REVISTA O MUNDO DA SAÚDE

Spatial analysis of hiv cases in young adults and access to public services in a municipality of Paraná

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Abstract

This study aimed to analyze the spatial distribution of notified cases of HIV infection in young adults, from 2007 to 2016, and its relationship with accessibility to public health and social care services in a municipality in Paraná. This was an ecological study with georeferencing of notified HIV cases in young adults living in São José dos Pinhais, Paraná, from 2007 to 2016. The study analyzed data from the National System of Notifiable Diseases. A total of 309 cases of HIV/AIDS infection were reported, and of these, 251 cases were georeferenced using the QGIS software. The geolocation of the cases was performed using the Google Earth Pro software. Concerning the characterization of the cases, there were 147 (47.5%) people with HIV and 162 (52.5%) with AIDS. Regarding gender, 97 (31%) were female and 212 (69%) were male. Meanwhile, the distribution of public centers were among the health sector (43) and the social assistance sector (16). Since the health facilities are located in the center of the urban space, and all social care facilities are within the urban area, these locations cannot guarantee accessibility to individuals who reside in more peripheral urban and rural areas. Therefore, there is a need for decentralization of services to ensure access to health promotion and disease prevention actions.

Keywords: Acquired Immunodeficiency Syndrome. Geographic Information Systems. Spatial Analysis.

INTRODUCTION

Accessibility to health services[1] for the prevention and early diagnosis of HIV infection is an epidemical challenge to overcome. Socioeconomic, cultural, and political barriers define the distance to be covered between housing and health establishments, as well as the tolerance to the stigmas related to HIV infection, the lack of sufficient professionals or training to face the phenomenon, and the lack of social support for those living with HIV. Thus, consequently, early diagnosis and treatment adherence are weakened[2]. In order to overcome some of these limitations, in 1996 Brazil implemented one of its most important policies to fight the epidemic, with the enactment of Law No. 9313 consolidating the public policy of free medication for people living with HIV (PLHIV).

In order to accelerate the process towards the end of AIDS as a threat to global public health by 2030, in 2014 the Joint United Nations Program on HIV/AIDS (UNAIDS)

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launched the target 90-90-90 whose goals are that 90% of PLHIV would be diagnosed, 90% of PLHIV diagnosed would have started antiretroviral therapy (ART), and 90% of PLHIV on ART would demonstrate viral suppression[3]. To consolidate these goals, the diagnosis, early initiation of ART, and adherence to treatment are considered important tools for improving the health care of PLHIV[4].

In December 2013, with the "Clinical Protocol and Therapeutic Guidelines for the Management of HIV Infection in Adults" (CPTG), treatment as prevention was instituted, which recommends the start of antiretroviral therapy for all PLHIV, independently of the user's T-CD4+ lymphocyte count[5]. With this perspective, Ordinance No. 1.271, of June 6, 2014, of the Ministry of Health, defined the mandatory notification of HIV carriers in public and private services, modifying the previous guideline that regulated mandatory notification only for AIDS cases. This new way of coping with the phenomenon was supported by research that demonstrated that the early initiation of ART not only improves PLHIV's living conditions, but also reduces the risk of virus transmission[6].

As a measure to prevent HIV infection, in 2015, post-exposure prophylaxis risk (PEP) was introduced, which consists of the use of antiretroviral drugs to reduce the risk in situations of exposure to the HIV virus[7]. Finally, Ordinance No. 22 of May 25, 2017, was published, which regulated the Clinical Protocol and Therapeutic Guidelines for pre-exposure prophylaxis risk (PrEP) to prevent HIV infection in populations considered to be more vulnerable[8].

Despite the advances in confronting the epidemic of HIV infection in recent years, it is recognized that these have been insufficient. During this same period, there was also an increase in the detection rate of the virus in young adult males aged 15 to 24 years, with an emphasis on the period from 2007 to 2017, in which the rate among young people aged 20 to 24 more than doubled from 15.6 to 36.2 cases per 100,000 inhabitants[9]. Based upon the aforementioned items, the present study analyzing the accessibility to health services is justified. With this information, the goal is to guide the decision-making of public health professionals and managers in dealing with this phenomenon in a municipal territory. Therefore, this study aimed to analyze the spatial distribution of reported cases with HIV infection in young adults, from 2007 to 2016, and its relationship with accessibility to public health and social care services in the municipality examined herein.

METHODOLOGY

This was an ecological study with spatial analysis of notified cases with HIV infection in young adults, from 2007 to 2016, in São José dos Pinhais (SJP), located in the Metropolitan Region of Curitiba, Paraná, and its relationship with accessibility to public health services and social assistance services within the city.

Social care centers provide social assistance and socio-educational services of basic social protection to families[10]. The city's health establishments carry out actions at the individual and collective levels, which cover the promotion and protection of health, the prevention of injuries, surveillance actions, diagnosis, treatment, rehabilitation, harm reduction, and health maintenance among other activities. HIV infection diagnoses in the city are referred to the Specialized Care Service (SCS), which centrally carries out the treatment and monitoring of these users. The health units and the SCS in the city carry out testing and counselling for sexually transmitted

infections[11].

This city has the sixth largest contingent population in Paraná, with one of the largest industrial centers in the region. The Human Development Index is 0.758, considered high, and a Gini Index of 0.45, which demonstrates a low level of social inequality[12]. According to the last population census, the municipality had 236,895 inhabitants in urban areas and 27,315 in rural areas, totaling 264,210 inhabitants[13]. The population estimate for 2019 was 323,340 thousand inhabitants[13].

The sizes of urban and rural spaces are distinct and possess the following measurements: 750.95 Km^2 of rural area and 195.29 km^2 of urban area[14].

Secondary data analyzed were from the National System of Notifiable Diseases (NSND), consulted during the first half of 2018. The variables used in the study were: General Data (injury/disease, date of notification, State), Individual Notification (date of birth, age, sex), Residential Data (State, city of residence, IBGE code, street, street number, country), and AIDS case definition criteria; Rio de Janeiro/Caracas Criterion, Adapted Centers for Disease Control and Prevention (CDC) Criteria.

For the geoprocessing of the notified cases, the data was transposed from NSND Net to an Excel® Spreadsheet. After correcting the places of residence, the organization and standardization of the data in a Microsoft Excel® 2016 spreadsheet was carried out for later transposition of the data into the software.

The geoprocessing was performed using the QGIS[15] software (version 2.18.9) using plane coordinates of the UTM System (Universal Transverse Mercator) and the Datum SIRGAS 2000 (Geocentric Reference System for South America) whose code European Petroleum Survey Group (EPSG) is 31982 for the UTM 22 Southern Hemisphere time-zone. The geolocation (spatialization) of the cases in the cartographic base was done using the Google Earth Pro software. To attribute the addresses of the reported cases, the QGIS free software (version 2.18.9) was used through the Geosearch plugin that uses Google's geospatial database.

The study included all cases residing in the municipality of São José dos Pinhais of young people aged 20 to 29 years, living with HIV, notified in NSND in the period 2007 to 2016. All duplicate notifications were excluded from the study. In the end, there were a total of 309 cases residing in the city, according to the city code in the residential address contained in the notifications for the period, and within the delimited age group. After coding the places of the cases notified through the Google Earth Pro Software, 251 cases were analyzed for the development of the geoprocessing technique. Cases with missing residential data, notifications with city codes other than that of São José dos Pinhais, places with no possibility of spelling correction and not located by the Google Earth Pro software, places that did not correspond to the neighborhood recorded in the notification, and those who after correction of the residential data still did not match (neighborhood reported in the notification and residential district) were excluded from the study in the geoprocessing analyses.

The geoprocessing of notified cases was carried out through the construction of a Shapefile of the territories where reported cases with HIV infection occurred and the construction of thematic maps. The territories were numbered from 1 to 40 to maintain anonymity regarding the names of the districts and colonies in the municipality, as directed by the Research Ethics Committee.

As for the ethical aspects of this research, the parameters of Resolution no. 466/2012 of the National Health Council were followed. The project was approved by the Research Ethics Committees of the Health Sciences Sector of the Federal University of Paraná (2.435.190) and of the Pontifical Catholic University of Paraná (2.691.350) and followed the recommendations of the Report Strengthening Observational Studies in Epidemiology (STROBE)[16].

RESULTS

In the period from 2007 to 2016, there were 309 notifications of young people aged 20 to 29 years old. Regarding the distribution by sex, 97 (31%) individuals were female and 212 (69%) were male. As for the diagnosis, 147 (47.5%) people were diagnosed with HIV and 162 (52.5%) with AIDS. Most of those notified, 150 (92.6%) individuals, had a T lymphocyte - CD4+ count lower than 350 cells/mm3.

Among the 251 notifications analyzed with the geoprocessing technique, four (2%) notifications were located in territories 37, 38, 39, and 40 belonging to the rural area, and 247 (98%) notifications were within urban territories, that is, distributed in territories 1 to 36.

Concerning health centers, there were 43 public facilities, of which 35 (81%) were in urban areas and eight (19%) were in rural areas. Public social care centers totaled 16 (100%), all of which are located in urban areas. Next, Figure 1 illustrates the geographic distribution of these public facilities in the city.

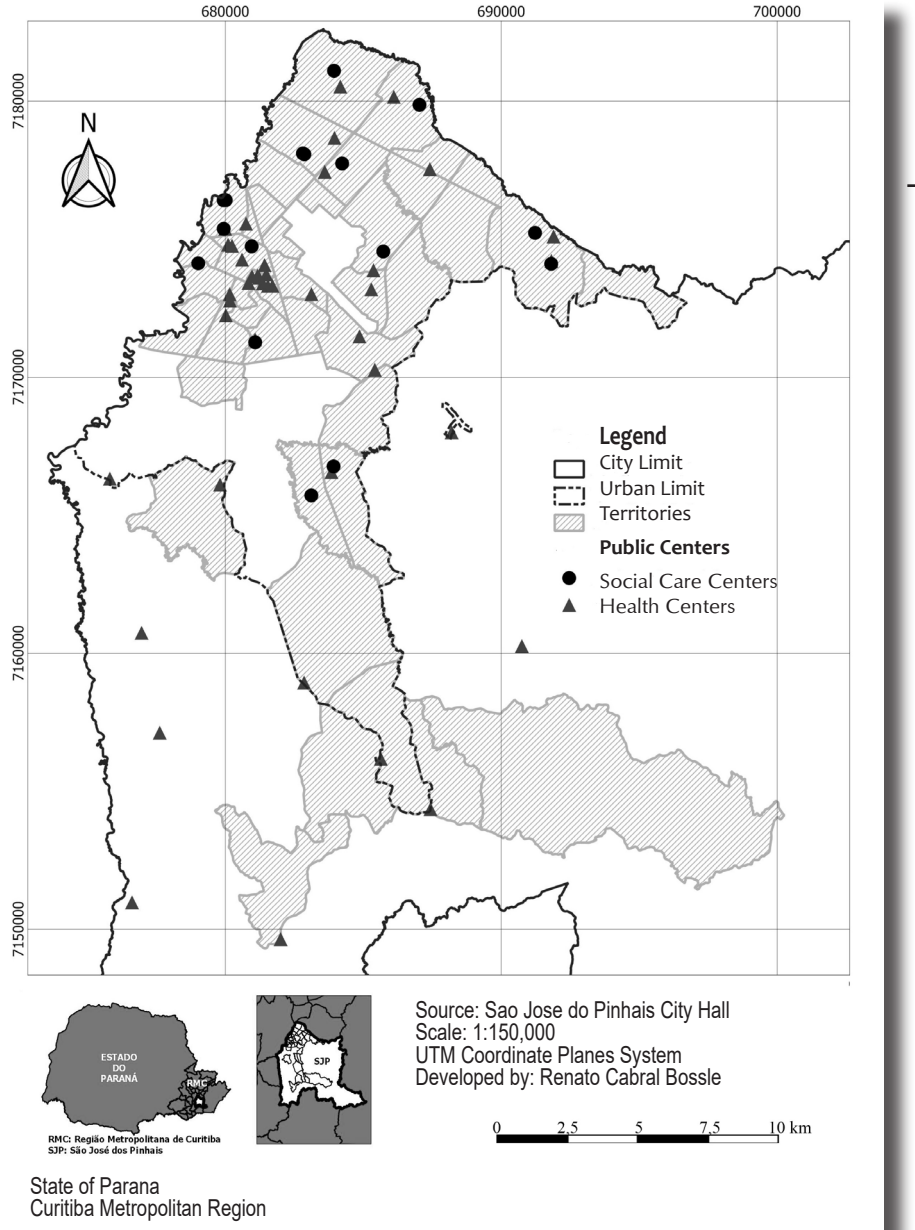

Figure 1 – Geographical distribution of public health and social care centers in São José dos Pinhais. Curitiba, PR, Brazil – 2020.
Source: São José dos Pinhais[17, 18].

Note: The vector files (shapefiles) for the construction of maps come from the Department of Agriculture and Department of Urbanism of São José dos Pinhais, PR.

Among the most populous territories in the city according to the last census were: territory 25 (21,849 inhabitants); territory 27 (16,743 inhabitants); territory 34 (18,198 inhabitants); territory 26 (14,436 inhabitants); territory 24 (12,316 inhabitants); territory 17 (11,958 inhabitants); territory 9 (11,789 inhabitants); territory 21 (11,199 inhabitants); territory 15 (11,052 inhabitants); and territory 22 (10,052 inhabitants)11. Figure 2 shows the geographic distribution of the 251 notified cases of HIV and AIDS in the period from 2007 to 2016, according to residential territories in São José dos Pinhais.

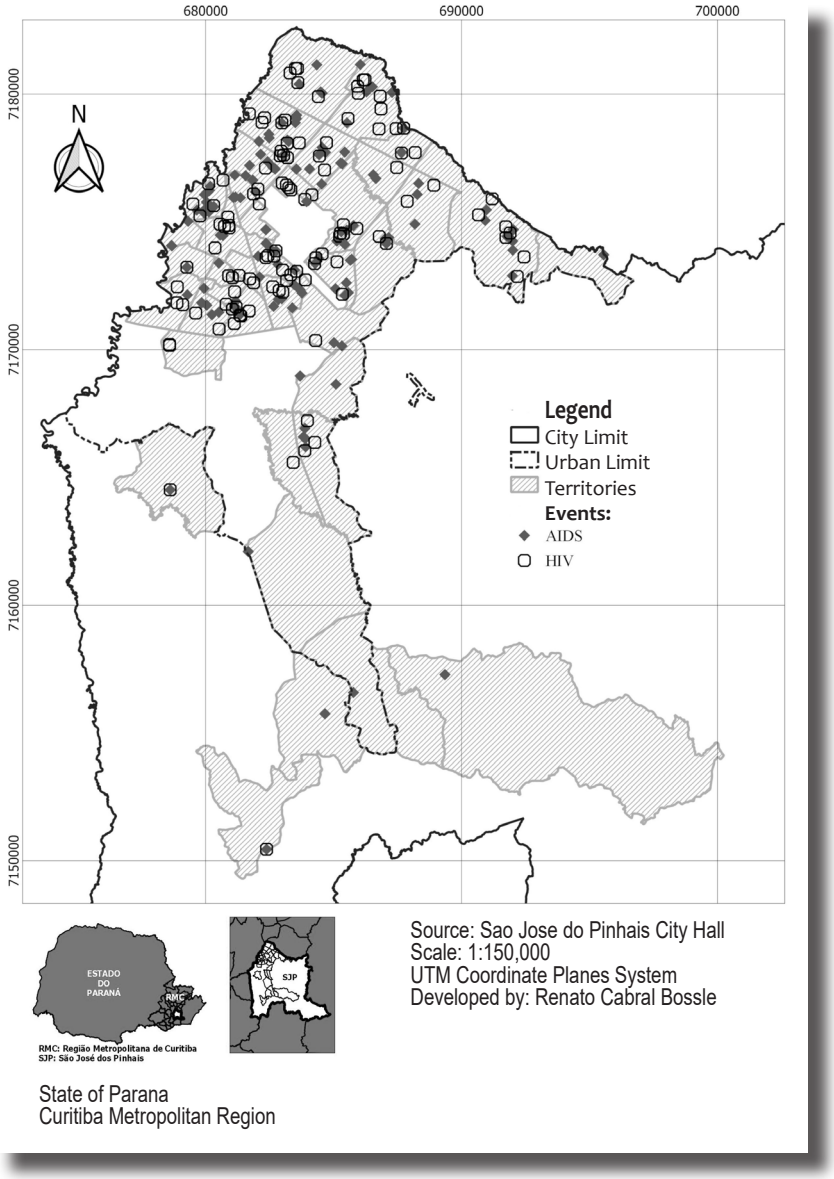

Figure 2 – Geographical distribution of cases with HIV infection in those 20 to 29 years old, notified in the 2007 to 2016 period, according to place of residence in São José dos Pinhais. Curitiba, PR, Brazil - 2020 Source: São José dos Pinhais[17, 18].

Note: The vector files (shapefiles) for the construction of maps come from the Department of Agriculture and Department of Urbanism of São José dos Pinhais, PR.

Table 1 – Number of cases with HIV infection notified, among those 20 to 29 years old, during the 2007 to 2016 period, according to residential territories in São José dos Pinhais, Curitiba, PR, Brazil – 2020.

Territories	No. cases
1, 2, 4, 8, 9, 10, 11, 12, 13, 16, 18, 19, 28, 29, 31, 32, 33, 34, 35, 36, 37, 38, 39, 40	0 to 5
3, 5, 7, 14, 20, 23	6 to 10
6, 17, 21, 22, 24, 26, 30	11 to 15
15, 27, 34	16 to 20
25	21 or more

Note: Database (NSND), consulted during 1st semester of 2018.

Table 1 shows the number of notified cases of HIV infection according to the residential territory.

Figure 3 shows the degrees of occurrence of reported cases with HIV infection, according to residential territories.

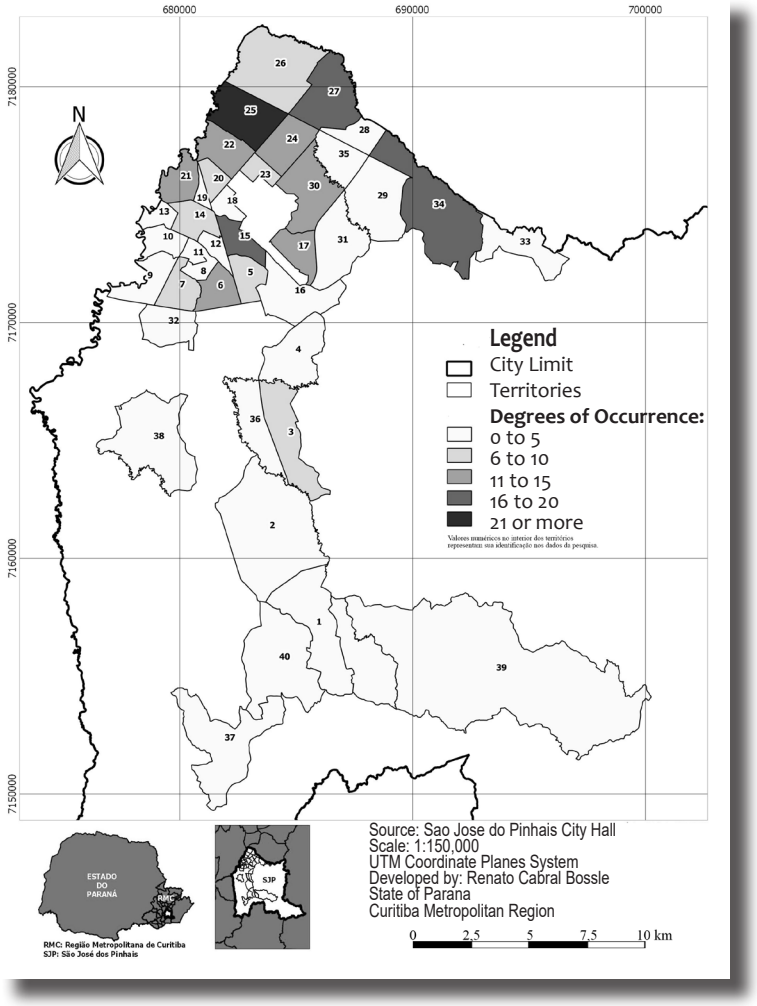

Figure 3 – Degrees of occurrence of notified cases of HIV infection, among those 20 to 29 years old, during the 2007 to 2016 period, in São José dos Pinhais, Curitiba, PR, Brazil - 2020.
Source: São José dos Pinhais[17, 18].

Note: The vector files (shapefiles) for the construction of maps come from the Department of Agriculture and Department of Urbanism of São José dos Pinhais, PR.

With regards to mortality, among the notified cases, 16 cases (10%) evolved to death from AIDS in the period. According to the distribution by sex, there were six (10.2%) deaths in women and 10 (9.7%) deaths in men due to AIDS.

DISCUSSION

Considering the spatial distribution of health and social assistance centers in the city of São José dos Pinhais, it appears that there is an unequal distribution of centers for guaranteeing the municipal population's access to sector services. As for the 16 social assistance centers and the 43 centers in the health sector, it was found that all social assistance reference centers are located in the urban area. Regarding the location of health facilities, 12 health units are indicated as belonging to the rural area; however, after the geolocation of these units, it was found that only eight were located in rural areas, which indicates that four health centers serve users in both the rural and urban areas of the municipality. Among the 35 (81%) health establishments belonging to the urban area, 16 (37%) correspond to specialty centers, a hospital, Hospital Emergency Care Unit, a laboratory, and Department of Promotion and Surveillance, which serve users in both urban and rural areas.

It was possible to verify that the territories with the highest number of notified cases did not correspond to those with the highest number of health centers. Although 98% of those notified with an HIV infection and 81% of the centers were in urban areas, it appears that the services were concentrated in two micro-territories in less populated central areas. Therefore, this finding allows us to reflect on the insecure accessibility of users, since the municipality has a vast territorial extension with populations in territories farther from the center. As for social assistance centers, despite these being in urban areas, it was found that there is a more regular distribution within the territory. This is based upon the observation that in territories 21, 25, and 34 there are a greater number of social assistance centers and concentrations of contingents. The municipal territory is divided into 41 neighborhoods in the urban area and 33 colonies in the rural area[14]. Furthermore, territories 25 (21,849), 27 (16,743), 34 (18,198), and 26 (14,436) had the largest populations according to the last demographic census[13].

According to the National Primary Care Policy, the population covered by Primary Care and Family Health teams is from 2,000 to 3,500 people, and up to four teams in the health units were located in the territories covered[19]. According to the population identified by the last demographic census[13], the results presented herein regarding the health centers indicate that, even with the number of teams per health unit as regulated by the Ministry of Health, there are areas that would need more health services to achieve the team per number of people residing in that territory parameter, as can be seen in territories 25, 27, 34 and 26. Thus, it is possible to state that in these regions there is an irregular distribution of sector resources to the target population, mainly those of health promotion and disease prevention, which should be continuously developed with groups/individuals[20]. Universal and equal citizen access to health services significantly depends on improvements in the management, supply, and distribution of establishments in the sector, as well as the allocation of financial and material resources, and hiring of qualified personnel[1].

The largest number of notifications of young adults with HIV infection, as well as the largest population was found in territory 25. In this territory, the health resources identified was a Hospital Emergency Care Unit, with no basic health unit. This finding exemplifies the population's difficulty in accessing continuous health actions in this territory. Therefore, it is difficult to prevent the phenomenon studied, as a study shows that in territories with greater

coverage of health teams there are lower rates of detection of AIDS; a fact that can be explained by the public policy to combat AIDS that defines promotion and prevention strategies and early diagnosis of the disease[20].

The territories 4, 5, 8, 9, 10, 18, 20, 22, 23, 29, 31, 32, 33, 35, and 39 did not have health and/or social assistance centers; however, they have reported cases with infection by the HIV virus. This confirms that in these territories there were difficulties in ensuring the individual's access to the health system, since 52.5% of the individuals notified had already arrived at the referral service with an AIDS status receiving late diagnoses and, consequently, contributing to virus transmission[20].

The causes that can influence the access, availability and use of HIV Specialized Care services are mostly structural and are related to transportation[2] and the distance from home to public health services[21]. A study conducted in all US counties showed geographic access to HIV care services for urban and rural populations less than ideal for 82% of counties and for 19% of people living with HIV diagnosed in that country. The authors called attention to rural areas, where it is more difficult to access specific services for the care of people living with HIV[22]. It must be considered that, in confronting HIV infection, barriers related to the supply and quality of services are still highlighted. These include the availability of specific tests and health professionals prepared to face the phenomenon, social and economic support initiatives for the retention of PLHIV to treatment, and the stigma of the phenomenon in society[2, 23].

As shown in Figures 2 and 3, which illustrate the territories where notifications of HIV infections occurred, the highest concentration of cases was in the urban area of the municipality. This trend converges with national and international studies that show that the highest concentration of reported cases with HIV infection occurs in urban areas, characterizing this as an urban epidemic, mainly in metropolitan regions of large cities[22, 24-26].

In the present study, it was observed that 10% of the young people notified progressed to death due to AIDS, which is considered an unwanted outcome, since there is a public health policy, consolidated through Law No. 9313, regulating the free distribution of antiretroviral drugs. This law was implemented in the services of the Unified Health System and is considered one of the most effective ways to deal with the problem. Early initiation of antiretroviral therapy among patients with a CD4 cell count ≥500 cells per ml was associated with a 94% reduction in the risk of death from AIDS, compared with initiation of <200 cells per ml[6].

A study on the organization of health services in actions to promote, monitor, and support the retention of the individual following the monitoring of the virus infection showed that managerial retention and support actions remain low in health services, such as in the discussion of cases and records of absentee in consultations. Meanwhile, care activities with regards to adherence remain focused on the physician and resources such as medication and follow-up tests for HIV remained high in the services[27]. Therefore, the control of the HIV infection epidemic will only occur if there are public policies committed to and prioritize implementing actions that guarantee access and stability of the individual in health services in order to ensure continuous multidisciplinary monitoring and treatment with antiretroviral drugs[3, 5, 7, 8, 27].

The accessibility of PLHIV to public health services in the territory can also take on a paradoxical meaning, mainly due to the stigma related to AIDS. Since territorial proximity cannot always be considered a facilitating process for the diagnosis and treatment of HIV, several users move to other micro-territories or municipalities to receive care

and assistance, despite having an organized service network in their municipality of residence. This displacement of the individual to other territories has been attributed to the search for anonymity in meeting their health needs, as they do not want to suffer discrimination for living with the virus[28].

As a limiting factor in the present study, there is the need to carry out qualitative studies to verify the reasons why people, in this study, young adults, enter municipal services for monitoring HIV infection later. As noted, the number of young people notified with AIDS was significant. The question that arises is whether this was due to the lack of accessibility to health services, as identified in the geoprocessing, the stigma of monitoring the disease in their territory of residence, or by changes in sexual behavior driven by apps that expanded the ways individuals interact. Moreover, understanding their approaches to treat HIV infection as a chronic health condition, without the perception that it is possible to develop complications and unwanted outcomes in life with the HIV virus[29].

We also recognize the incompleteness of the notification forms in relation to the street as a limiting factor. There is a need to invest in improving the quality of information, as well as in standardizing the recording of users' residencies in the systems used in health facilities, as this would facilitate the spatial analysis and geoprocessing of the HIV epidemic.

CONCLUSION

The distribution of health establishments showed an organization no focused on the target population in each territory, indicating the need for the decentralization of health actions in order to ensure accessibility to health promotion or disease prevention actions aimed at coping with the HIV phenomenon.

The use of georeferencing techniques in epidemiological surveillance has demonstrated an important role in the planning and monitoring of diseases such as HIV infection. Indeed, many individuals entered health monitoring system later, which can determine processes of illness and, consequently, premature death. In addition, it is necessary to implement this technology, establishing it in the daily work of professionals in the sector, in order to elaborate public policies aimed at dealing with health problems.

It is noteworthy that it is necessary to understand the disease beyond the information from the notification databases, because to intervene in the future of the phenomenon, it is necessary to understand the history and dynamics of the lives of individuals/groups in municipal territories, and thus, promote health actions that, articulated with other sectors, transform realities such as that of young adults living with HIV.

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