



## Temporal trend of the incidence of HIV/Aids cases in the Northwest of Paraná State

*Tendência temporal da incidência dos casos de HIV/Aids no Noroeste do Estado do Paraná*

**Marcelo da Silva<sup>1,2</sup>, Luana Cristina Bellini<sup>1</sup>, Anderson da Silva Rêgo<sup>1,3</sup>, Fernanda Gatez Trevisan dos Santos<sup>1</sup>, Maria Aparecida Salci<sup>1</sup>, Marcelle Paiano<sup>1</sup>, Cremilde Aparecida Trindade Radovanovic<sup>1</sup>**

<sup>1</sup> Center of Health Sciences, Graduate Program in Nursing, State University of Maringá (UEM), Maringá (State of Paraná), Brazil; <sup>2</sup> Cesumar University (UniCesumar), Maringá (State of Paraná), Brazil; <sup>3</sup> University Hospital of Maringá, Maringá (State of Paraná), Brazil.

\*Corresponding author: Marcelo da Silva – E-mail: marceloascencio@gmail.com

### ABSTRACT

This study aimed to analyze the temporal trend of incidence rates of HIV/Aids cases in the northwest of the State of Paraná. Ecological study of analysis of time series with data referring to notifications of HIV/Aids in the 15th Regional Health of the State of Paraná, from 2009 to 2019. The access to notification and health problems information system occurred in the month of June 2020. The Mann-Kendall test was used to verify the existence of a trend in the annual case series. The total grade showed an increasing trend, the most significant increase was in men (tau of 0.96), over 65 years old and between 20 and 34 years old (0.64 and 0.56, respectively), with university education and high school (0.89 and 0.78, respectively). There was no significant increase in death rates. There was an increase in the temporal trend in most of the analyzed incidence rates of HIV/Aids cases.

**Keywords:** Epidemiology descriptive. HIV Infections. Health information systems.

### RESUMO

Objetivou-se analisar a tendência temporal das taxas de incidência dos casos de HIV/Aids no noroeste do Estado do Paraná. Estudo ecológico, de análise de séries temporais com dados referentes às notificações de HIV/Aids na 15ª Regional de Saúde do Estado do Paraná no período de 2009 a 2019. O acesso ao sistema de informação de notificação e agravos ocorreu no mês de junho de 2020. Foi utilizado o teste de *Mann-Kendall* para verificar a existência de tendência nas séries anuais de casos. A série total apresentou tendência crescente, e o aumento mais expressivo foi em homens (tau de 0,96) acima de 65 anos e de 20 a 34 anos (0,64 e 0,56, respectivamente), com ensino superior e médio (0,89 e 0,78, respectivamente). Não houve aumento significativo nos óbitos. Observou-se crescimento da tendência temporal na maioria das taxas analisadas de incidência dos casos de HIV/Aids.

**Palavras-chave:** Epidemiologia descritiva. Infecções por HIV. Sistemas de informação em saúde.

Received in February 09, 2021  
Accepted on July 16, 2021

## **INTRODUCTION**

More than 30 years after the emergence of the human immunodeficiency virus (HIV), the acquired immunodeficiency syndrome (AIDS) is still considered a pandemic and a serious public health problem in Brazil and worldwide<sup>1</sup>. The HIV epidemic has highlighted the various weaknesses, such as social inequality, violence and discrimination<sup>2</sup>.

In Brazil, the first HIV-positive diagnosed case took place in the 1980s, since then, more than one million cases of AIDS have been reported. The country has registered, annually, an average of 39 thousand new cases in the last five years<sup>3</sup>. Brazil is also the one that accumulates the most cases of new HIV infections in Latin America, equivalent to 40% new infections, however, it is the only one that offers pre-exposure prophylaxis (PrEP) through the public health system. The highest AIDS detection rates in the country are concentrated in the Southeast and South regions. However, in the last ten years, these regions showed a decreasing trend, from 23.2 and 32.7 in 2009, to 15.4 and 22.8 cases per 100,000 inhabitants in 2019, corresponding to a drop of 33.6% and 30.3%, respectively<sup>4</sup>.

Also, in 2019 in the country, the Information System for Notifiable Diseases (SINAN) received 41,909 new HIV notifications and 37,308 new AIDS cases. From 1980 to June 2019, there were a total of 982, 129 cases of AIDS identified in the

country, with a detection rate of 17.8/100,000 inhabitants<sup>5</sup>.

Considering other disease control programs, Brazil continues to face AIDS in an eminent way, in the defense of human rights, with promotion and prevention campaigns, free distribution of medicines through highly potent antiretroviral therapy by the Unified Health System (SUS) and with the implantation and implementation of specialized services for the assistance of People Living with HIV/AIDS (PLWHA)<sup>6</sup>.

Since the onset of the disease, several changes have been observed in the epidemiological profile, including its transmission without restriction to risk groups, spreading the possibility of infection to all people. As of 2009, cases of HIV/AIDS have suffered a downward trend in women and an exponential increase among adolescents (13 to 19 years old) and in the category of men who have sex with men (MSM)<sup>7</sup>.

Some studies demonstrate diffuse moments in the history of HIV/AIDS in Brazil, which are intertwined with the history of public policies in the country. Thus, the appearance of the first cases was marked by the negligence of government authorities, especially at the federal level, accompanied by an influx of discrimination, fear and stigma<sup>8</sup>. From 1993 to the current stage, it is defined by the reorganization of the National STI/AIDS Program and by the establishment of the epidemic control policy, resulting from bank loans to the Brazilian government<sup>9</sup>.

With the prevention and control of AIDS in mind, the state of Paraná decentralized to municipalities the rapid HIV tests. The state is composed of four macro-regions, east, west, north and northwest. The northwest macro-regional is divided into five Regional Health, integrating the 15th Regional Health Division object of study in this research. It is the largest in the northwest macro-region, comprising 30 municipalities, with an estimated population of 816,771<sup>10</sup>. The STI/AIDS outpatient clinic promotes daily actions, in partnership with municipal secretariats, aimed at monitoring the disease, receiving and monitoring cases and dispensing medication, justifying the importance of surveying the incidence of HIV/AIDS cases.

Therefore, it is necessary to develop strategies that promote the quality of epidemiological surveillance and the dissemination of information, which can support the management of actions for the promotion, protection and prevention of HIV and AIDS, and changes in health indicators for the general population, key populations and PLWHA. Thus, this study aimed to analyze the temporal trend in incidence rates of HIV/AIDS cases in the 15th Regional Health Division of the state of Paraná, in general and for certain characteristics.

## **METHOD**

This was an ecological, descriptive, retrospective study, based on the analysis of

time series with data on HIV/AIDS notifications in the 15th Regional Health Division (RS) of the state of Paraná, from 2009 to 2019. Data were obtained by consulting the Information System for Notifiable Diseases (SINAN) of the 15th RS made available by the institution.

Information was collected regarding notifications from 2009 to 2019. This study period was chosen as it contains the most complete and current records available at SINAN. Access to SINAN occurred in June 2020, based on available information, the researchers developed an instrument in order to systematize data collection. For this, electronic spreadsheets were built in the Microsoft Office Excel 2019 program, they were doubled tabulated and the inconsistencies corrected. This process was reproduced for the variables: case definition (AIDS, HIV+, death), education (illiterate, children education, elementary school, high school, higher education), age group (10 to 14, 15 to 19, 20 to 34, 35 to 49, 50 to 64, 65 to 79) and gender (male and female).

For the following analyses, the number of HIV/AIDS cases was corrected according to the population estimate provided by IBGE in each of the years evaluated. It is noteworthy that in addition to the total population (used to correct the total number of cases and by definition: HIV/AIDS, HIV+ and death), IBGE publications also present estimates per age group and gender, used to correct the respective characteristics. In addition, the distribution of the level of education of the population in the micro-region of Maringá

was considered for the correction of the analysis by education.

Thus, the following analyses refer to the rate of cases per 100,000 inhabitants, according to each profile evaluated, and only the division by category was not considered.

At first, a descriptive analysis of the results was performed to obtain line graphs, in order to characterize the behavior of the annual case series. The line graph of a time series presents the values of the variable in question for each month or year of the evaluated period, in order, linked by a single line.

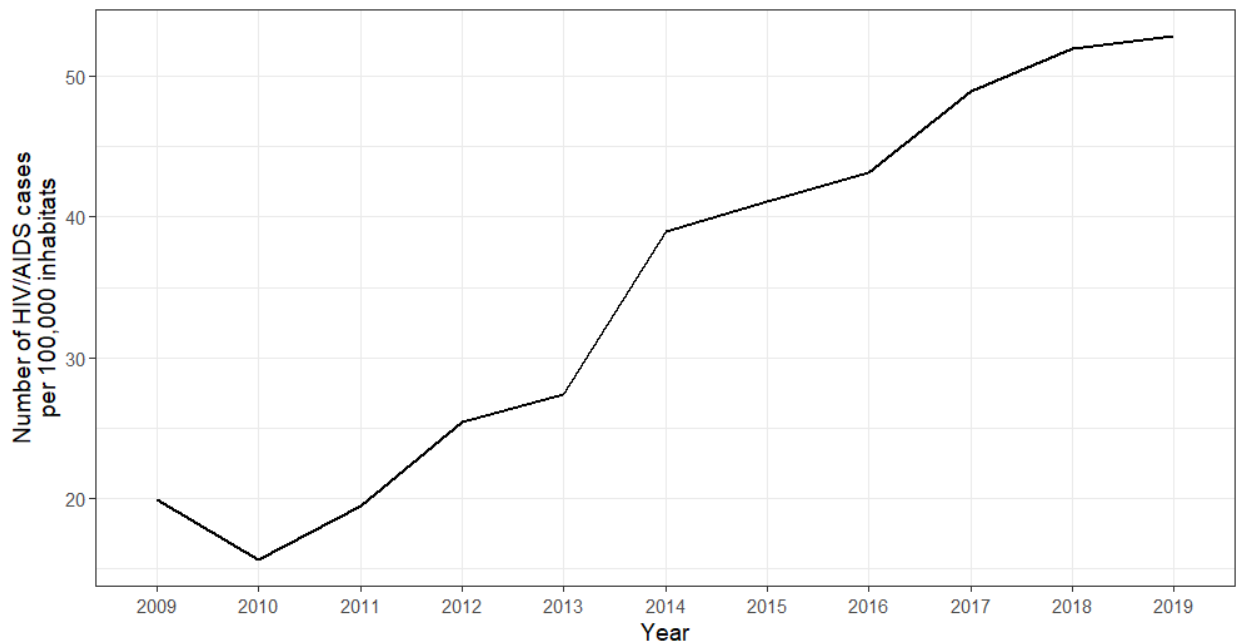
To check for a trend in the annual case series, the Mann-Kendall test was used. The Mann-Kendall non-parametric test assesses the presence of a trend in a time series, whether linear or non-linear<sup>11</sup>. If the series  $x_t$ , with  $t = 1, \dots, n$ , the Mann-Kendall  $S$  statistics represents the number of positive differences minus the number of negative differences of all comparisons considered. Furthermore, the statistics in which tau is the Mann-Kendall  $\tau$  was obtained, whose

sign indicates whether the trend is increasing ( $\tau > 0$ ) or decreasing ( $\tau < 0$ ). All analyses were performed with the aid of the statistical environment R (*R Development Core Team*), version 3.5.

The project was approved by the Research Ethics Committee of the State University of Maringá (COPEP/UEM), under opinion 4178321 and CAAE 31370720.0.0000.0104, respecting all the precepts of resolution 466/2012 and 510/2016. And obtained authorization from the Ethics Committee of the 15th Regional Health Division of the state of Paraná.

## RESULTS

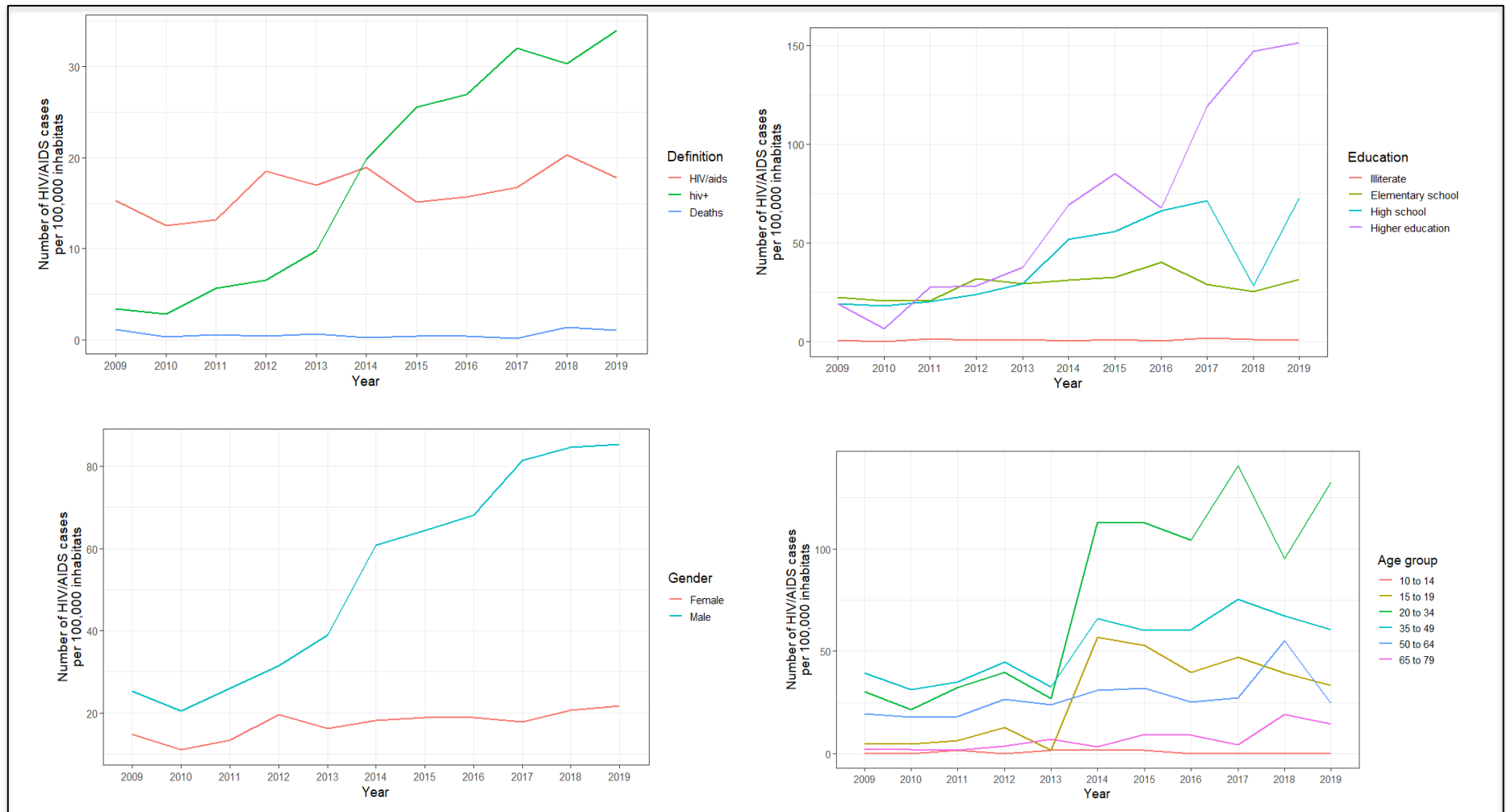
The analysis of time series (Figure 1) revealed that in 2009, the first year of the period evaluated, the HIV/AIDS rate was approximately 20 per 100,000 inhabitants, with a decrease in the following year and showing a constant growth since then. In 2019, the number exceeded 50/100,000, about three times more than in 2009.



**Figure 1.** Temporal evolution of HIV/AIDS incidence coefficients, per 100,000 inhabitants, 15th Regional Health Division, state of Paraná, from 2009 to 2019. Maringá, State of Paraná, Brazil, 2021.

It is observed in Figure 2 that, in the definition category, HIV+ rates showed a high increase, from a rate of less than 5 cases per 100,000 inhabitants in 2009 to a rate of more than 30 cases per 100,000 in 2019, in the same period, deaths remained constant. In the education category, it is noteworthy that the greatest growth refers to higher education, followed by high school, in which the rate increased from 25 to 150 and 75 cases per 100,000 inhabitants,

respectively. In 2009, about 25 cases were observed in the age group from 20 to 34 years, while this same age group surpassed 125 cases per 100,000 inhabitants at the end of the period, in 2019. On the other hand, the growth of cases observed in children and adolescents up to 19 years old was milder. Finally, the figure below illustrates that in males the cases had a significant growth, from 25 cases in 2009 to 80 cases per 100,000 inhabitants in 2019.



**Figure 2.** Distribution of HIV/AIDS incidence coefficients, per 100,000 inhabitants, according to exposure category, education, gender and age group, 15th Regional Health Division, state of Paraná, from 2009 to 2019. Maringá, State of Paraná, Brazil, 2021.

Table 1 lists the results of the Mann-Kendall non-parametric test for the number of HIV/AIDS cases from 2009 to 2019. The total series showed a strong positive trend

(tau of 0.93), which was statistically significant (p value < 0.001), at the 5% level of significance.

**Table 1.** Mann-Kendall test result of the annual HIV/AIDS case series, total and by characteristic, 15th Regional Health Division, state of Paraná, from 2009 to 2019. Maringá, State of Paraná, Brazil, 2021

	<b>Z</b>	<b>Tau</b>	<b>P</b>
<b>Total</b>	3.97	0.93	<0.001*
<b>Definition</b>			
HIV/AIDS	1.79	0.42	0.087
Death	-0.23	-0.05	0.876
HIV+	3.97	0.93	<0.001*
<b>Education</b>			
Illiterate	0.39	0.09	0.755
Elementary school	1.48	0.35	0.161
High school	3.35	0.78	0.001*
Higher education	3.81	0.89	<0.001*
<b>Age group</b>			
10 to 14	0.00	0.00	1.00
15 to 19	1.48	0.35	0.16
20 to 34	2.41	0.56	0.019*
35 to 49	2.41	0.56	0.019*
50 to 64	2.10	0.49	0.043*
65 to 79	2.73	0.64	0.008*
<b>Gender</b>			
Male	4.13	0.96	<0.001*
Female	2.73	0.64	0.008*

\* p-value < 0.05.

In terms of education, there was a significant positive trend for higher education and high school, especially for the last grade (tau of 0.89). Regarding age groups, only 10 to 14 and 15 to 19 years old did not show a significant trend. The most significant increase was observed in the 65 to 79 age group (tau of 0.64). It is noteworthy that the data showed an increasing trend in all age groups from 20 years onwards.

Both males and females showed a significant positive trend, especially males, whose tau coefficient reached 0.96.

## DISCUSSION

From the second year evaluated, there was an increasing and constant trend in cases of PLWHA, and in 2019 this number tripled compared to cases reported in 2009. Regarding deaths, the number remained low throughout the period. It is noteworthy an exponential increase in

HIV/AIDS cases in the young population, aged 20 to 34 years, and a significant increase in rates among the elderly, males and people with higher education and high school, at the end of 2019.

Reaffirming these data, according to the 2019 Epidemiological Bulletin, in the period from 2009 to June 2019, it was observed that most cases of HIV infection are in the range of 20 to 34 years, with a percentage of 52.7% cases. Regarding education, most had completed high school, representing 20.7% total. Then, 12.1% cases with incomplete education, between the 5th and 8th grades, were observed. Furthermore, a total of 69.4% cases in men and 30.6% in women were reported. The sex ratio for 2019 was 26 men for every ten women<sup>4</sup>.

A study carried out with secondary data of HIV/AIDS cases notified between 1980 and 2015 in the state of Rio Grande do Sul, showed that, among the periods studied, the detection rate of HIV/AIDS cases in the state increased by 19.9 times. From 1980 to 2015, of the total number of cases registered in the state, 59.3% were male and 40.6% female<sup>12</sup>.

A similar study was carried out in Campinas, state of São Paulo, with the objective of analyzing the temporal trend of the incidence coefficients of HIV/AIDS infection between 1980 and 2016. Of the notified cases, 70.9% were male and evidenced the resurgence of the HIV epidemic in the population of men who have sex with men. These data reflect continuous risky sexual behavior and lack

of concern about the infection, given the idea that AIDS is a disease with treatment<sup>13</sup>.

The same study pointed out that the death rates showed a sharp drop after 1995. The reduction in deaths can be attributed to the positive impact of early detection policies and access to clinical and therapeutic follow-up of individuals with HIV and AIDS in the city<sup>13</sup>. On the other hand, a documentary research identified underreporting of AIDS deaths in Brazil, through the pairing between the Mortality Information System and the Hospital Information System, for the years from 2008 to 2012. These results serve as a warning of the need for a better certification of the causes of death among patients with AIDS<sup>14</sup>.

Another study carried out with secondary data from 112 medical records of a Testing and Counseling Center (CTA) showed an important predominance of the 20 to 39 years group and a higher incidence of males. In relation to education, 35 records registered eight to 11 years of study<sup>15</sup>. The knowledge of the higher prevalence of the disease in males is important to guide public policies and give greater focus to men's health. For this, sensitization and awareness actions have been carried out, particularly regarding the use of male condoms<sup>16</sup>.

As a relevant result of the present study, the growing trend of HIV/AIDS notifications in the elderly stands out. A Northeastern study corroborates data from this study and demonstrated that elderly people aged 80 years and over had higher



mortality, which is an inherent factor in the decrease in the individual's functional and cognitive capacity, in addition to the fact that, when there is a late diagnosis, the chances of survival are reduced. Specific campaigns are required for intervention about safe sex also among the elderly, as well as the development of public policies aimed at sexuality in aging<sup>17</sup>.

In this perspective, it is important to emphasize that the HIV/AIDS epidemic is still a worrying scenario for public health and is the cause of thousands of victims every year, creating challenges for health professionals and managers. Due to its principles of resoluteness, longitudinality and accessibility in the work process, Primary Health Care (PHC) together with its team, has the role of receiving and guiding the patient who enters the service. The PHC team has the possibility of making an early diagnosis by applying the rapid test, and advising on changes in risk behavior and/or harm reduction<sup>18</sup>.

Despite numerous studies and research, the disease is still stigmatized. PLWHA is understood as a passive object and incapable of organizing themselves into society. Thus, the role of health professionals is to go beyond the biomedical model, focusing on holistic and sensitive care, adapting to the particularities of each subject<sup>19-20</sup>.

In a population frame of the PLWHA in the study group, the category belonging to the general population prevailed, therefore, this study contributed to the knowledge of the vulnerable

population, bringing subsidies for the adoption of preventive measures. Still, the majority prevalence in males reinforces the spread of self-conviction of male invulnerability, which added to the greater neglect of self-care, indirectly increases male mortality and the number of infected women<sup>15</sup>.

As for the limitations of the present study, it is pointed out that the use of secondary data does not allow for controlling potential recording errors or even the full filling of the variables under consideration, a fact that was presented as the main drawback to the complete analysis of the sample. As an indication for future research, it is important to develop actions and strategies to improve the quality of data from health information systems, in addition, the development of monitoring and evaluation research on the characterization of HIV/AIDS cases is indicated, aiming at the elaboration of more effective public policies to fight the disease.

## **CONCLUSION**

The data analyzed in the period between 2009 and 2019 showed an increase in the temporal trend in the incidence rates of HIV/AIDS cases, especially among men, aged between 20 and 34 years, with education between high school and higher education. Still, the data showed an increasing trend in the age groups that correspond to the elderly population. This indicates that there is a need to implement effective public policies for health

education for all audiences, since the change in the sociodemographic profile of the disease no longer exempts any population segment.

The discussion about the forms of transmission and the severity of the disease is essential to raise awareness about the use of condoms, as well as other methods, since sexual contact is the main mode of transmission. Furthermore, it is essential that health professionals are aware of the demand for the proper completion of notification forms, since this is one of the most relevant tools for national epidemiological studies, acting, secondarily, as a guide for the formulation of public policies. It is suggested as practical applications the development of educational campaigns that address the mode of transmission and prevention of HIV.

## REFERENCES

1. United Nations Programme on HIV/AIDS - UNAIDS. Data Global AIDS update; 2019 [internet]. Geneva: World Health Organization; 2019. Available from: [https://www.unaids.org/sites/default/files/media\\_asset/2019-UNAIDS-data\\_en.pdf](https://www.unaids.org/sites/default/files/media_asset/2019-UNAIDS-data_en.pdf)
2. United Nations Programme on HIV/AIDS - UNAIDS. Communities at the centre: defending rights, breaking barriers, reaching people with HIV services [internet]. Data Global AIDS update; 2019. Available from: [https://www.unaids.org/sites/default/files/media\\_asset/2019-global-AIDS-update\\_en.pdf](https://www.unaids.org/sites/default/files/media_asset/2019-global-AIDS-update_en.pdf)
3. Faria MPR, Toni JCV, Imamura KB. Perfis epidemiológicos de pacientes com HIV/aids, no período de 1996 até 2016 no município de Vilhena-RO. *Revista Intersaúde* [Internet]. 2019 [cited 2020 Out 20];1(1):2-21. Disponível em: [http://revista.fundacaojau.edu.br:8078/journal/index.php/revista\\_intersaude/article/view/107](http://revista.fundacaojau.edu.br:8078/journal/index.php/revista_intersaude/article/view/107)
4. Brasil. Ministério da Saúde. Secretaria de Vigilância em Saúde. Boletim Epidemiológico Especial HIV/Aids [internet]. Brasília: MS, n. especial, Dez. 2020. Available from: <http://www.aids.gov.br/pt-br/pub/2020/boletim-epidemiologico-hivaids-2020>
5. Brasil. Ministério da Saúde. Secretaria de Vigilância em Saúde. Boletim Epidemiológico de HIV e Aids 2019 [internet]. Brasília: MS, n. esp, Dez, 2019. Disponível em: <http://www.aids.gov.br/pt-br/pub/2019/boletim-epidemiologico-de-hivaids-2019>
6. Greco DB. Trinta anos de enfrentamento à epidemia da Aids no Brasil, 1985-2015. *Ciênc. saúde coletiva* [internet]. 2016 [cited 2021 Jan 28];21(5):1553-1564. DOI: <https://doi.org/10.1590/1413-81232015215.04402016>.
7. Pereira BM, Silva NM, Moura LRP, Brito CMS, Câmara JT. Estudo epidemiológico de pacientes com infecção pelo Vírus da imunodeficiência humana/Síndrome da imunodeficiência adquirida (HIV/Aids), Caxias-MA. *R Interd* [Internet]. 2016 out-dez [citado 2020 jan 8];9(4):132-41. Disponível em: <https://dialnet.unirioja.es/servlet/articulo?codigo=6771942>

8. Leite DS. AIDS no Brasil: mudanças no perfil da epidemia e perspectiva. *Braz. J. of Develop* [internet]. 2020 [citado em 2021 Jan 28];6(8):57382-57395. DOI: <https://doi.org/10.34117/bjdv6n8-228>
9. Dartora WJ, Ânflor ÉP, Silveira LRP. Prevalência do HIV no Brasil 2005-2015: dados do Sistema Único de Saúde. *Rev Cuid* [internet]. 2017 [cited 2021 Jan 28];8(3):1919-28. DOI: <http://dx.doi.org/10.15649/cuidarte.v8i3.462>
10. Instituto Brasileiro de Geografia e Estatística (IBGE). PIB \_ Per capita \_ Brasil \_ 2010/2016 [Internet]. Brasil em síntese. 2017. Disponível em: <https://brasilemsintese.ibge.gov.br/contas-nacionais/pib-per-capita>.
11. Machiwal D, Jha MK. Hydrologic time series analysis: theory and practice. Springer, Dordrecht: New Delhi, 2012. 272p.
12. Pereira GFM, Shimizu HE, Bermudez XP, Hamann EM. Epidemiologia do HIV e aids no estado do Rio Grande do Sul, 1980-2015. *Epidemiol. Serv. Saude* [Internet]. 2018 [cited 2020 Out 20];27(4):e2017374. DOI: <http://dx.doi.org/10.5123/s1679-49742018000400004>
13. Melo MC, Almeida VC, Donasílio MR. Tendência da incidência de HIV-aids segundo diferentes critérios diagnósticos em Campinas-SP, Brasil de 1980 a 2016. *Cien Saude Colet* [Internet]. 2021 [cited 2021 Jul 25];26(1): 297-307. DOI: <https://doi.org/10.1590/1413-81232020261.08652019>
14. Carmo RA, Policena GM, Alencar GP, França EB, Bierrenbach AL. Subnotificação de óbitos por AIDS no Brasil: linkage dos registros hospitalares com dados de declaração de óbito. *Cien Saude Colet* [Internet]. 2021 [cited 2021 Jul 25];26(4):19. DOI: <https://doi.org/10.1590/1413-81232021264.15922019>
15. Moura JP, Faria MR. Caracterização e perfil epidemiológico das pessoas que vivem com HIV/aids. *Rev enferm UFPE on line* [Internet]. 2017 [cited 2020 Out 20];11(Supl. 12):5214-20. DOI: <https://doi.org/10.5205/1981-8963-v11i12a22815p5214-5220-2017>
16. Trindade FF, Fernandes GT, Nascimento RHF, Jabbur IFG, Cardoso AS. Perfil epidemiológico e análise de tendência do HIV/AIDS. *Journal Health NPEPS* [internet]. 2019 [cited 2020 Out 19];4(1):153-165. DOI: <http://dx.doi.org/10.30681/252610103394>
17. Souza Júnior EV, Cruz DP, Caricchio GMN, et al. Aspectos epidemiológicos da morbimortalidade pelo vírus da imunodeficiência humana no nordeste brasileiro. *Rev Fund Care Online*. [Internet]. 2021 [cited 2021 Jul 28];13:144-149. DOI: <http://dx.doi.org/10.9789/2175-5361.rpcfo.v13.8025>
18. Bones AANS, Costa MR, Cazella SC. The education for facing the HIV Epidemic. *Interface (Botucatu)* [internet]. 2018 [cited 2021 Jan 28];22(supl.1). DOI: <https://doi.org/10.1590/1807-57622017.0066>
19. Maia ECA, Reis Junior LP. Modes of Coping HIV/AIDS: Human Rights, Vulnerability and Health Care. *Rev. NUFEN* [internet]. 2019 [cited 2021 Jan 27];11(1). DOI: <http://dx.doi.org/10.26823/RevistadoNUFEN.vol11.nº01ensaio48>

20. Silva BN, Sarmiento WM, Silva FCV, Pereira MG, Silva CRDV, Vêras GCB. Panorama epidemiológico da aids em idosos. *Hygeia* [Internet]. 2018 [cited 2020 Set 10];14(29):80-88. DOI: <http://dx.doi.org/10.14393/Hygeia142907>