

HIV/AIDS case definition criteria and association between sociodemographic and clinical aspects of the disease reported in the State of Minas Gerais from 2007 to 2016

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Abstract

Introduction: Over 30 years after the acquired immunodeficiency syndrome epidemic, several strategies have been implemented to verify the trend of the infection, the profile of the affected individuals, and the impact of prevention and control measures, with notification of asymptomatic carriers being the most recent measure. This study aimed to verify the geographic distribution of human immunodeficiency virus/acquired immunodeficiency syndrome and analyze the association between case definition criteria, sociodemographic data, and clinical aspects of the disease in the State of Minas Gerais between 2007 and 2016. **Methods:** In this ecological and analytical study, 35,349 cases of human immunodeficiency virus/acquired immunodeficiency syndrome reported in the State of Minas Gerais between 2007 and 2016 were analyzed. The data were analyzed using multiple correspondence factor analysis, time series analysis, descriptive statistics, and spatial distribution of the cases by macro-region. **Results:** The majority of the patients were brown-skinned individuals, alive, diagnosed with human immunodeficiency virus/acquired immunodeficiency syndrome on the basis of the criteria adapted from the Centers for Disease Control and Prevention, and living in municipalities with more than 50,000 (80.5%) inhabitants. Between 2007 and 2016, there was an increase in the number of criteria used for diagnosing human immunodeficiency virus. By contrast, a consequent decrease was observed in the number of criteria used for defining cases, which were adapted from the Centers for Disease Control and Prevention, Rio de Janeiro/Caracas, and for identifying AIDS-related deaths. Young people aged between 13 and 29 years, individuals whose education level is compatible with the observed age, and homosexual men were associated with the HIV+ criterion. **Conclusions:** Our study showed that after the mandatory notification of human immunodeficiency virus-positive cases in 2014, there was a decrease in other criteria for defining human immunodeficiency virus/acquired immunodeficiency syndrome cases and changes in the profile of people living with human immunodeficiency virus/acquired immunodeficiency syndrome.

Keywords: HIV. Acquired immunodeficiency syndrome. Time series studies. Factor analysis. Health profile.

INTRODUCTION

Over 30 years after the acquired immunodeficiency syndrome (AIDS) epidemic, AIDS remains one of the challenges to global public health, with consequences to the society and families. Every day more than 7,000 people are infected, and every 20 seconds, an AIDS-related death occurs, being the fifth most common cause of death among adults^{1,2}.

Although everybody is subject to contamination, sexual contact remains the main route of AIDS transmission. The rate of AIDS detection in Brazil has stabilized in the last 10 years, with an average of 20.5 cases/100,000 inhabitants. The mortality rate in 2014 was 5.7 deaths/100,000 inhabitants³.

Clinical monitoring of people living with human immunodeficiency virus/acquired immunodeficiency syndrome (PLHA), defined by the Pan American Health Organization, was carried out in three stages/goals. These goals became known as 90-90-90, in which countries by 2020 should reach 90% of the diagnosed PLHA, 90% of PLHA under antiretroviral therapy (ART), and 90% of PLHA under ART with viral suppression^{3,4,6}.

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Some strategies have been implemented to verify the trend of HIV infection and the impact of prevention and control activities such as compulsory notification of pregnant women and children exposed to vertical transmission, notification of asymptomatic carriers, optimization of risk, and vulnerability research⁷.

Since 2014, the Ministry of Health has included mandatory notification of HIV-positive cases by health services, with the aim of increasing the number of people aware of the serological condition and offering free access to the treatment for inhibition of viral replication⁸. This requirement can have important implications on the epidemiological profile of the disease in the country and health authorities' response to HIV/AIDS. The sub-registration may compromise the continuity of the provision of antiretroviral drugs and priority actions to vulnerable populations⁹.

Increasing access to diagnostic testing as well as eliminating HIV-related discrimination are among the current challenges for monitoring and controlling the HIV/AIDS epidemic⁶.

To verify whether there was a change in the pattern of the case definition criteria after the mandatory notification of HIV-positive cases, this study aimed to analyze the association between HIV/AIDS case definition criteria and clinical aspects of the disease, as well as to verify the geographical distribution of occurrence of cases in the state of Southeast Brazil between 2007 and 2016 by macro-region of health.

METHODS

This was an ecological study with an analytical approach. The Information System for notifiable diseases (SINAN) database, provided by the Minas Gerais State Health Department (SHD/MG) for the period between 2007 and 2016, containing the data of patients with HIV/AIDS older than 13 years was used.

Minas Gerais is the second most populous state in Brazil. The SHD/MG divided the state into 13 macro-regions and 77 micro-regions to facilitate in the expansion of public policies¹⁰. Of the 853 municipalities in the State of Minas Gerais, the median population is 8,203 (interquartile range of 4,848:17,782) and the average number of inhabitants is 23,766 [standard deviation (SD): 96,887], with 36.3% of the municipalities comprising of 5,000 inhabitants, and 28.7% comprising of 5,000-10,000 inhabitants.

The variables used in the study were age, age group, race, education, gender, zone, case definition criteria, the period before and after the compulsory notification of HIV-positive cases, population range, sexual transmission, case evolution, exposure category, and macro- and micro-regions of health.

The descriptive statistics and multiple correspondence factor analysis (MCFA) were used to analyze the data, which allows verification of the association between the supplementary variables and active variables of the case definition. The active variables that made up the factorial plane were all mentioned, except for zone and health region. The relations between geometric proximity and the points in the factorial plane help identify the associations between the active and supplementary

variables. The active variables were used to calculate the position of each individual in the factorial plane. By contrast, the supplementary variables were not used in the calculation but were used to determine the association of active variables in the factorial plane on the basis of similarity^{11,12}.

The MCFA demands complete data¹¹, and it is necessary to disregard cases with blank records. Variables whose categories have very unbalanced frequencies, that is, a category with a very high frequency (over 80%) and other categories with a very low frequency, were excluded, as the contribution of categories used in the construction of axes in the MCFA is inversely proportional to their frequency^{11,13}.

For the analysis of the temporal trend, the proportion of records according to HIV/AIDS case definition criteria per year (2007-2016) was used. In the analysis, the linear regression models standardized by the procedure proposed by Prais-Winsten were used to quantify the annual percent change (APC) of the Centers for Disease Control and Prevention (CDC)-adapted criteria, the number of HIV-positive cases in RJ/Caracas, and the number of HIV-related deaths, with 95% confidence intervals. A positive APC indicated an increasing time series; a negative APC indicated a decreasing times series; and when no significant difference was identified, a steady trend was considered¹⁴.

The notifications were spatially distributed according to the cartographic base of the territory of Minas Gerais (available in <http://datasus.saude.gov.br/cadastrros-nacionais/294-dowload-mapas-tabwin>), with the macro-regions of health as the unit of analysis. The total number of notifications from 2007 to 2016 was evaluated by macro-regions, and the linkage was given the cartographic base according to the macro-regional code of the Department of Informatics within the Unified Health System. The distribution considered the division of the values in the same frequency (quintile); the darkest gradation corresponded to the quintile of a higher value of notifications within a specific period. The Tabwin/DATASUS free software for mapping was used for mapping the frequency distribution.

Ethical considerations

This study was approved by the UFTM Research Ethics Committee (approval number: 2.099.176).

RESULTS

There was a higher proportion of notifications in the Central area (44.1%), Southeast (11.4%), and Northern triangle (10.8%) of the state (data not shown in table). With regard to the State Administrative Regions of Health, there was a greater proportion of cases in the regions of Belo Horizonte, Uberlândia, Uberaba, Juiz de Fora, Varginha, Divinópolis, Coronel Fabriciano, and Pouso Alegre (**Figure 1**). There were more reported HIV/AIDS cases in municipalities with more than 50,000 inhabitants (80.7%) and in municipalities with 20,000-50,000 inhabitants (9.9%).

Between 2007 and 2016, there were 35,349 HIV/AIDS cases reported in the State of Minas Gerais. The average age was 37.3 years (SD: 11.9 years), the median age was 35.6 years, and the

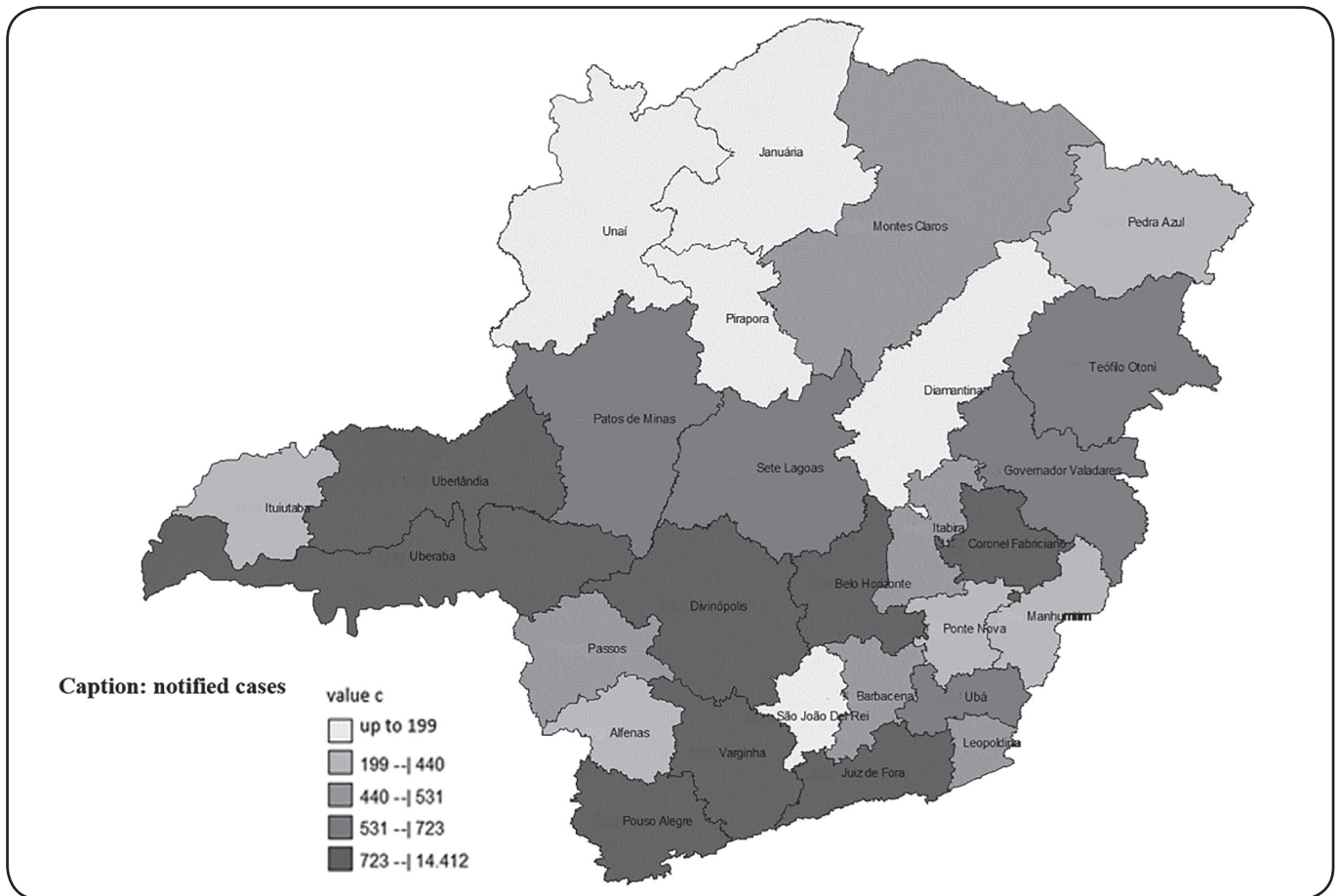


FIGURE 1: Distribution of the 35,349 reported cases of HIV/AIDS according to the State Administrative Regions of Health (Health Macro region), Minas Gerais, from 2007 to 2016. **HIV/AIDS:** human immunodeficiency virus/acquired immunodeficiency syndrome.

interquartile range was 28.1:45.0. There was a higher proportion of cases in the 40-to-59-year age group (33%) and 30-to-39-year age group (31.6%). About 13,921 (39.4%) patients were white, while 11,094 (31.4%) were brown skinned. Approximately 31.8% of patients had elementary education, and 18.4% had high school education; however, a large proportion of data about educational background ignored (37.4%). Majority of the study participants were living in urban areas (92.8%) and were men (67.8%) (**Table 1**).

In 2007-2016, the annual rate of change in the proportion of cases based on the reporting criteria for HIV infection increased (42.9%). For the other criteria, the annual rate of change decreased, with - 10.7% for the proportion of AIDS cases defined by the criteria adapted from CDC, - 6.9% for the proportion of cases reported based on the Rio de Janeiro/Caracas criteria, and - 13.9% for the proportion of cases that were reported based on the AIDS-related death criterion (**Figure 2**).

It was observed through the MCFA that most of the people living with HIV/AIDS, observed within the circle of **Figure 3**, were brown-skinned individuals, alive, diagnosed with AIDS based on the criteria adapted from CDC, and living in municipalities with more than 50,000 inhabitants. The quadrants of this figure were as follows:

Quadrant 1: Most cases of HIV infection were reported in white individuals aged 13-19 years and 20-29 years, and HIV infection was predominant in medium-framed and large-framed individuals. At the time of the notification, patients were probably alive owing to the time of the diagnosis and because they did not develop the immunodeficiency syndrome. It was also associated with being a male homosexual (**Figure 3**).

Quadrant 2: The variables with ignored information such as exposure category, race, educational level, evolution, mode of transmission, and exposure categorized as *others* that presented small percentages (presence of hemophilia, drug use, accidents with biological material, blood transfusion, and perinatal infection), municipalities with over 50,000 inhabitants, and being male were associated (**Figure 3**).

Quadrant 3: As regards the factors associated with period 1 (2007-2013) before the introduction of HIV notification, it was observed that the CDC and Rio de Janeiro/Caracas criteria were used to diagnose individuals aged 40-59 years and those aged over 60 years. Regarding the evolution of the case at the time of notification, patients' death was because of other causes unrelated to HIV infection. Still in this quadrant, a significant association was found in the criteria for defining an AIDS-related death case (**Figure 3**).

TABLE 1: Distribution of the 35,349 cases of HIV/AIDS according to the sociodemographic profile, Minas Gerais, from 2007 to 2016.

Profile	Number	Percentage
Race		
brown skinned	11,094	31.4
white/caucasian	13,921	39.4
black	4,655	13.2
ignored	5,473	15.5
asian	151	0.4
indigenous	55	0.1
Schooling		
illiterate	496	1.4
elementary	11,244	31.8
high School	6,504	18.4
higher	3,874	11.0
ignored	13,231	37.4
Zone		
urban	32,800	92.8
ignored	1,478	4.2
peri-urban	74	0.2
rural	997	2.8
Gender		
female	11,362	32.1
male	23,982	67.8
ignored	5	0.1
Age range		
from 13 to 19	1,102	3.1
from 20 to 29	9,841	27.9
from 30 to 39	11,179	31.6
from 40 to 59	11,676	33.0
over 60	1,551	4.4

HIV/AIDS: human immunodeficiency virus/acquired immunodeficiency syndrome.

Quadrant 4: Women living in municipalities with up to 5,000 inhabitants were included, followed by those living in municipalities with 10,000-20,000 inhabitants, heterosexuals, and those who had elementary school education. In the lower part of the quadrant, more associated with the average profile of the individuals, it was observed that the transmission of infection was caused by men who have sex with men (MSM) and by women who have sex with women, that is, homosexuals; HIV infection was also prevalent among brown-skinned individuals, those aged 30-39 years, and those living in municipalities with 20,000-50,000 inhabitants. This quadrant was not associated with any HIV/AIDS case definition criteria (**Figure 3**).

DISCUSSION

As of 2014, the obligation to notify HIV-positive cases was implemented in Brazil through Ordinance No. 1,271, dated

June 6, 2014⁸; this strategy was implemented to modify the profile of infected persons over time, especially in terms of age, sex, sexual orientation, and disease progression, as cases are expected to be detected early and the antiretroviral therapy regimen to be initiated allowing viral loads and reducing deaths and new infections.

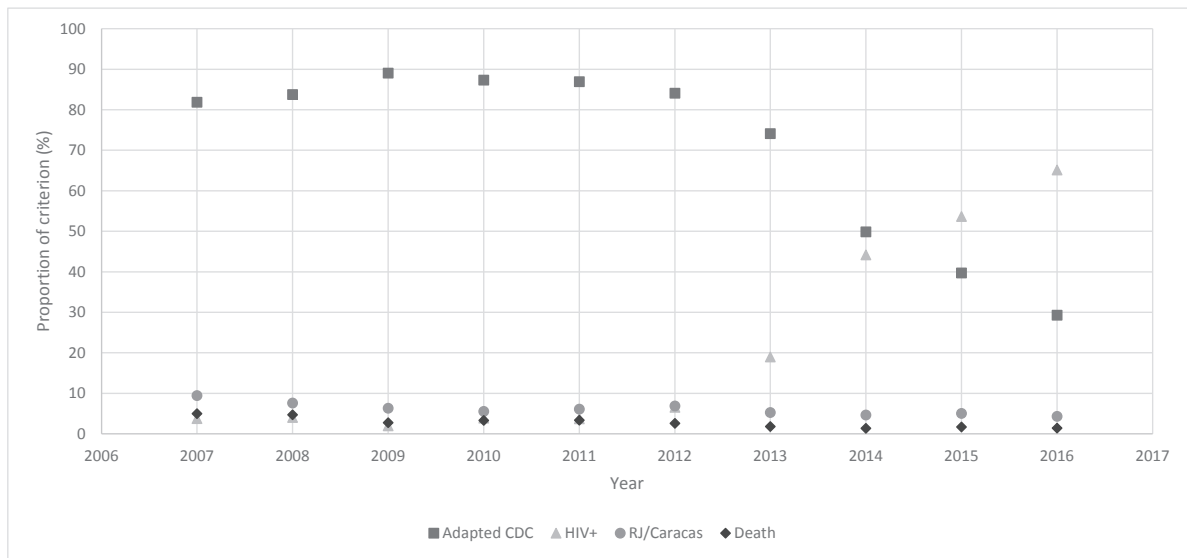
After the mandatory notification of HIV-positive cases, there was an increase in the temporal trend of this case criterion to the detriment of the others and the association of this criterion with the diagnosis of HIV in white individuals, in individuals aged up to 29 years, male homosexuals, and those with education level compatible with the observed age. A study conducted in Recife and Curitiba in 2013 had already verified a high incidence of HIV in MSM and stressed the importance and urgency of strategies to control the spread of the epidemic in this population subgroup¹⁵. Findings of a recent study conducted in Switzerland indicated a recent resurgence of HIV infection among MSM, indicating possible changes in the epidemiological profile of the epidemic¹⁶ which may or may not be linked to the obligation to notify HIV-positive cases in Brazil.

In Brazil, the prevalence of HIV/AIDS cases among MSM ranged from 5.2% to 23.7% in the 10 cities surveyed¹⁷, and the risk was much higher in MSM than in heterosexuals¹⁸, a significant and important issue that must be prioritized and rethought in health action planning.

According to the Epidemiological AIDS and STD Bulletin⁸, the Brazilian epidemic is currently focused on MSM, transvestites, people who use drugs, and sex workers and reaffirm the growth of AIDS among people aged 15-24 years, a fact observed in the present study. It also revealed that this age group is more likely to be tested serologically, which is a good indication of the success of the campaigns that promote early awareness on the serological state, held by the federal government, especially the *Be Aware* campaign with mobile units for the serological testing of HIV, syphilis, and hepatitis B and C that are conducted at various events such as carnival and LGBT pride parade (lesbian, gay, bisexual, transsexual, and transgender), among others.

However, young male homosexuals still engage in same-sex sexual relationships, drawing the attention of the health authorities toward the implementation of prevention strategies specific to this target population⁹. A study carried out in the City of Salvador with MSM found that 63% had never undergone the HIV test; among the individual vulnerability factors, ages between 18 and 29 years, sexual life before the age of 15, prevalence of STI in the last 12 months, number of sexual partners in the last 6 months, and unprotected receptive anal sex with a casual partner were people of color and had up to 8 years of study¹⁹.

Another study carried out among MSM older than 18 years old in Fortaleza found that the majority were young (40.3%), unmarried (85.1%), had between 5 and 11 years of schooling (57.3%), and had a low income (37.6%), with 58.1% having been tested for HIV at some time in their lives, 34.1% have been tested to ensure that they were not infected, and 34% tested owing to the national campaign *Be Aware*²⁰, which reinforces the need for this campaign.



HIV/AIDS case definition criteria	APC	CI (95%)	Trend
Adapted CDC	-10,7	-18,4 - -2,2	Descending
HIV+	42,9	14,9 - 77,6	Ascending
RJ/Caracas	-6,9	-9,8 - -3,9	Descending
Death	-13,9	-17,9 - -9,7	Descending

FIGURE 2: Temporal tendency according to the HIV/AIDS case definition criteria, Minas Gerais, 2007 to 2016. **HIV/AIDS:** human immunodeficiency virus/acquired immunodeficiency syndrome; **APC:** annual percent change; **CI:** confidence interval (95%); **CDC:** Centers for Disease Control and Prevention; **RJ:** Rio de Janeiro.

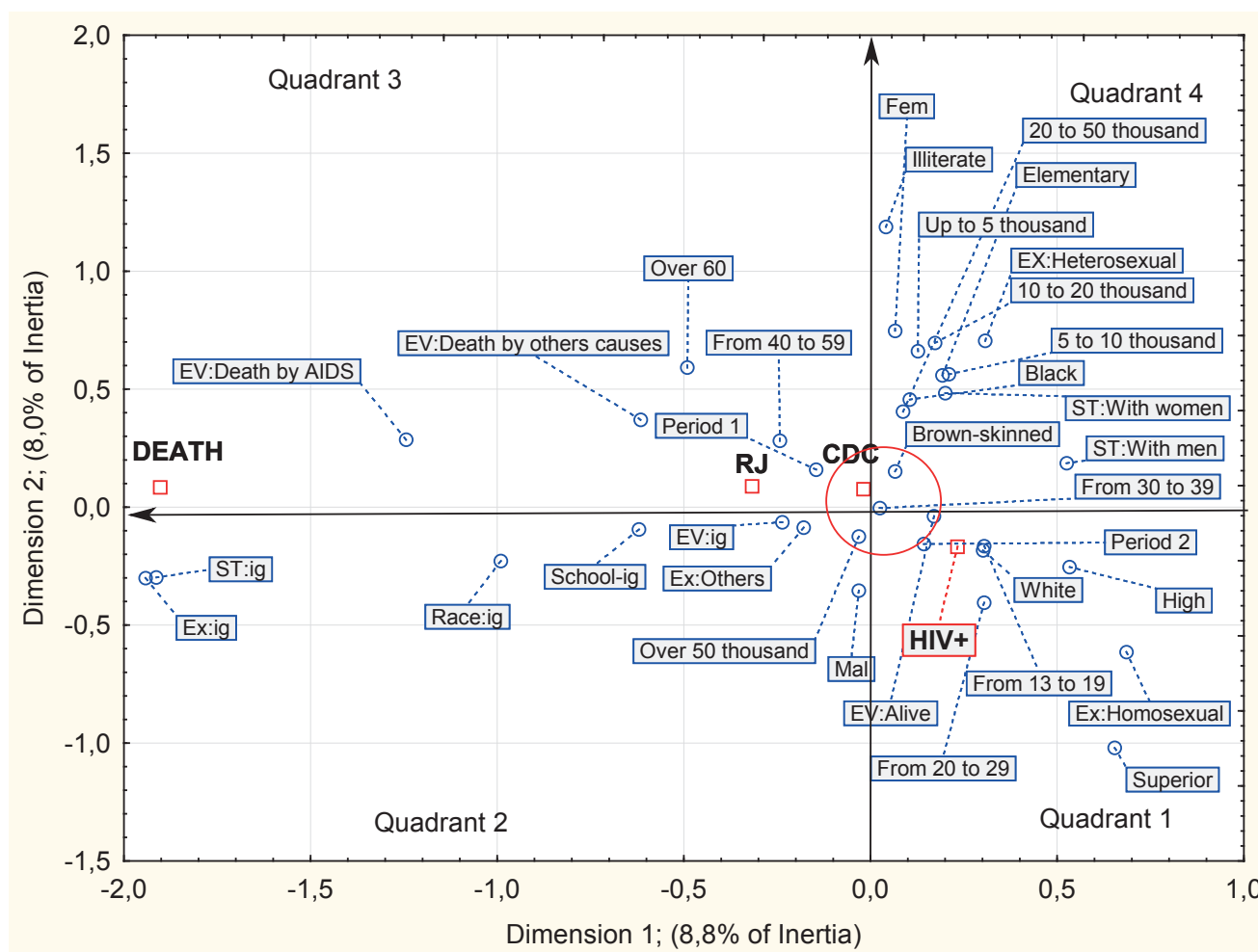
The reason for not taking the HIV test is to show trust the partner (21%) and the fear of discrimination if the test is positive (20.3%). Among MSM, the majority (97.6%) reported at least one advantage for the serological testing, and the remaining reported knowledge on serology testing (91.3%), immediate onset of treatment (83.5%), use of protection to avoid opportunistic diseases (56.7%), having sex without fear (55.6%), and increasing the quality of survival with HIV (54.1%)²⁰. These vulnerabilities and fears served as barriers to the spontaneous performance of the exam, as also described by Terto Junior²¹.

Cardoso et al.²² in a review of the literature showed that alcohol-related sexual behavior is a risk factor for sexually transmitted infections, especially among men, adolescents, immigrants, and sex workers, for having sex without a condom when consuming alcohol. Alcohol, which has been increasingly used among adolescents and young adults, may contribute to

the vulnerability to HIV infection observed in this study among those aged 13-29 years.

According to Asinelli-Luz and Junior²³, the sexual behavior among adolescents is complex and permeated by behavioral, affective, and cognitive paradigms. Being influenced by gender characteristics, in which the female is linked to emotional involvement and the male is linked to pleasure and performance at the expense of condom use, also associated with family issues, self-esteem, early sexual initiation, and pressures of coexistence groups.

The decentralization of HIV testing in the basic healthcare network was an advanced measure and should be widely disseminated to the population in order to receive community support for this service^{24,25}, as many people do not seek help from Testing and Counseling Centers because it is stigmatized as a place of treatment for AIDS. Testing through the *Be Aware*



EV: death by aids, alive, death by other causes and ignored
ST: sexual intercourse with men, sexual intercourse with women, sexual intercourse with men and women, it was not a sexual transmission and ignored
Ex: heterosexual, homosexual, bisexual, others, and ignored
Cr: Adapted CDC, HIV+, Rio de Janeiro/Caracas, Death related to HIV/AIDS. School – Schooling: illiterate, elementary, high, superior and ignored
HAB: number of inhabitants per municipality: up to 5,000; 5,000-10,000; 10,000-20,000; 20,000-50,000; and over 50,000
Gender: male and female
Race: brown skinned, white, black, and ignored
Age group: from 13 to 19 years old, from 20 to 29 years old, from 30 to 39 years old, from 40 to 59 years old, and greater than 60 years old

FIGURE 3: Factor analysis of multiple correspondence, association between HIV/AIDS case definition criteria and sociodemographic and exposure aspects. **EV:** evolution; **AIDS:** acquired immunodeficiency syndrome; **Cr:** criterion; **CDC:** Centers for Disease Control and Prevention; **Ex:** exposure category; **ST:** sexual transmission; **HIV:** human immunodeficiency virus; **ig:** ignored.

campaign deserves to be optimized and expanded to cover other events and population segments such as the elderly, heterosexual women, and adolescents.

For the State of Minas Gerais, in the small municipalities, a profile of heterosexual women with a low educational level living with HIV/AIDS was observed. The study characterized

these phenomena as *feminization and internalization* of the illness²⁶.

Women primarily acquire the infection by having unprotected heterosexual relationships (86.8%)²⁷. In the municipality of São Paulo, a study conducted in HIV-positive women reported a higher prevalence of a low level of schooling and unsatisfactory

socioeconomic conditions²⁸. In Rio Grande do Norte, most women in recent years acquire infection by having heterosexual relationships²⁹; other studies indicated that women in a stable union have difficulties imposing the use of condoms use during sexual contact, as this may generate negative gender relations and mistrust in the partner^{30,31}.

A survey carried out in the municipality of São Leopoldo, RS, involving women aged between 23 and 55 years with HIV/AIDS found that the majority were in a childbearing age, were in a stable union, had incomplete elementary school level, were employed as household workers, and belonged to the low social class. They were misinformed about the transmission and evolution of the disease³².

Between 2007 and 2013, before the mandatory notification of HIV-positive cases, the Rio de Janeiro/Caracas and Adapted CDC criteria were found to be associated with the diagnosis in individuals aged 40 to 59 years and over 60 years old, a fact explained by the case definition criteria available in the period, a late diagnosis after the symptoms manifested by AIDS, and the consequent notification of older individuals, which was also partially explained by the greater sexual freedom of the elderly after the creation of drugs that stimulate the male sexual erection³³, together with the lack of information about the disease as described in a study by Lazzarotto et al.³⁴ on the elderly's knowledge about HIV/AIDS carried out in Vale dos Sinos, Rio Grande do Sul, which favors the group age that are more vulnerable to infection, as verified by Melo et al.³³ in a study carried out in Pernambuco.

Between 2007 and 2013, as regards the evolution of the disease, it was observed that individuals aged over 60 years died from other causes not related to AIDS, but also associated with this period were the notifications made after the death and consequently AIDS-related deaths. The death from non-infection/illness-related causes is probably attributed to the antiretroviral therapy offered free of charge to PLHA since 1996, which increased the patient survival by reducing opportunistic infections and hospitalizations³⁵, optimizing the survival and quality of life. AIDS-related deaths may be related to the late identification of the serological condition and the disease, the non-adherence to the antiretroviral therapy by some people^{36,37} and the identification/notification of the disease at the time of death.

PLHA in the State of Minas Gerais were brown-skinned, diagnosed based on the CDC criteria, and living in medium-sized municipalities, which are the majority in the state (80.7%). A study conducted in Rio Grande do Norte also found a higher prevalence of AIDS in brown-skinned individuals²⁹. Historically, people of color and those with a low educated have less access to health services and education, which directly relates to information on how diseases are transmitted and the means of prevention, making them more vulnerable³⁸⁻⁴¹.

Although the period before the mandatory reporting of HIV-positive cases was higher in years (7 years), the number of cases (n=17,519) was similar to that in the period after the notification (n=17,830), which presented another PLHA profile, composed of adolescents and young people and male homosexuals, indicating changes in the epidemiological profile of PLHA after the addition of the new case definition criteria.

In the State of Minas Gerais, a higher prevalence of cases in the Central, Triângulo Mineiro, and Southeastern regions of the state was observed. Barbosa et al.⁴² analyzed spatially the spread of AIDS in Minas Gerais and verified a spatial concentration of similar AIDS incidence in the Triângulo Mineiro and Alto Paranaíba, Central, Metropolitan Belo Horizonte, and West Minas regions⁴².

In the present study, the municipalities with the highest cumulative number of cases were Belo Horizonte, Uberlândia, Juiz de Fora, and Uberaba. In another study, very similar results were found; the municipalities with the highest accumulation of cases up to June 2010 were Belo Horizonte, Juiz de Fora, Uberlândia, Contagem, and Uberaba⁴³. These cities have Regional Health Offices and therefore are more structured and resolving regarding the care, which can lead to a greater demand for health services and consequent notification of the illness.

After more than three decades of the AIDS epidemic, much success has been observed with the Brazilian experience, but some points still need to be improved, especially when it comes to prevention to reduce the number of cases of social stigma that the infection/illness still entails. According to Ayres⁴⁴ the educational practices should be developed less in terms of population groups and behavior models and more in search of emancipatory attitudes that reduce the spaces that generate vulnerabilities.

This study had some limitations. This study was performed using a secondary database whose variables were restricted to the notification form but was considered an official database and recognized by researchers and health authorities. It should be observed that SINAN data before 2007 were not available for tabulation, which restricted the historical period analyzed.

In conclusion, when analyzing the period before and after the compulsory notification of HIV-positive cases, a considerable increase in the notification of HIV-positive cases and a decrease in the other criteria for case definition were observed, indicating a good adherence to this strategy of case detection by the health services. It was verified that the profile of PLWHA is already changing after the notification of HIV-positive cases because the individuals affected previously were those aged over 40 years and the elderly; those with a low educational level; those who were notified on the basis of the CDC, Rio de Janeiro/Caracas, and AIDS-related death criteria; and/or those whose disease evolution was related or unrelated to AIDS. Between 2014 and 2016, there was a change in the profile of adolescents and young people, most of whom were male, with schooling compatible with their ages.

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Conflict of interest

The authors declare that there is no conflict of interest.

REFERENCES

1. The Joint United Nations Programme on HIV/AIDS (UNAIDS). Global Report: UNAIDS Report on the Global AIDS Epidemic 2013. Geneva; UNAIDS; 2013. 150p. Cited 2017 Nov 23. Available from: http://www.unaids.org/sites/default/files/media_asset/UNAIDS_Global_Report_2013_en_1.pdf.
2. The Joint United Nations Programme on HIV/AIDS (UNAIDS). UNAIDS Brasil. A ONU e a resposta à AIDS no Brasil. Brasília: UNAIDS do Brasil; 2013. 54p. Citado em 20 de janeiro de 2018. Disponível em: http://www.renatodamatta.com/uploads/1/2/3/1/12315172/unaids_2_a_onu_e_a_resposta_aids_no_brasil.pdf.
3. Ministério da Saúde (MS). Aids e DST. Brasília: MS; 2015. Boletim Epidemiológico: 4(1):3-95. Citado em 23 de fevereiro de 2018. Disponível em: <http://www.aids.gov.br/pt-br/pub/2015/boletim-epidemiologico-hivaids-2015>.
4. Deeks SG, Lewin SR, Havlir DV. The end of AIDS: HIV infection as a chronic disease. *Lancet*. 2013;382(9903):1525-33.
5. Nosyk B, Montaner JSG, Colley G, Lima VD, Chan K, Heath K, et al. The cascade of HIV care in British Columbia, Canada, 1996-2011: a population-based retrospective cohort study. *Lancet Infect Dis*. 2014;14(1):40-9.
6. Sidibé M. Charting a path to end the AIDS epidemic. Editorial. *Bull World Health Organ*. 2016;94(6):408. <http://www.who.int/bulletin/volumes/94/6/16-176875.pdf>.
7. Santos NJS, Tayra AA, Silva SR, Buchalla CM, Laurenti R. A aids no Estado de São Paulo: as mudanças no perfil da epidemia e perspectivas da vigilância epidemiológica. *Rev Bras Epidemiol*. 2002;5(3):286-310.
8. Ministério da Saúde (MS). Portaria nº 1.271, de 06 de junho de 2014. Define a lista nacional de notificação compulsória de doenças, agravos e eventos de saúde pública nos serviços de saúde públicos e privados em todo o território nacional, nos termos do anexo, e dá outras providências. Brasília, DF: MS; 2014 Citado em 15 de março de 2018. Disponível em: http://bvsmms.saude.gov.br/bvsm/saudelegis/gm/2014/prt1271_06_06_2014.html.
9. Ministério da Saúde (MS). HIV e Aids. Brasília: MS; 2017. Boletim Epidemiológico: 5(1):3-60. Citado em 13 de março de 2018. Disponível em: <http://www.aids.gov.br/pt-br/pub/2017/boletim-epidemiologico-hivaids-2017>.
10. Malachias I, Leles FAG, Pinto MAS. Plano Diretor de Regionalização da Saúde de Minas Gerais (PDR/MG) [Internet]. Belo Horizonte: SES/MG; 2011 [cited 2018 Mar 22]. Available from: http://www.saude.mg.gov.br/images/noticias_e_eventos/000_2016/Livro%20Plano%20Diretor%20de%20Regionaliza%20-%20PDR-SUS-MG.pdf.
11. Hair Jr JF, Black WC, Babin BJ, Anderson RE, Tatham RL, Tatham RL. Análise multivariada de dados. 6ª edição. Porto Alegre: Bookman; 2009. 688p.
12. Scatena LM, Villa TCS, Rufino Neto A, Kritski AL, Figueiredo TMRM, Vendramini SHF, et al. Dificuldades no acesso a serviços de saúde para diagnóstico de tuberculose em municípios do Brasil. *Rev Saúde Pública*. 2009;3(43):389-97.
13. Carvalho H. Análise multivariada de dados qualitativos: utilização da HOMALS com o SPSS. 1ª edição. Lisboa: Editora Sílabo; 2004.
14. Antunes JLF, Cardoso MRA. Uso da análise de series temporais em estudos epidemiológicos. *Epidemiol Serv Saúde*. 2015;24(3):565-76.
15. Szwarcwald CL, Ferreira Júnior OC, Brito AM, Luhm KR, Ribeiro CE, Silva AM, et al. Estimation of HIV incidence in two Brazilian municipalities, 2013. *Rev Saúde Pública*. 2016;50:55.
16. Sighem AV, Vidondo B, Glass TR, Bucher HC, Vernazza P, Gebhardt M, et al. Resurgence of HIV infection among men who have sex with men in Switzerland: mathematical modelling study. *PLoS One*. 2012;7(9):e44819.
17. Kerr LRFS, Mota RS, Kendall C, Pinho AA, Mello MA, Guimaraes MDC, et al. HIV among MSM in a largemiddle-income country. *AIDS*. 2013;27(3):427-35.
18. Barbosa Júnior A, Szwarcwald CL, Pascom ARP, Souza Júnior PB. Tendências da epidemia de AIDS entre subgrupos sob maior risco no Brasil, 1980-2004. *Cad Saúde Pública*. 2009;25(4):727-37.
19. Brignol S, Dourado I, Amorim LD, Kerr LRFS. Vulnerability in the context of HIV and syphilis infection in a population of men who have sex with men (MSM) in Salvador, Bahia State, Brazil. *Cad Saúde Pública*. 2015;31(5):1035-48.
20. Gonçalves VF, Kerr LFS, Mota RS, Macena RHM, Almeida RL, Freire DG, et al. Incentives and barriersto HIV testing in men who have sex with men in a metropolitan area in Brazil. *Cad Saúde Pública*. 2016;32(5):e00049015.
21. Terto Junior V. Homossexualidade e saúde: desafios para a terceira década de epidemia HIV/Aids. *Horiz Antropol*. 2002;8(17):147-58.
22. Cardoso LRD, Malbergier A, Figueiredo TFB. O consumo de álcool como fator de risco para a transmissão das DSTs/HIV/Aids. *Rev Psiquiatr Clín*. 2008;35(Supl1):70-5.
23. Asinelli-Luz A, Fernandes Junior N. Gênero, adolescências e prevenção ao HIV/aids. *Pro-Posições*. 2008;19(2):81-97.
24. Zambenedetti G, Silva RAN. Descentralização da atenção em HIV-Aids para a atenção básica: tensões e potencialidades. *Physis Rev Saúde Colet*. 2016;26(3):785-806.
25. Ministério da Saúde (MS). 5 passos para a implementação do manejo da infecção pelo HIV na Atenção Básica – guia para gestores. Brasília: MS; 2014. Citado em 13 de março de 2018. Disponível em: file:///C:/Users/webnow/Downloads/coordenadores_pdf_46953.pdf.
26. Barroso LMM, Carvalho CML, Galvão MTG. Mulheres com HIV/AIDS: subsídios para a prática de enfermagem. *Rev Rene*. 2006;7(2):67-73.
27. Ministério da Saúde (MS). Centro Brasileiro de Análises e Planejamento. Comportamento sexual da população brasileira e percepções do HIV/AIDS. Brasília: MS; 2000.
28. Felix G, Ceolim MF. The profile of women with HIV/AIDS and their adherence to the antiretroviral therapy. *Rev Esc Enferm USP*. 2012;46(4):882-9.
29. Silva LTS, Silva D, Salvetti IMG, Torres GV, Silva RA, Souza NL. Perfil dos casos de Síndrome da Imunodeficiência Adquirida em um Estado do Nordeste do Brasil. *Rev Enferm UFSM*. 2014;4(4):727-38.
30. Figueiredo LG, Silva RAR, Silva ITS, Souza KGS, Silva FFA. Percepção de mulheres casadas sobre o risco de infecção pelo HIV e o comportamento preventivo. *Rev Enferm UERJ*. 2013;21(esp.2):805-11.
31. Santos NJ, Barbosa MR, Pinho RM, Villela WV, Aidar T, Filipe EMV. Contextos de vulnerabilidade para o HIV entre mulheres brasileiras. *Cad Saúde Pública*. 2009;25(Supl2):S321-S333.
32. Cechim PL, Selli L. Mulheres com HIV/AIDS: fragmentos de sua face oculta. *Rev Bras Enferm*. 2007;60(2):145-9.
33. Melo HMA, Leal CC, Marques APO, Marino JG. O conhecimento sobre Aids de homens idosos e adultos jovens: um estudo sobre a percepção desta doença. *Ciênc Saúde Coletiva*. 2012;17(1):43-53.
34. Lazzarotto AR, Kramer AS, Hädrich M, Tonin M, Caputo P, Sprinz E. O conhecimento de HIV/aids na terceira idade: estudo epidemiológico no Vale do Sinos, Rio Grande do Sul, Brasil. *Ciênc Saúde Coletiva*. 2008;13(6):1833-40.
35. Dourado I, Veras MASM, Barreira D, Brito AM. Tendências da epidemia de Aids no Brasil após a terapia anti-retroviral. *Rev Saúde Pública*. 2006; 40(Supl):9-17.

36. Miyada S, Garbin AJI, Gatto RCJ, Garbin CAS. Treatment adherence in patients living with HIV/AIDS assisted at a specialized facility in Brazil. *Rev Soc Bras Med Trop.* 2017;50(5):607-61.
37. Fonseca LC, Martins FJ, Vieira RCPA, Pereira RMC, Ferreira AS, Raposo NRB. Evaluation of inadequate anti-retroviral treatment in patients with HIV/AIDS. *Rev Soc Bras Med Trop.* 2012;45(2):151-5.
38. Paniz VMV, Fassa AF, Silva MC. Conhecimento sobre anticoncepcionais em uma população de 15 anos ou mais de uma cidade do Sul do Brasil. *Cad Saúde Pública.* 2005;21(6):1747-60.
39. Garcia S, Souza FM. Vulnerabilidades ao HIV/aids no Contexto Brasileiro: iniquidades de gênero, raça e geração. *Saúde Soc.* 2010;19(Supl 2):9-20.
40. Batista LE, Escuder MML, Pereira JCR. A cor da morte: estudo de causas de óbito segundo características de raça no Estado de São Paulo, 1999-2001. *Rev Saúde Pública.* 2004;38(5):630-6.
41. Batista LE. Masculinidade, raça/cor e saúde. *Ciênc Saúde Coletiva.* 2005;10(1):71-80.
42. Barbosa LM. A Aids: uma análise espacial da disseminação em Minas Gerais. *In: XI Seminário sobre a Economia Mineira. Diamantina, MG; 2004. Belo Horizonte: CEDEPLAR/UFMG; 2004. p. 1-15. Disponível em: <http://www.cedeplar.ufmg.br/diamantina2004/textos/D04A010.PDF>.*
43. Ministério da Saúde (MS). Sistema nacional de vigilância em saúde: relatório de situação: Minas Gerais 5ª edição. Brasília, DF: MS; 2011. 34p. Citado em 23 de março de 2018. Disponível em: http://bvsms.saude.gov.br/bvs/publicacoes/sistema_nacional_vigilancia_saude_mg_5ed.pdf.
44. Ayres JRCM. Educational practices and the prevention of HIV/ Aids: lessons learned and current challenges. *Interface Comun Saúde Educ.* 2002;6(11):11-24.