ORIGINAL ARTICLE

Cases of AIDS in Individuals from 0 to 14 Years of Age in Brazil from the 1980s to 2022

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ABSTRACT

Objective: To gather epidemiological data on AIDS in Brazil over more than four decades in the population aged 0 to 14 years. **Material and Methods:** This is a descriptive cross-sectional study. The population corresponded to individuals with AIDS aged 0 to 14 years, with data registered in the Notifiable Diseases Information System, collected through the DATASUS website, reported in Brazil from the first case in July 1982 to 2022. Using descriptive statistics based on the calculation, it was found that there was an association using the Chi-Square test. Furthermore, the Prais-Winsten linear analysis model was used for trend analysis. **Results:** A total of 28,007 cases were reported. An increase in HIV cases was observed until the beginning of the 2000s. Regarding races/skin color, the majority of affected individuals belonged to the white race (16.75%), second only to those who did not report this characteristic (64.5%). The highest incidence rate was found in the South region, with 475 new cases of AIDS per 100.000 live births. **Conclusion:** The annual variation rate showed a stationary trend, with a gradual decrease from 2000 to 2022. There was a significant percentage of notifications in which the race/color item was ignored. The most affected age group was 1 to 4 years old.

Keywords: Epidemiology; Health Information Systems; Acquired Immunodeficiency Syndrome.

◼ Introduction

Acquired Immunodeficiency Syndrome (AIDS) was first recorded in the early 1980s by researchers Robert Charles Gallo and Luc Montagnier. The first decade was marked by the discovery and formulation of initial responses to the AIDS epidemic in the world, while the second (1990-2000) advanced therapeutic approaches. From the end of the 1980s to 1996, monotherapy anti-HIV treatment was introduced and replaced by combined therapy, ushering in a new era [1,2]. Thus, it was expected that the epidemic would be under control. However, it is evident from current epidemiological studies that the number of people living with HIV has been increasing in Brazil [3,4].

Human immunodeficiency virus (HIV) infection is characterized by progressive and continuous impairment of the immune system. The antigen requires T lymphocytes to multiply, and these are the primary cells affected. The virus has a predilection for the defense system and central nervous system (CNS); without therapeutic intervention, the infection can lead to AIDS and, in the CNS, cognitive impairment and/or memory loss [5].

Historically, in 1986, the US Food and Drug Administration approved Zidovudine for the treatment of AIDS. In Brazil, this medication began to be distributed in 1991. During this period, Antiretroviral Therapy (ART) was based on the use of a single medication. With developments in research, new drugs have emerged, expanding treatment options. Between 1993 and 1994, the first studies on the combination of medicines were carried out, double ART and then triple ART, which became a global standard in 1996 [6].

In 2015, CD4-based clinical staging criteria for ART initiation were removed, expanding eligibility to children. From 2010 to 2020, pediatric ART coverage tripled, and AIDS-related deaths were cut in half. Compared to the pre-implementation period, observed ART coverage continued to increase after the adoption of "Treat All", but this rate of increase decreased by 6%. AIDS mortality continued to decline after the adoption of "Treat All," but this rate of decline slowed by 8% in the post-implementation period. While the "Treat All" program calls for greater equity in HIV treatment, ART coverage continues to lag in children, and comprehensive approaches that address structural issues, including family services and intensive case finding, are needed to close gaps in pediatric HIV care [7].

Studies and clinical trials carried out with non-human pediatric primates have facilitated the investigation of complex immunological issues aimed at generating HIV-specific humoral and cellular responses capable of controlling viremia and eliminating infected cells. Although early ART in children living with HIV promotes virological control as well as reduces reservoir size, challenges arise due to compromised antiviral immune response. Furthermore, many immunotherapeutic strategies tested in adults have not been conducted in children. The current body of evidence has not yet filled the knowledge gap on how to reproducibly induce viral control without ART in the context of an immune system that is not fully developed [8].

Among developing countries, Brazil was the first to make antiretroviral drugs available free of charge through the public health network. The democratization of AIDS treatment was of great relevance, in addition to being an intrinsic factor in raising awareness among the civilian population. The involvement of different spheres of health care, including prevention, treatment, and respect for human rights, is fundamental to achieving gains related to the problem [9,10]. Policies like this resulted in a substantial reduction in mortality and AIDS in patients infected by the virus, increasing survival. On the other hand, the prevalence of HIV in the pediatric population has increased [11].

The history of infection in the child and adolescent population may vary; there is the possibility of the virus being acquired in the perinatal period or later through behavioral acquisition. The most common form of

infection in children is vertical transmission, which can occur during pregnancy, childbirth, or breastfeeding. Other possibilities of contamination in this age group involve cases of sexual violence, perforations by non-sterile medical or dental instruments, and transfusion of contaminated blood [12]. Therefore, measures to improve the health and well-being of children and adolescents need to include opportunities for them to have meaningful lives through interventions that alleviate the impact of HIV/AIDS on their lives. Therefore, preventing mother-to-child transmission of HIV is one of the greatest achievements of pediatric research and becomes crucial for the management of infected women during pregnancy [13].

Each year, about 1.5 million HIV-infected women give birth in low- and middle-income countries. Approximately 25 to 45% of babies born to mothers infected with the virus will be infected without appropriate interventions to prevent transmission. HIV-infected babies have high morbidity and mortality without immediate initiation of treatment [14]. The increase in the number of women infected with HIV resulted in the birth of children exposed to or infected by the virus. According to national guidelines, the definition of childhood AIDS includes any individual under 13 years of age who presents laboratory evidence of HIV infection and some evidence of immunodeficiency. Reducing the risk of infection faced by the fetus of a mother who is seropositive for the virus is achieved when available diagnostic tests and antiretroviral medications are used at the appropriate time. Vertical transmission of HIV continues to be an area where preventive efforts can be optimized, as vertical transmission rates hover around 11.4% [15].

Decisions in recent decades have resulted in severe reductions in vertical transmission rates. However, ongoing challenges in infrastructure, health economics, and misunderstandings surrounding HIV may limit progress toward the goal of global elimination. Future directions for achieving the total elimination of vertical transmission of HIV will move towards greater accessibility to antiretrovirals, more research into resistance to these medications, and more efforts to destigmatize HIV/AIDS around the world. However, the current picture of vertical transmission of HIV is extremely encouraging compared to the end of the 1990s [16].

The global HIV/AIDS epidemic remains a significant public health challenge. While progress has been made in treatment and prevention, addressing issues of access, financing, stigma, and discrimination remains crucial to achieving effective control and eventual eradication of the disease. Promoting HIV testing continues to be an essential strategy in the fight against the epidemic. Testing initiates a cascade of care, connecting individuals to treatment and prevention services, which in turn facilitates viral load suppression and reduces the spread of disease. The WHO has therefore been advanced in advocating and promoting HIV testing as a fundamental strategy in the global response to the HIV/AIDS epidemic [17].

In the available literature, there is a lack of epidemiological studies focused on the age group from 0 to 14 years old, which include data from the first reported case until 2022 [18,19], allowing to construct an overview of the disease in this population and from then on to outline goals and interventions in accordance with the needs found. Obtaining and discussing data that allow us to trace the epidemiological profile of AIDS in Brazil exposes the relevance of designing public prevention and care policies, not only to significantly reduce metrics, but to improve the quality of life of those living with the infection. Epidemiological data, corresponding to a specific age group, contribute to personalizing interventions.

Health professionals must acquire skills for prenatal care and promoting the health of pregnant women and their babies, to prevent HIV contamination for this binomial. Reception and adequate pre- and post-antiviral test counseling, always aiming for the best alternative for maintaining health, whether referring the pregnant woman to a specialized service or offering complementary tests and the necessary treatment in case of test positivity as soon as possible, are essential interventions. Despite the success of Prevention of Vertical HIV

Transmission (PMTCT) programs, low patient adherence and retention in services represent a significant obstacle to achieving the elimination of this type of transmission in low- and middle-income countries. Since HIV infection and AIDS constitute global public health problems, it is crucial to know their epidemiological profile in Brazil [14,15].

Therefore, this study aimed to gather epidemiological data on AIDS in Brazil over more than four decades in the population aged 0 to 14 years, to emphasize public policies that enable changes in the health standards of this population group.

■ Material and Methods

Study Design

This is a descriptive cross-sectional study on the number of cases of AIDS (ICD B24) from 0 to 14 years of age reported in Brazil since the first case in July 1982 to 2022.

Data Collection

Brazil has an estimated population of 203,080,756 inhabitants, and it is divided into 26 states, in addition to the Federal District, which is made up of 5,570 municipalities [20]. The country has recorded an average of 39 thousand new cases of AIDS annually [21].

Data collection was carried out in January 2023. It was sourced from data available in the Notifiable Diseases Information System (SINAN), a database made available by the Department of Informatics of the Unified Health System (DATASUS), these being collected through the DATASUS website (http://www2.datasus.gov.br/DATASUS/index.php) [22,23].

All data presented is public domain and accessible and was obtained through sequential access to the following commands available on the website: >> "Health Information (TABNET)" >> "Epidemiological and Morbidity" >> "AIDS Cases - Since 1980 (SINAN)" >> "Brazil by region, state and municipality". Data were collected regarding all variables available on the platform, which applied to this population: year of notification, region of notification, gender, age group, and race/skin color.

All data were analyzed using descriptive statistics based on the calculation of measures of central tendency and variability. It was verified whether there was any association between the dependent variable age and the independent variables sex, race/skin color, region, and year of notification using the Chi-Square test. Furthermore, for trend analysis, the Prais-Winsten linear analysis model was used, in which the independent variable (X) was the years in which cases were reported, and the rates of new cases were considered dependent variables (Y). For the model to be applied, the method reported by Antunes and Cardoso [24] was used. Initially, the logarithmic transformation of the Y values was performed, followed by the application of the Prais-Winsten autoregressive model to estimate the rate of variation in the percentage of cases, as well as its 95% Confidence Interval (95%CI). From the analysis of the rate of variation, it was possible to state that the trend of cases was: (1) increasing, when the rate of variation was positive, (2) decreasing, when the rate of variation was negative, and (3) stationary, when there was no significant difference between its value and zero.

Data Analysis

All data were analyzed adopting a significance level of 5%, where comparisons in which p < 0.05 were considered statistically significant. In addition, data processing and analysis occurred in the Statistical Package for the Social Sciences 20.0 (SPSS) and Data Analysis and Statistical Software (STATA), version 14.

■ **Results**

The data shows that between the years 1982 and 2022, a total of 28,007 (2.5%) cases of Pediatric AIDS were reported in Brazil of a total of 1.107.782 reported cases in the country, with the most significant case numbers concentrated in the age group from 1 to 4 years of age, equivalent to 37% of the total cases reported in children, followed by children under one year of age, corresponding to 31% of reported cases, children aged 5 to 9 years 19% and individuals aged 10 to 14 years 3% of the total sample. As the most common form of transmission is vertical, there is a concentration of cases in the earliest age groups, as the majority of cases are reported in the maternity ward, shortly after birth, with the first examinations of the newborn.

There was an increase in the incidence of AIDS until the beginning of the 2000s, remaining constant in the first decade, and then the rate gradually decreased (Figure 1). When analyzing the trend in childhood AIDS cases (0-14 years of age) from 1982 to 2022, using the Prais-Winsten model, a stationary temporal trend in the number of cases was observed, with an annual variation rate of 4.78% (IC95% -5.92;16.70). When analyzing the regions of the country, the South was the region that showed the most significant annual variation in the number of cases (6.05%; IC95% -4.79;18.15); however, it showed a stationary trend like the other regions (Table 1).

Table 1. Variation and trends in incidence rates of childhood AIDS cases (per 100,000 live births) in Brazil from 1980 to 2022.

Variables	Annual Variation (%)	95% CI	p-value	Trend
Year				
1980-2022	4.78	-5.92;16.70	0.386	Stationary
Region				
North	5.77	-0.84;12.84	0.087	Stationary
Northeast	5.49	-2.06;13.63	0.165	Stationary
Southeast	3.78	-8.68;17.95	0.561	Stationary
South	6.05	-4.79;18.15	0.278	Stationary
Midwest	3.30	-4.53;11.79	0.410	Stationary

Statistically significant associations (p<0.05) were observed between the dependent variable age and all independent variables: sex, race/skin color, region, and decade of notification. Concerning sex, the distribution of cases was homogeneous, with no predilection for either sex; 49.89% were male, 50.01% were female, and 0.10% chose not to report this data (Table 2).

In terms of races/skin color, 16.75% of the affected individuals belonged to the white race, followed by black (3.65%), yellow (0.15%), and indigenous (0.20%). In addition to these, a significant percentage of notifications were observed in which this item was ignored, representing a total of 64.5% (18,080). Regarding the regions of the country, the highest incidence rate was found in the South region, with 475 new cases of AIDS in children aged 1 to 4 years for every 100,000 live births (Table 2).

Table 2. Association between the age and sex, race/skin color, region, and decade of notification.

Variables	Category	Age				p-value
		<1 year N (%)	1-4 years N (%)	5-9 years N (%)	10-14 years N (%)	
Sex	Female	4045 (47.30)	5358 (52.00)	2734 (50.30)	1867 (50.60)	<0.0001
	IC 95%	0.2813 - 0.2964	0.3746 - 0.3907	0.1887 - 0.2018	0.1277 - 0.1389	
	Male	4510 (52.70)	4941 (48.00)	2701 (49.70)	1821 (49.40)	
	IC 95%	0.3150 - 0.3305	0.3457 - 0.3615	0.1868 - 0.1998	0.1247 - 0.1359	
Race/Skin Color	White	1009 (52.60)	1820 (46.10)	1072 (46.60)	788 (44.80)	<0.0001
	IC 95%	0.2034 - 0.2269	0.3742 - 0.4021	0.2166 - 0.2406	0.1574 - 0.1788	
	Black	163 (8.50)	383 (9.70)	254 (11.00)	214 (12.20)	

	IC 95%	0.1381 – 0.1834	0.3479 – 0.4076	0.2238 – 0.2772	0.1859 – 0.2362	
	Yellow	6 (0.30)	17 (0.40)	7 (0.30)	8 (0.50)	
	IC 95%	0.0420 – 0.2738	0.2893 – 0.6055	0.0610 – 0.3075	0.0809 – 0.3402	
	Brown	728 (38.00)	1709 (43.30)	953 (41.40)	738 (42.00)	
	IC 95%	0.1647 – 0.1880	0.3990 – 0.4290	0.2180 – 0.2437	0.1671 – 0.1905	
	Indigenous	12 (0.60)	21 (0.50)	14 (0.60)	11 (0.60)	
	IC 95%	0.1026 – 0.3111	0.2384 – 0.4858	0.1312 – 0.3515	0.0888 – 0.2905	
Region	North	142 (2.70)	559 (7.30)	265 (7.30)	172 (6.80)	<0.0001
	IC 95%	0.1056 – 0.1440	0.4622 – 0.5203	0.2083 – 0.2574	0.1303 – 0.1720	
	Northeast	523 (9.80)	1261 (16.40)	618 (17.10)	373 (14.80)	
	IC 95%	0.1739 – 0.2030	0.4359 – 0.4729	0.2072 – 0.2382	0.1217 – 0.1471	
	Southeast	2923 (54.90)	3725 (48.50)	1667 (46.10)	1200 (47.50)	
	IC 95%	0.2979 – 0.3165	0.3817 – 0.4013	0.1676 – 0.1828	0.1194 – 0.1328	
	South	1477 (27.70)	1725 (22.40)	904 (25.00)	673 (26.60)	
	IC 95%	0.2960 – 0.3222	0.3473 – 0.3746	0.1781 – 0.2003	0.1310 – 0.1507	
	Midwest	262 (4.90)	415 (5.40)	165 (4.60)	110 (4.40)	
	IC 95%	0.2468 – 0.3036	0.4044 – 0.4674	0.1493 – 0.1974	0.0952 – 0.1359	
Notification Decade	1980s	119 (2.20)	102 (1.30)	49 (1.40)	69 (2.60)	<0.0001
	IC 95%	0.3002 – 0.4018	0.2521 – 0.3497	0.1071 – 0.1820	0.1607 – 0.2464	
	1990s	2499 (46.90)	2315 (30.10)	665 (18.40)	386 (14.70)	
	IC 95%	0.4134 – 0.4387	0.3822 – 0.4072	0.1053 – 0.1215	0.0595 – 0.0722	
	2000s	1705 (32.00)	3247 (42.30)	1839 (50.80)	889 (33.80)	
	IC 95%	0.2127 – 0.2313	0.4117 – 0.4338	0.2299 – 0.2490	0.1086 – 0.1229	
	2010s	887 (16.70)	1862 (24.20)	989 (27.30)	1179 (44.90)	
	IC 95%	0.1696 – 0.1911	0.3651 – 0.3922	0.1899 – 0.2123	0.2278 – 0.2517	
	2020s	117 (2.20)	159 (2.10)	77 (2.10)	105 (4.00)	
	IC 95%	0.2155 – 0.2954	0.3036 – 0.3908	0.1339 – 0.2024	0.1908 – 0.2678	

■ Discussion

The majority of AIDS cases corresponded to the age group of 1 to 4 years. The incidence increased until the beginning of the 2000s, and after the first decade, it gradually decreased. The annual variation rate was 4.78%, being higher in the South region, which also had a higher incidence rate in the 1 to 4 year old age group, but showed a stationary trend like the other regions. The distribution of cases between sexes was homogeneous. There was a significant percentage of notifications in which the race/color item was ignored.

Highly Active Antiretroviral Treatment (HAART) contributes to reducing the risk of perinatal transmission, in addition to reducing the general risk of transmission [25]. As a result, advances in the management of patients with HIV/AIDS over the last few decades have resulted in a paradigm shift, and HIV/AIDS is no longer seen as a fatal disease, but rather a chronic disease [26].

The reduction in the number of cases may be associated with public health campaigns; treatment is guaranteed free of charge to all people with HIV in Brazil. There is a lot of work carried out by primary health care, with rapid tests and counseling, among other actions aimed at prevention, promotion, and rehabilitation. However, the percentage of HIV/AIDS, especially in developing countries, is still a daunting challenge for public health authorities as its mortality rate is significantly higher than that of other sexually transmitted diseases [27,28].

Public health policies aimed at AIDS in Brazil have transformed over the years, influenced both by the evolution of the SUS and by the evolution of the disease itself. The decentralization of actions in the field of AIDS was a concern expressed by the National STD/AIDS Program in the 1990s, as a way of maintaining the sustainability of actions and controlling the epidemic. However, it can be said that the policy aimed at AIDS has evolved, segregated from other areas of health, representing a challenge for the consolidation of the guiding

principles of the SUS. This challenge, crucial for health in the country, needs to be faced by managers, health professionals, as well as users of health services and the community in general [29].

Surveillance systems, policy evaluation systems, and laws must be implemented to control this disease, including adopting cure and prevention strategies such as health education, extensive testing, financial incentives for research programs, increased use of condoms, access to antiviral therapy, and banning illegal blood collection centers. Due to widely used antiretroviral treatment, people living with HIV can now have good immune responses resulting in a better life expectancy [30,31].

Concerning race/skin color notifications, this could imply a criticism of the way banks and information systems are registered and fed. Due to this, the public data made available usually does not reliably express some indicators, as aspects relating to certain diseases and occurrences are incomplete or underreported.

The highest incidence rate, found in the South region, may have occurred because it is a more populous and urbanized region, or even due to the possibility that in this region, affected children have greater access to treatment and a lower mortality rate, and therefore spend more time living with the disease, thus increasing their percentage.

The highest percentage of HIV/AIDS in Brazil is directly related to low education and economic vulnerability. On the other hand, the higher the level of education, the greater the stimulus and access to knowledge about health risks and disease transmissibility [20,32]. The Brazilian Government points out a high number of infected people who know their diagnosis, but who are not monitored by a health service and, therefore, are considered important sources of infection [32].

The success of pediatric HIV programs depends on the timely identification of HIV-positive children, the prompt initiation of ART, and sustained retention in HIV care and treatment services to ensure viral suppression and optimal health outcomes. Unfortunately, many HIV-positive children in low- and middle-income countries are lost to follow-up or die without accessing and benefiting from recommended HIV care and treatment services. The high dropout rate of HIV-positive children from HIV care and treatment services in low- and middle-income countries highlights the urgent need for implementation research and resources to mitigate attrition and improve retention among this vulnerable population [33].

Although there is a wide availability of effective medications, the management of individuals with childhood AIDS continues to present significant challenges, such as late seeking assistance, failure to adhere to treatment, social inequality, discrimination, social stigma, and the helplessness of parents. /responsible for management, since the lack of supervision of those responsible often makes the situation complex [34]. In this sense, low knowledge about HIV/ART/vertical transmission, low level of maternal education, psychological problems after diagnosis of the infection, stigma, and fear of revealing the condition to partners, family, or community are considered the main reasons for low adherence to HIV/ART/vertical transmission. ART, contributing to the increase in cases of the disease in the pediatric population [15,35].

Given this, the WHO highlights the importance of screening and early diagnosis of HIV for all children and adolescents for a better prognosis. It is essential that HIV treatment policies and programs, such as routine maternal screening, prevention of mother-to-child transmission, monitoring of exposed newborns, and early HIV diagnosis programs in newborns [12].

Regarding the limitations of the present study, these may be related to the underreporting of cases. Despite providing vital information for evaluating health services, DATASUS presents problems with reliability, absence, or classification of data that may interfere with or result in false assessments of the health scenario.

Conclusion

The annual variation rate showed a stationary trend, with a gradual decrease after the first 10 years, from 2000 to 2022. There was a significant percentage of notifications in which the race/color item was ignored. The most affected age group was 1 to 4 years old. The knowledge accumulated during almost four decades of the epidemic has enabled profound changes in the evolutionary profile of patients living with HIV/AIDS: the lethal infection has become a chronic disease.

More specific measures can be taken to change the health pattern presented, the age group with the highest number of cases reflects the importance of raising awareness regarding vertical transmission, despite the historical character achieved by advances and availability in treatment, the general population needs to continue to be educated about prevention, the importance of prenatal care and the free and relevance of early diagnosis.

Authors' Contributions

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All authors declare that they contributed to the critical review of intellectual content and approval of the final version to be published.

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Conflict of Interest

The authors declare no conflicts of interest.

Data Availability

The data used to support the findings of this study can be made available upon request to the corresponding author.

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