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Original Article

Mortality from HIV/AIDS in adolescents and young adults: a temporal time series

Mortalidade por HIV/aids em adolescente e adulto jovem: análise de séries temporais

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ABSTRACT
Objective: to analyze the trends of mortality from HIV/AIDS in adolescents and young adults. **Methods:** ecological, time series investigation of deaths by HIV/AIDS in adolescents and young adults, from 2009-2019 in Brazil, in populated areas included in records from the System of Information on Mortality. We applied correcting factors to the mortality rates and carried out analysis using polynomial regression modeling. **Results:** we analyzed 6,344 deaths by HIV/AIDS in adolescents and young adults. We found high mortality rates in young adults when compared to adolescents. There was a growing trend in the north of the country, in the age group from 10 to 14. Mortality rates were higher among males in all regions, with a reduction in the mean rate for white persons and an increase for black/brown persons. **Conclusion:** there was an increasing trend, followed by a decrease in the last few years, with relevant differences between regions. The age group from 20 to 24 and males presented the highest mean rates of deaths from this disease. **Contributions to practice:** most of all, our findings give support to health planning, considering the specificities of the public and the regions with the most growing trends, thus helping improve public policies.
Descriptors: Mortality; HIV; Acquired Immunodeficiency Syndrome; Adolescent; Young Adult.

RESUMO
Objetivo: analisar a tendência da mortalidade por HIV/aids em adolescente e adulto jovem. **Métodos:** estudo ecológico, de séries temporais, referente aos óbitos por HIV/aids em adolescentes e adultos jovens, de 2009-2019, no Brasil e regiões de residência, com registros do Sistema de Informação sobre Mortalidade. Utilizaram-se fatores de correção das taxas de mortalidade, e a análise foi realizada por meio da modelagem de regressão polinomial. **Resultados:** foram analisados 6.344 óbitos por HIV/aids entre adolescentes e jovens. Observaram-se altas taxas de mortalidade entre adultos jovens em comparação às observadas nos adolescentes, tendência crescente na região Norte, entre a faixa etária de 10 a 14 anos. Houve maior taxa de mortalidade para o sexo masculino em todas as regiões, redução da taxa média anual para o branco e aumento para raça/cor parda. **Conclusão:** nota-se tendência de aumento com posterior decréscimo nos últimos anos, com importantes disparidades regionais. A faixa etária de 20 a 24 anos e o sexo masculino apresentaram maiores taxas médias de óbitos ocasionadas por esse agravo. **Contribuições para a prática:** os achados conduzem especialmente ao planejamento em saúde, considerando especificidades do público e das regiões com maiores tendências, aprimorando, assim, as políticas públicas.
Descritores: Mortalidade; HIV; Síndrome de Imunodeficiência Adquirida; Adolescente; Adulto Jovem.

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Introduction

The epidemic of the human immunodeficiency virus (HIV) and the acquired immunodeficiency syndrome (AIDS) is a serious worldwide health hazard, producing challenges for the coverage and access to qualified health services to prevent and treat the disease[1]. 2021 estimates indicated there were 38.4 million people living with HIV, with 690,000 deaths related to HIV and AIDS worldwide[2]. In Latin America, estimates indicate an increase in 21% of new cases of infection by the virus from 2010 to 2019, a total of nearly 120 thousand more people infected[3].

From 2007 to June 2020, there were 342,459 notifications of new HIV cases in Brazil, mostly in the Southeast, corresponding to 152,029 (44.4%). In Brazil, there were 41,909 new cases of infection by this virus, with a detection rate of 17.8/100 thousand people. In addition, from 1980 to December 31, 2020, there were 360,323 deaths by AIDS, that is, deaths which had the syndrome as their main basic cause of death. 10,417 of them took place last year[4].

In spite of global commitments to reduce AIDS--related deaths and new HIV infections to less than 500,000 until the end of 2020, 680,000 people died from this disease in 2020, and 1.5 million people were infected in the same period. There was also a significant increase in AIDS cases in adolescents (10 to 19) and young adults (20 to 24). In 2021, in the age group from 15 to 24, the infection was more common in men than women, in a ratio of 36 to 10. The rates of mortality by AIDS in Brazil increased, from 2010 to 2020, among males in the age group from 20 to 24, from 3.1 to 3.4 deaths per 100 thousand people[4].

Rates of new infections and deaths by HIV/AIDS worldwide have, as their main reasons, the lack of access to diagnostic technology, late treatment, and the lack of specialized care for preventive action. Considering the need to reduce rates of transmission and death by HIV/AIDS worldwide, as well as the improvement of access, regardless of geographic region, the United Nations Joint Programme on HIV/AIDS (UNAIDS) released a new global strategy against AIDS 2021 - 2026, whose goals are to end these inequalities, taking the right paths to end the disease until 2030[2].

HIV/AIDS have been affecting several groups of people, regardless of sex, sexual orientation, or gender, significantly increasing in adolescents and young adults[5]. Adolescence and youth can be seen as periods prone to behaviors more vulnerable to Sexually Transmitted Infections, due to the discovery of sexuality and physical, social, and psychological conflicts that can lead to risk behaviors[6].

Considering that sex among youths has been taking place increasingly earlier, the likelihood of HIV infection can increase. Health workers must interfere using strategies to reduce new infections, while also searching measures to improve early detection rates and start/continuity of antiretroviral treatments[7].

Therefore, for the Global Strategy against aids 2021 - 2026 to reach estimated goals, all countries must do their part, analyzing, internally, which actions are lacking, and what can be solved using strategies of prevention and health treatment. The failure in achieving the global goal of reducing deaths related with this disease, the new infections, the increased number of deaths by HIV/AIDS worldwide, and the lack of research regarding deaths by the disease in adolescents and young adults[8] are more than enough justification to carry out this epidemiological study.

This study will be relevant as it will aid in monitoring this epidemic and the deaths caused by the disease, as stratified by region and age group, in addition to providing scientific evidence that can contribute for the planning, management, and evaluation of policies and actions targeted at health, to increase the survival of those who live with AIDS. Therefore, this study aimed to analyze trends of HIV/AIDS deaths in adolescents and young adults from 2009 to 2019 in Brazil.

Methods

This is an ecological study, with a time series analytical approach of deaths by AIDS in adolescents and young adults in Brazil from 2009 to 2019.

Brazil is in South America, and shares a frontier with 11 countries, being also limited by the Atlantic Ocean. Its territory comprises 8,510,820.623 km^2 and is divided in five regions: Midwest, North, Northeast, Southeast, and South; in 27 federative unions; and in 5,570 municipalities[9].

Records of deaths by AIDS were gathered from the System of Information on Mortality, from the Ministry of Health. Data on the population of adolescents and young adults, according to year and place of residence, were gathered from estimates of the resident population. All data was available in the electronic site of the Informatics Department of the Single Health System (DATASUS). Data survey was carried out in June 2021.

We analyzed all deaths of adolescents and young adults diagnosed with HIV/AIDS. The main diagnoses pointed as a cause of death in cases of HIV/AIDS is coded according to norms from the International Classification of Diseases (ICD), 11th revision, chapter 1 — "Certain infectious and parasitic diseases", under cods B20 through B24 — Human immunodeficiency virus disease[10].

The variables analyzed included: year of death; Brazilian regions; age (10 –14; 15 –19; 20 –24). In this research, we considered adolescence to include the ages from 10 to 19, and young adults, to be aged 20 to 24, in accordance with the World Health Organization[11]. In addition to age, we gathered data on the sex (female, male) and ethnicity/color (white, black, brown, Asian, native, unknown) from DATASUS.

To calculate mortality rates, we selected the total number of deaths whose primary cause was AIDS or HIV disease. The mortality rates were calculated using the ratio between the number of deaths of adolescents and young adults due to AIDS and the total population of adolescents and young adults in the same period and location, according to sex and multiplied by 100,000 people.

Considering the undernotification of deaths in the System of Information on Mortality in less developed regions of the country, mortality rates in adolescents and young adults were adjusted to identify the disease more precisely. Therefore, we used the corrective factors proposed by Szwarcwal and collaborators to guarantee the quality of data, considering the undernotifications[12].

The death rate trend was analyzed by polynomial regression modeling. For this model, rates were considered to be a dependent variable (y), and the year of birth as the independent variable (x). The variable "year" was transformed into the year-focused variable (x-2014), and the series were smoothed using a three-point moving average. We tested linear polynomial regression models ($y = \beta0+\beta1x^1$), as well as second order ($y = \beta0+\beta1x1+\beta2x^2$) and third order models ($y = \beta0+\beta1x^1+\beta2x^2+\beta3x^3$). The model with p value < 0.05 was considered to have found a significant trend. We also analyzed the dispersion diagram, the value of the determination coefficient (r^2), and the residue analysis (assuming there was homoscedasticity) to choose the best model. When more than one model and similar determination coefficients provided significant criteria, the simplest model was chosen. Information was organized in Microsoft Office Excel® spreadsheets, and statistical analysis was carried out using the software R, version 3.6.2.

For the space distribution of mortality rates of HIV/AIDS, we used the cartographic base of Brazil including the borders of the states, available online in shape file, on the Brazilian Institute of Geography and Statistics website. We elaborated choropleth maps to show the chronological distribution of general rates of death by HIV/AIDS per age group in the Brazilian states, in three-year periods (2009 to 2011, 2013 to 2015, 2017 to 2019). Scales were divided in: Level 0 - not significant; Level 1 - From the minimum value to the first quartile; Level 2 - From the 1st quartile to the median; Level 3 - From the median to the mean; Level 4 - From the mean to the 3rd quartile; Level 5 - from the 3rd quartile to the maximum value. Figures were created using the software QGIS 3.14. The space distribution of death rates is presented in intervals of minimum and maximum rates, and the choropleth maps are represented in green scales, with lighter colors indicating lower rates and darker ones indicating

higher ones. It should be noted that units of analysis took place by determining the rates in the Brazilian region sand states, based on the grouping of deaths and the population of the states.

This study was developed following all ethical and legal precepts from Resolutions No. 466/12 and 510/16 from the National Council of Health. Since these are secondary, public domain data, there was no need for an evaluation by the Permanent Committee for Ethics in Research Involving Human Beings.

Results

We analyzed 6,344 deaths caused by HIV/AIDS in adolescents and young adults in Brazil, from 2009 to 2019. Most deaths took place in youths from 20 to 24, with 2.72 deaths by HIV/AIDS per 100,000 people in 2009, which increased to 2.97 in 2015, and decreased to 2.53 in 2019. The mortality rates in the age group from 15 to 19 of 0.63 in the first year of the study, increased to 0.80 in 2014 and decreased to 0.43 in 2019. The lowest mean rates were found in the age group from 10 to 14, with 0.28 in 2009, which decreased to 0.09 in 2019 (Figure 1).

	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
10 to 14 y/o	0.28	0.24	0.22	0.19	0.15	0.12	0.10	0.09	0.09	0.09	0.09
15 to 19 y/o	0.63	0.62	0.64	0.70	0.75	0.80	0.78	0.74	0.61	0.51	0.43
20 to 24 y/o	2.72	2.73	2.82	2.90	2.96	2.93	2.96	2.97	2.89	2.74	2.53

Source: System of Information on Mortality from the Ministry of Health, 2009-2019

Figure 1 – Historical series of mortality rates by HIV/AIDS in adolescents and young adults, per age group, from 2009 to 2019. Maringá, PR, Brazil, 2022

The polynomial regression analysis showed that, in Brazil, there was an increasing trend in the beginning of the period investigated, followed by a decrease in the mortality rates by HIV/AIDS in the age groups analyzed, except for the group from 10 to 14, which consistently presented a downwards trend 0.02 per year; r^2= 0.88; p<0.001)

In regard to the age group from 10 to 14, the Northeast, Southeast, and South were also in a downwards trend. The decrease was greater in the Southeast (β1= -0.034; r^2=0.96), while the Midwest showed a downwards/upwards/downwards trend, due to variations in the period (β0=0.043; r^2=0.97); and the north of the country showed a growing trend, with a yearly increase of 0.024 (r^2=0.73).

In the age group from 15 to 19, the Midwest presented a downwards/upwards/downwards trend, with variations in the mean rates in the period (β0=0.446; r^2=0.92; p<0.001). The Northeast, Southeast, and South presented, in this group, the same upwards trend, followed by a decrease. In the North, the rates remained constant (p=0.066).

Concerning the age group from 20 to 24, the North showed an upwards trend, with the highest mean rate in the period (β0=4.741). The Southeast and South, in turn, presented an upwards trend, followed by a downwards one (p=0.001; p<0.001), with the South presenting a larger decrease (β1= -0.073). Regarding the Midwest, rates remained constant (p=0.730) (Table 1).

Table 1 – Trend of mortality rates by HIV/AIDS in adolescents and young adults, per age group, from 2009 to 2019. Maringá, PR, Brazil, 2022

Region/Age (years)	Model*	$R^{2\dagger}$	p-valor‡	Trend§
Brazil				
10-14	y= 0.150–0.020x	0.88	<0.001	↓
15-19	y= 0.761-0.013x–0.011x^2	0.86	<0.001	↑↓
20-24	y=2.970-0.005x–0.014x^2	0.88	<0.001	↑↓
North				
10-14	y= 0.209+0.024x	0.73	0.001	↑
15-19	y= 0.800+0.016x	0.33	0.066	–
20-24	y= 4.741+0.097x	0.56	0.008	↑

(the Table 1 continue in the next page...)

Northeast				
10-14	y= 0.129–0.009x	0.56	0.008	↓
15-19	y= 0.655–0.004x–0.013x^2	0.83	0.001	↑↓
20-24	y= 2.638+0.071x–0.012x^2–0.004x3	0.79	0.009	↓/↑/↓
Southeast				
10-14	y= 0.145-0.034x	0.96	<0.001	↓
15-19	y= 0.824–0.019x–0.012x^2	0.88	<0.001	↑↓
20-24	y= 2.839–0.015x–0.016x^2	0.83	0.001	↑↓
South				
10-14	y= 0.216–0.029x	0.73	0.001	↓
15-19	y= 0.960-0.028x–0.017x^2	0.84	0.001	↑↓
20-24	y= 3.244-0.073x–0.021x^2	0.87	<0.001	↑↓
Midwest				
10-14	y= 0.043+0.028x+0.009x^2–0.003x^3	0.97	<0.001	↓/↑/↓
15-19	y= 0.446+0.042x+0.000x^2–0.003x^3	0.92	<0.001	↓/↑/↓
20-24	y=0.058+0.007x	0.01	0.730	–

Source: System of Information on Mortality from the Ministry of Health, 2009-2019

*Polynomial linear regression models (y=β0+β1x^1), models of second (y=β0+β1x1+β2x^2), and models of third order (y=β0+β1x^1+β2x^2+β3x^3);†Determination coefficient value; ‡Models with p<0.05 were considered to show significant trends; §↑ Upwards; ↓ Downwards; – Constant; ↑/↓ Upwards/Downwards; ↓/↑ Downwards/Upwards; ↓/↑/↓ Downwards/Upwards/Downwards

In the analysis of the space distribution of mortality rates by HIV/AIDS each three years, we found the highest rates in the age group from 10 to 24 from 2013 to 2015, with a concentration of the rates in the states of Amazonas, Roraima, Amapá, Pará, Rio de Janeiro, and Rio Grande do Sul, with variations from 1.68 to 7.92 deaths per 100 thousand people (Figure 2).

After evaluating the age groups, we found that in the group from 10 to 14, mortality rates significantly reduced throughout the study. However, it should be mentioned that, in the final period analyzed (2017 to 2019), the states of Pará, Maranhão, and Tocantins had the highest rates. Regarding the age group from 15 to 19, the highest rates were found from 2013 to 2015, in the states of Amapá and Rio de Janeiro, which maintained the highest values from among all the states from 2017 to 2019. Regarding the age group from 20 to 24, in turn, HIV/AIDS death rates remained constantly high in the country as a whole. Still, the rates in the state of Paraná decreased in the last three years analyzed (Figure 2).

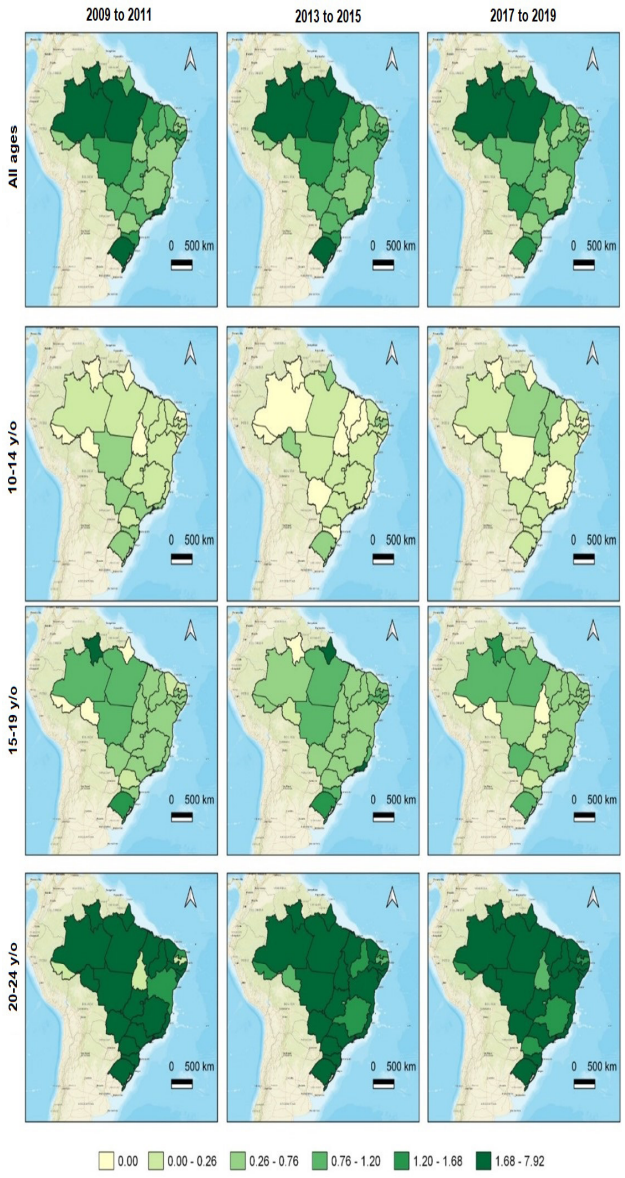

Figure 2 – Distribution of mortality rates by HIV/AIDS in Brazilian adolescents and young adults, per age group, every three years from 2009 to 2019. Maringá, PR, Brazil, 2022

When HIV/AIDS mortality rate trends were analyzed according to sex and Brazilian regions, we found a downwards trend for females in the country as a whole (p=0.001) and in the Northeast (p=0.004), Southeast (p<0.001), South (p<0.001), and Midwest (p=0.001), with the highest yearly mean decrease being presented in the South (-0.048).

Among males, there was an increase in the beginning of the period studied, followed by a decrease, in the country as a whole. They also presented a higher mean rate of death (β0= 1.596) when compared to females. Similar results were found in the Northeast (p=0.011), Southeast (p<0.001), and South (p=0.003). Regarding the North and Midwest, rates increased, with the North presenting the highest mean rate (β0= 2.491). It is worth noting that mean HIV/AIDS mortality rates in males were higher than those of females in all regions (Table 2).

Table 2 – Trend of mortality rates by HIV/AIDS in adolescents and young adults, according to sex and region, from 2009 to 2019. Maringá, PR, Brazil, 2022.

Region/Sex	Model*	$R^{2\dagger}$	p-value‡	Trend§
Brazil				
Male	$y=1.596+0.011x–0.009x^2$	0.94	<0.001	↑/↓
Female	y=0.916 - 0.031x	0.71	0.001	↓
North				
Male	y=2.491+0.124x	0.92	<0.001	↑
Female	$y=1.245+0.071x–0.004x^2-0.005x^3$	0.66	0.046	↓/↑/↓
Northeast				
Male	$y=1.430+0.013x–0.009x^2$	0.68	0.011	↑/↓
Female	y=0.7219-0.0272x	0.63	0.004	↓
Southeast				
Male	$y=1.555-0.005x–0.011x^2$	0.95	<0.001	↑/↓
Female	y=0.9468-0.0347x	0.82	<0.001	↓
South				
Male	$y=1.698-0.029x–0.022x^2$	0.76	0.003	↑/↓
Female	y=1.278-0.048x	0.79	<0.001	↓
Midwest				
Male	y=1.162+0.038x	0.42	0.031	↑
Female	y=0.605-0.042x	0.71	0.001	↓

Source: System of Information on Mortality from the Ministry of Health, 2009-2019

*Polynomial linear regression models ($y=\beta0+\beta1x^1$), models of second ($y=\beta0+\beta1x1+\beta2x^2$), and models of third order ($y=\beta0+\beta1x^1+\beta2x^2+\beta3x^3$); †Determination coefficient value; ‡Models with p<0.05 were considered to show significant trends; §↑ Upwards; ↓ Downwards; - Constant; ↑/↓ Upwards/Downwards; ↓/↑ Downwards/Upwards; ↓/↑/↓ Downwards/Upwards/Downwards

Regarding HIV/AIDS mortality rates per ethnicity/color in Brazil, there was an upwards trend, with a later decrease, among white (p<0.001) and brown (p=0.006) persons. However, among white persons, there was a reduction (mean of -0.014 per year), while brown persons presented a mean yearly increase (0.006), with the highest mean rates when compared to other ethnicities (β0= 0.600). It stands out that persons whose ethnicity/color were not informed presented a downwards trend (p<0.001), with a decreasing mean yearly rate (β1= -0.004) (Table 3).

Table 3 – Trend of mortality rates by HIV/AIDS in adolescents and young adults, according to ethnicity/color, from 2009 to 2019. Maringá, PR, Brazil, 2022

Ethnicity/color	Model*	$R^{2\dagger}$	p-value‡	Trend§
White	$y=0.462–0.014x–0.004x^2$	0.98	<0.001	↾⇂
Black	y= 0.157+0.001x	0.05	0.496	–
Asian	y=0.002+0.000x	0.24	0.126	–
Brown	$y=0.600+0.006x–0.003x^2$	0.72	0.006	↾⇂
Native	y= 4.741+0.097x	0.02	0.644	–
Ignored	y= 0.055–0.004x	0.96	<0.001	↓

Source: System of Information on Mortality from the Ministry of Health, 2009-2019

*Polynomial linear regression models ($y=\beta0+\beta1x^1$), models of second ($y=\beta0+\beta1x1+\beta2x^2$), and models of third order ($y=\beta0+\beta1x^1+\beta2x^2+\beta3x^3$); †Determination coefficient value; ‡Models with p<0.05 were considered to show significant trends; §↑ Upwards; ↓ Downwards; - Constant; ↑/↓ Upwards/Downwards; ↓/↑ Downwards/Upwards; ↓/↑/↓ Downwards/Upwards/Downwards

Discussion

The results of this study show that mortality rates between adolescents and young adults in Brazil are still high. Considering the number of deaths from HIV/AIDS in this specific population, the highest death rates were in young adults from 20 to 24.

A study from Ribeirão Preto, a city in the state of São Paulo, carried out from 2007 to 2017, found that HIV/AIDS infection rates increased from 11.9 to 13.3 per 100 thousand people. Reflecting about HIV/AIDS cases in youth implies developing actions to minimize the effects of the disease and, especially, allow for an increase in survival rates, since this pathology is still a serious public health issue[13].

High mortality rates in this age group can be associated with infections acquired in adolescence[14]. The epidemiological profile of the children and adolescents with HIV shows that nearly 65% of participants were from 12 to 18 years old at time of diagnosis, and, in addition, most cases involved adolescents from 15 to 18, who, in most cases, were transmitted the disease through sexual intercourse[15].

Adolescence is a transition period between childhood, the first stage of life, and adulthood, involving significant physical, psychic, social, and emotional changes[16]. In this context, new life habits and behaviors are assumed in a search for identity, by curiosity, and/or due to social customs imposed on the individual, that may lead them to adopt activities that compromise their health. In addition, they feel the need to be accepted by social groups, leading the person to expose themselves to the risk of contracting Sexually Transmitted Infections[17].

In addition, early initiation into sexual life leads to the experience of unsafe practices, increasing the odds of clinical syndromes such as AIDS. However, an early beginning to sex life is not the only issue, but the fact that they do so without any protection to their health. Furthermore, it should be noted that, in this period of life, both adolescents and youths present risky behavior, such as the use of illegal drugs and high doses of alcohol, which affects their decision making and judgment, leading them be exposed to risks. These findings reiterate the lack or inefficiency of guidance regarding the safe practice of sex in this population, reiterating the need for sexual education in health, including the development of actions of prevention, protection, and control. Additionally, the use of condoms is negatively influenced by a lack of conversations about sex with the mother[18].

Regarding adolescents from 10 to 14, vertical transmission is the main reason for the infection, considering the infection of women in a reproductive age. In the last few years, the cases of vertical HIV transmission have decreased, due to existing prevention protocols. The fact that the Single Health System provides free antiretroviral medication, the use of rapid tests of pregnant women, and the early detection of the disease, in addition to public policies to provide a quality prenatal care, have contributed to reduce vertical transmission rates, in addition to increasing mother-child survival[19].

Nonetheless, this study shows an upwards trend in regard to the infection of adolescents from 10 to 14, in the north of the country. In accordance with these findings, a study which evaluated prenatal care in the North and Northwest found a percentage of 2.44% of HIV positive pregnant women. Furthermore, there was a reduction in the number of women who did not adhere to the second repetition test (29.27%) recommended by the Ministry of Health in the third trimester of pregnancy, in addition to shortcomings in prenatal assistance[20].

The variation in mortality coefficients by HIV/AIDS in adolescents and young adults in the different regions of the country is related with the diversity and social inequality of socioeconomic and demographic contexts, leading to different vulnerabilities in the same territory. Different rates and time trends, depending on the region and state, can be directly associated to risk factors for this issue, and to the access to health services. The states are in different stages of epidemiological, demographic, and nutritional transition, and, consequently, these discrepancies are presented from one place to another[21].

Still regarding age group, there is an upwards trend of HIV in young adults, which leads to a higher number of deaths in this public. Therefore, it is important to highlight that, in addition to prevention strategies, there should be public policies to access medication treatment and treat those who do not require medication, to increase survival rates and provide quality follow up[22].

In the state of Paraná, the death rates by HIV/AIDS in the group from 20 to 24 decreased. As a result, it becomes clear that HIV treatment should be encouraged in all states, considering therapeutic schemes recommended by the Ministry of Health[23]. The-

refore, there is a good result in low viral replication, since adhering to the treatment provides quality of life to people and reduces virus transmission, hospitalizations, and mortality rates due to HIV/AIDS.

Regarding mortality trends due to HIV/AIDS according to sex, the coefficient among males is significant in Brazil as a whole. This is due to high exposure to unsafe sexual practices, legal and illegal drug use, and sexism-related social factors. Previous studies corroborate these findings, also justified by a low adherence from males to follow up and treatment[15,24].

Regarding mortality rates according to ethnicity/color, brown persons presented a higher mean than white ones. The ethnic and cultural diversity in Brazil is substantial, since the country is a large territory, influenced by several ethnicities. Thus, social determinants are relevant in regard to HIV and AIDS, since, historically, brown persons have less access to information, health, and education, which affects the transmission of disease and the prevention methods[25].

The persons whose ethnicity/color was "ignored" showed a trend downwards, showing the need to improve the way in which data is inserted in the System of Information on Mortality. It is clear that, in Brazil, the quality of health information has been receiving more attention. Proper record-keeping should be consistent and reliable, since it can give support to institutional public policies. Therefore, health workers and managers must be trained and made aware of the need for quality records and notifications for cases of mortality and other issues, diseases, and events associated with public health. Health information systems help analyzing epidemiological situations and planning and evaluation actions and programs[25].

Therefore, the findings of this study allow us to infer the likelihood that HIV/AIDS may be leading to severe complications that affect the health of adolescents and young adults, causing their deaths due to chronic conditions or to the risk of complications, considering the particularities of this disease and how difficult it is to manage it. Therefore, it has been challenging to guarantee adherence to HIV/AIDS treatment in outpatient services, since the stigma is reflected on the treatment, and, consequently, leads to non-adherence or abandonment, viral failures, and complications caused by lack of follow up, which can, often, lead to death.

Study limitations

Although the System of Information on Mortality is recognized for its quality and constant improvement, a limitation of this study includes the use of secondary data, through forms that can be inadequately filled in. There can also be undernotifications, since this study compares the different regions of Brazil. However, we still consider the results presented to be valid and significant, due to the importance of information for the planning of actions to prevent complications of HIV/AIDS, which can lead to deaths.

Contributions to practice

This research provides epidemiological information regarding this disease, in addition to its spatial distribution throughout the country, providing a perspective regarding the situation of the disease and its condition in space, and, consequently, subsidizing the actions of nurses and managers about the situation of the country, focusing on the regions. As a result, information from this study can help decision making and, especially, aid in health planning, considering the specificities of this public and the regions with the worst trends.

Furthermore, our findings can help plan public health policies targeted at HIV and AIDS, especially considering the adolescent and young adult population. In addition, this investigation allows us to reflect on the relevance of health education on the topic of HIV and AIDS, both for this specific population and for health workers and the population as a whole, while allowing the reduction of complications from this disease, such as early deaths.

Conclusion

This study showed that mortality from HIV/AIDS among adolescents and young adults in Brazil increased in the first period analyzed and, later, decrease, in the last few years, despite relevant regional disparities. Death rates from the disease in the age group from 20 to 24 were higher. Mean mortality rates in males were higher in all regions, when compared to females. We expect this research to raise discussions and subsidize processes of planning, management, and evaluation of public policies and health actions, to increase the survival of persons who live with HIV/AIDS, especially adolescents and young adults, whose behavior presents more risks to their health.

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Authors' contribution

Concept, design, or data analysis and interpretation: Piran CMG, Oliveira RR, Furtado MD.
Writing of the manuscript or relevant critical review of the intellectual content: Piran CMG, Fonseca BS, Oliveira NN, Shibukawa BMC, Merino MFGL, Oliveira RR, Furtado MD.
Approval of the final version to be published and Parties responsible for all aspects of the text and for guaranteeing the precision and integrity of any part of the manuscript: Piran CMG, Fonseca BS, Oliveira NN, Shibukawa BMC, Merino MFGL, Oliveira RR, Furtado MD.

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