often interpreted as a deterioration in male sexual performance. The experience of erectile dysfunction and concerns about the ability to provide pleasure to a partner may be seen as challenges to one's male identity, contributing to resistance to condom use[18].

Additionally, there is an observed increase in incidence among young men (ages 15–29), with a higher proportion among gay men. People in this age group do not view HIV as a death sentence, as they grew up in an era where treatment allowed for a good quality of life for those living with the virus. Young men and women tend to distance themselves from preventive campaigns, not critically evaluating their own sexual practices even in the face of proven risks[19,20].

However, it's not only the youth that concerns health authorities. In a broader context, a study conducted in China identified a trend of increasing HIV cases among men and women over the age of 35 and estimated a rise in incidence rates from 2019 to 2023. This data underscores the need for special attention to this age group in various geographical contexts[21,22].

Regarding education, this study found that this variable plays a crucial role in disease prevention people with lower levels of education tend to have greater vulnerability and less access to information about diseases and prevention methods. This limitation is related to socioeconomic conditions, which affect access to information, healthcare, and prevention of complications, especially among the elderly[23,24].

In the Northeast, in 2019, the highest illiteracy rates in the country were recorded, reaching 13.9% of the population, according to the Brazilian Institute of Geography and Statistics (IBGE). More than 37% of these illiterates were elderly individuals.

Thus, in addition to deficiencies in professionals' perceptions regarding the implementation of preventive and diagnostic actions for the elderly population, the limitation of knowledge and learning, combined with social, cultural, and economic factors, may influence the disease outcome[22].

	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
Indigenous	88	77	83	83	77	74	66	49	74	56
Brown	13.321	12.775	11.592	10.694	10.660	10.175	9.759	7.830	8.752	8.566
Yellow	138	127	119	114	115	126	139	134	166	136
Black	3.163	2.937	2.764	2.720	2.570	2.349	2.353	1.762	1.975	2.081
White	13.419	12.163	11.120	9.858	9.387	8.437	7.667	5.845	6.305	5.995

Source: Own authorship, based on data available from national information systems.

Figure 4. AIDS cases reported in SINAN, by race/color, per year of diagnosis.

However, data related to higher education levels suggested a reduction in AIDS cases over the analyzed period. This study also observed that the Brown population had the highest percentage of reported HIV cases compared to other races/colors. This disparity may be attributed to the majority composition of the Brazilian population, approximately 45% of whom self-identified as Brown, according to IBGE data obtained from the 2022 National Household Sample Survey. In the United States, from 2006 to 2009, the incidence of the epidemic was higher among Black/African American and Hispanic/Latino populations compared to White populations[2,24].

In Brazil, the creation of the National Policy on Comprehensive Health Care for the Black Population (PNSIPN) in 2009 was a significant milestone, establishing guidelines for the promotion, prevention, and treatment of health for Black and Brown individuals, and proposing actions to overcome barriers to accessing the healthcare system. Originating from the demands of social movements, especially Black women, this policy recognizes racism as a social determinant of health, aligning with the World Health Organization (WHO)[25].

Notably, the PNSIPN proposes the inclusion of the topic of racism and the health of the Black population in the training of healthcare professionals. It also prescribes guidelines to strengthen the participation of the Black movement in social control, promote scientific research on health and race, and foster communication and education to combat stigma and prejudice. The aim is to reinforce the positive identity of the Black population, reduce health vulnerabilities, and address discrimination in medical and hospital services[26].

However, the effective implementation of the actions proposed by the PNSIPN has been hindered by a lack of incentives, monitoring, and resources, as well as low municipal adherence. These inequities manifest in various morbidity and mortality indicators, outcomes, and health issues, even after adjusting for socioeconomic and demographic factors, as evidenced by a range of research covering chronic diseases, maternal, child, and mental health, as well as various forms of violence in daily life[27].

The data from this study are significant as they address the evolution of AIDS cases in Brazil from 2013 to 2022, using detailed data by sex, region, educational level, and race/color. The analysis of HIV detection rates by region revealed significant variations, with a predominant increase in 2022. The abrupt reduction in diagnoses in 2020 was attributed to difficulties in accessing healthcare services during the restrictions imposed to contain the COVID-19 pandemic.

In summary, the crucial importance of a thorough analysis of AIDS epidemiological data is highlighted to understand trends, identify disparities, and guide more effective prevention strategies, especially in challenging contexts such as a pandemic.

Strengths

The study presents several strengths that enhance its quality and effectiveness in communication. One notable strength is the clarity in defining the study's objective, which is to understand the prevalence of HIV/AIDS in Brazil with an emphasis on the period from 2013 to 2022. This focus guides the reader toward the purpose of the research.

The methodology was described in detail, covering the data sources, considered variables, and analysis methods. The results

were presented in an organized manner, using tables and figures to provide a clear visualization of the information. The analysis of prevalence rates by region, sex, age group, educational level, and race/color was comprehensive and contributed to a deeper understanding of the situation.

The substantial discussion linked the results to observed trends and provided plausible interpretations for variations in prevalence rates. The integration of data from other studies and the correlation with the COVID-19 pandemic added relevance and context to the work.

Limitations

The present research had several limitations that should be considered when interpreting and generalizing the results obtained. Firstly, the use of secondary data from DATASUS implied a dependence on the quality and accuracy of the information recorded in the Unified Health System (SUS). Variations in case reporting and recording over time and across macro-regions may have influenced the consistency and reliability of the analyzed data.

CONCLUSION

The detailed analysis of AIDS epidemiological data in Brazil from 2013 to 2022 highlighted the complexity of the disease's dynamics and its interactions with socioeconomic, educational, and demographic factors.

The observation that men led notifications during this period, with a decrease until 2020 followed by an increase in 2021 and 2022, underscores the ongoing need for strategic approaches in HIV prevention and treatment.

The analysis of detection rates by macro-regions revealed significant variations, with the North experiencing a peak in 2014 and a declining trend until 2021, followed by an increase in 2022. Meanwhile, the Southeast demonstrated a constant decreasing trend, contrasting with the South, which showed a notable decline until 2021 followed by an increase in 2022. These variations highlight the importance of regionally adapted strategies to address HIV spread.

Educational levels indicated an overall reduction in AIDS cases over the period, suggesting a positive impact of educational programs and awareness campaigns in preventing HIV transmission across different educational groups. Additionally, the analysis by race/color revealed disparities, with White, Black, and Brown populations showing consistent reductions in reported cases, while the Yellow and Indigenous populations exhibited variations over the period.

The conclusion drawn from these data is that the approach to AIDS in Brazil must be multifaceted and adapted to different regional contexts, considering socioeconomic and educational factors. Ongoing prevention programs, equitable access to healthcare services, and addressing social inequalities are crucial elements in curbing the progression of AIDS in the country.

Approval by the Human Research Ethics Committee

The use of publicly available data on the internet streamlines the research process, enabling a detailed and informed analysis of HIV prevalence over time without the need for additional ethical procedures.

Participation of each author

JVM: Writing – original draft, Writing – review & editing. LEG: Conceptualization, data curation, formal analysis, investigation, methodology, resources, supervision, validation, visualization. AVJ: Data curation, formal analysis, investigation, project administration, validation, visualization, writing, reviewing, editing. FLR: Data curation, formal analysis, investigation, project administration, validation, visualization, writing, reviewing, editing.

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Conflict of interests

The authors declare no conflicts of interest.

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