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Hiv Detection In The Adolescent And Adult Population In A Brazilian State In The Pre- And Post-Pandemic Period

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Abstract:
Background: It is estimated that in 2021, 1.5 to 2 million people became newly infected with HIV worldwide. About 920,000 live with the virus in Brazil.Objective:Analyze the detection of HIV cases in the state of Ceará from 2017 to 2021.
MaterialsandMethods: Cross-sectional epidemiological study on HIV cases detected in people aged 13 years or older in the state of Ceará, Brazil, from 2017 to 2021.The study was conducted with data collected in the Information System for Notifiable Diseases of the Ministry of Health of Brazil throughthe Integration of Information of the Health Department of the State of Ceará (IntegraSUS). Data were analyzed with the aid of BioEstat 5.3 software.
Results: In Ceará, the HIV detection rate decreased from20.74 to 14.6/100,000 inhabitants in the analyzed period. There was a significant predominancein males, in brown people,among young people and in the median schooling category ($p<0.05$). Similarly, in the proportion of cases with sexual transmission in the hetero, homo and bisexual groups, in relation to sex ($p<0.0001$).
Conclusion: There has been a reduction in HIV detection in the population analyzed since the beginning of the COVID-19 pandemic, probably due to underreporting. The results indicate that it is necessary to strengthen HIV/AIDS prevention and control programs, in order to maintain this trend. We believe that research should continue the search for solutions that help interventions to reduce HIV/AIDS cases in the state of Ceará, Brazil.
Key Word:Epidemiology; HIV; Sexually Transmitted Infections.

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I. Introduction

Considered as a global public health problem, Sexually Transmitted Infections (STIs) have shown an increase in cases each year, especially in developing countries, which socioeconomic factors contribute directly to this increase[1].

In this context, STIs, such as syphilis, viral hepatitis, gonorrhea, trichomoniasis, HIV, among others, are caused by a range of etiological agents, such as viruses, bacteria, fungi and protozoa, transmitted in different ways, through pregnancy, blood transfusion and sexual contact, the latter being the most prevalent means of transmission[2].

Among the infections mentioned above, the Human Immunodeficiency Virus (HIV), considered a retrovirus, with RNA genome, of the subfamily of *Lentiviridae*, is largely responsible for several deaths worldwide, since its discovery in the 1980s, in the United States, in view of the impairment of the individual's immune system, which leads to the emergence of opportunistic infections, which can lead to death[3].

Acquired Immunodeficiency Syndrome (AIDS) was known in the early 1980s in the United States as a threatening pathology that compromised the immune system and favored the development of opportunistic diseases, such as pneumonia, in male and homosexual individuals[4].

One year after the outbreak of HIV in 1982, the Center for Disease Control (CDC) in the United States identified that the disease was not restricted to homosexuals, but could be transmitted by other routes, such as blood transfusion, and among heterosexual people. The discovery of other transmission routes expanded new coping strategies and fostered new advances in research on the virus, which later, in the 1990s, enabled the development of new public policies, such as the identification of risk groups, testing and disease prevention[5].

Currently, 37.7 million people live with HIV worldwide, of which 1.5 million people resulted in positive tests in 2021 alone[6]. In Brazil, between the 1980s and the end of 2021, 1,045,355 cases were identified throughout the country, 65.8% of which were male. Despite the introduction of antiretroviral therapies in Brazil, mortality rates are still high, considering that up to December 2020 360,323 deaths were reported with HIV/AIDS as the underlying cause[7].

After HIV infection, known as the first phase or acute infection, the disease is incubated between 30 and 60 days, and the individual has general symptoms, such as fever and malaise. After this phase, the disease can go unnoticed for many years, given that it is asymptomatic. Subsequently, after the deficiency of the individual's immune system, with the reduction of CD4+ T lymphocytes (white blood cells of the immune system), there may be the development of opportunistic diseases, which promote the worsening of the health condition[3].

Acquired Immunity Syndrome (AIDS), currently, presents itself as a disease of significant occurrence, and with still high mortality, despite the great advances in the discovery of new treatments and means of prevention. It is worth mentioning that social stigma and prejudice about HIV also present themselves as obstacles to be faced, given the lack of knowledge of the population, which has a great impact on the early detection of the disease[8].

Therefore, knowledge of the epidemiological profile of HIV cases detected in a territory is necessary to guide the creation of strategies for the prevention and control of the disease. Thus, the objective of this study was to describe the epidemiological profile of HIV cases detected in the population of adolescents and adults in the state of Ceará - Brazil, from 2017 to 2021.

II. Material AndMethods

Study Design: This is a cross-sectional epidemiological study, carried out with data collected in the Information System for Notifiable Diseases (Sinan) of the Ministry of Health of Brazil. Access was provided by the Integration of information from the Health Department of the state of Ceará - IntegraSUS (https://integrasus.saude.ce.gov.br/), secondary database, through the section "of the Strategic Indicators of Health Surveillance".

Study Location: The state of Ceará, located in the northeast of Brazil, consists of 184 municipalities, with a territorial area of 148,894.442 km². According to the 2010 census, the state had 8,452,381 inhabitants, with a population density of 56.76 inhabitants/km² [9]. With the Human Development Index (HDI) on the rise in recent years, Ceará presented an improvement from 0.682 to 0.735 in a research carried out in 2017 by the Institute of Research and Economic Strategy of Ceará[10].

Under about 2800 hours of sunshine a year and endowed with beautiful beaches, the state attracts thousands of tourists annually. With a coastal extension of approximately 34 kilometers, the capital of Fortaleza corresponds to the main gateway and tourist destination of the state[11]. In 2019, tourism generated an income of 20,544 million reais, and an impact of 12.6% on state GDP[12]. Unfortunately, this activity does not only generate benefits, as it contributes to the entry and spread of diseases in the state.

Study Duration and Sample: For the study, the "HIV detection rate in adults" was selected, considering the population aged 13 years or older. The variables analyzed were: year of detection (2017 to 2021), gender, education, age group, exposure category and HIV detection in pregnant women.

Ethical aspects: As this is a study with a consolidated database, in the public domain, the resolution of the National Health Council No. 510/16 does not require appreciation by a Human Research Ethics Committee[13].

Statisticalanalysis: The data were analyzed with the aid of the BioEstat5.3 software, which allowed the comparison of the number of median cases distributed by sex, using the Man Witney, Kruskal Wallis and Dunn tests, as well as to investigate the association between the variables gender and category of exposure to HIV, using the Chi-square and Williams G tests. The level $P < 0.05$ was considered as the cutoff value or significance.

III. ResultandDiscussion

The pattern of the HIV detection rate in people aged 13 years or older in the state of Ceará was analyzed considering the variables: year of detection, HIV detection in pregnant women, gender, education, age group and exposure category in the course of 2017 to 2021.

In Brazil, approximately 36,471 cases of HIV per year were detected and reported to SINAN in the period analyzed. In the country, the northeast is the second region with the most reported cases, especially the states of Pernambuco and Ceará, which represented 25.87% and 15.78%, respectively[7]. In the state of Ceará, it was found that 8,489 cases were detected in the population studied during the period from 2017 to 2021, with an average of 1,697.8 cases per year (Figure 1).

In an annual analysis, it can be seen that the number of cases detected with HIV in 2017 represented 22.04% (1,871) of the entire analyzed period. In the following year, 2018, there was an increase in the number by 3.21% (1,931), and 2019 had the highest detection record, when compared to the other years studied, totaling

1,953 people detected with HIV.

The first pandemic year of COVID-19, 2020, brought drastic changes in the epidemiological scenario in the detection of HIV in adults in Ceará. In that year, there was a decrease of 28.26% (1,401), when compared to the previous year. Similarly, 2021 also showed a decrease in the detection of this virus in the population of Ceará, presenting 1,333 cases, that is, a reductionof 4.85% compared to 2020.

Also in Figure 1, the total number of HIV cases reported in pregnant women in Ceará during the years 2017 to 2021 are shown. In this period, 1,375 cases were recorded, which represents 16.20% of the total number of cases reported in the analyzed population (8,489). In the pre-pandemic years of COVID-19, 281, 304 and 304 detected cases of HIV in pregnant women were reported to SINAN in 2017, 2018 and 2019, respectively, corresponding to an average of 296.3 (±13.27) cases per year. It is observed in the group of pregnant women the same trend of decline, in the post-pandemic period, observed for previously. There was a reduction of 12.83% from 2019 to 2020 (265 cases) and 16.60% from 2020 to 2021 (221 cases).

From the analytical perspective, it can be seen that, in relation to the analyzed period, the total number of new HIV cases from 2019 to 2020 in the state of Ceará presented a considerable reduction, although it did not suffer such a significant reduction in the group of pregnant women. Similarly, this trend also occurred in other countries of the world. As an example, in the period from 2019 to 2020, the number of diagnoses of new HIV infections in the US declined by 17%. This change may be related to the effects of the COVID-19 pandemic on HIV services and serology[14]. In the case of Brazil, according to the Ministry of Health, the Unified Health System (SUS) expanded the supply of HIV self-tests and continued to guarantee free access to rapid tests, condoms and medicines for those undergoing treatment in the pandemic period[15].

In another Brazilian state (Pará), the prevalence of HIV cases in pregnant women was recorded in the age group of 20 to 29 years and showed a propensity to increase[16]. Nevertheless, Ceará has been increasing detection in pregnant women before the pandemic, falling after it was installed. This may have occurred due to underreporting generated by the isolation measures adopted during the pandemic, or thanks to the actions of the Ministry of Health that has invested in prevention measures throughout the population.

Prenatal care is essential for the early detection of HIV. It is necessary to monitor HIV+ pregnant women to provide adequate care and treatment to avoid future complications to the fetus, such as low birth weight, small size for age, prematurity and stillbirth[17].

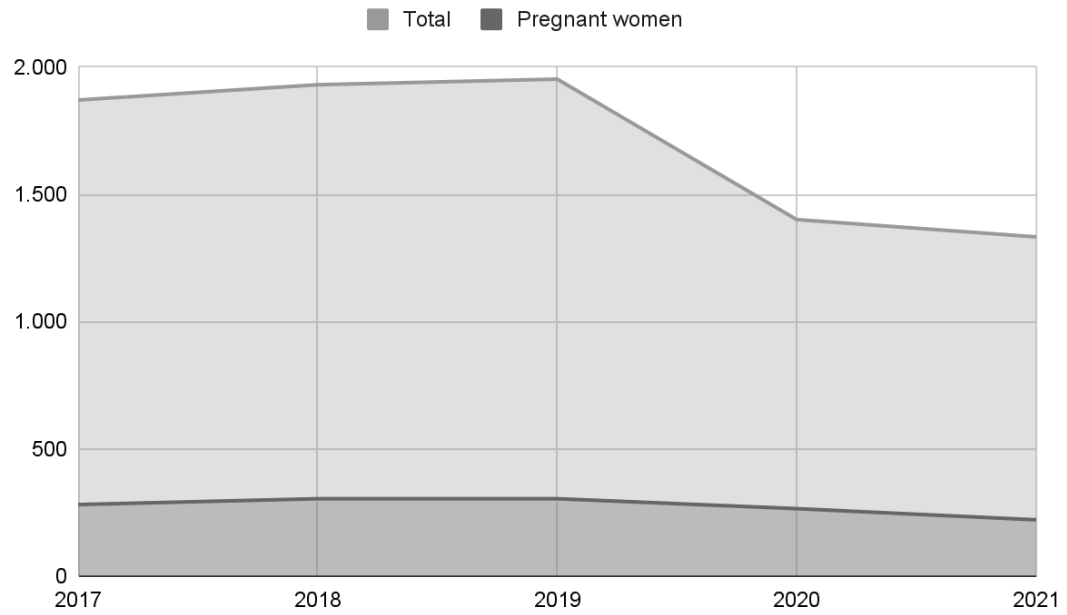

Figure 1 - Total number of HIV cases reported in the general population and in pregnant women in Ceará (2017-2021).

In Table 1, the cases detected of HIV are distributed in the period, according to the epidemiological characteristics: gender, race/ethnicity, education and age group. There is a significant difference between males (6,585 cases) and females (1,904 cases) (p= 0.0374). This higher prevalence in males occurs even considering the male population lower than that of women in the state. According to IBGE, the last survey reports that there are 4,456,662 (48.5%) men and 4,731,224 (51.5%) women[9].

Although males represent a higher index when compared to females, there was an increase in the detection of cases in women in the years preceding the Sars-CoV-2 pandemic. Similarly, the global epidemiological scenario of HIV has undergone changes with the increase in the number of cases detected in women, characterizing itself as the feminization of this epidemiological phenomenon[18,19].

Considering race/ethnicity in the state of Ceará, the number of cases was significantly higher among those who declared themselves brown(6,609 cases). Statistically significant differences were observed between browns and yellows, as well as between browns and indigenous peoples ($p<0.0001$). The white race occupied the second position in number of cases(1,008 cases) and its distribution of cases was significantly different over the studied period in relation to the indigenous ($p<0.0001$), who presented only 40 cases, the lowest number (Table 1).

This ethnic-racial distribution is not limited to Ceará, since the vulnerability of Afro-descendants, associated with economic, social and cultural aspects, is present throughout the national territory, as well as in other regions of the globe. In Brazil, according to SINAN, the total number of HIV cases registered from 2007 to 2021 was 39.4% in whites and 51.7% in blacks, of which 40.8% are brown and 10.9% are black[7]. In comparison, in the USA, the population of blacks/Afro-descendants corresponded to 42% of the new cases registered in 2019. This is probably explained by factors such as racism, stigma associated with HIV and poverty, as well as other barriers related to health care that drive ethnic-racial disparities[20].

Regarding education, discarding ignored and uninformed records (2,576), detection was higher in people who completed high school and among those with incomplete elementary school with 1,935 (32.72%) and 1,370 (23.17%) cases, respectively. In illiterate individuals, 193 cases (3.26%) were detected, representing the lowest prevalence. In fact, the statistical tests indicated a significant difference between the number of cases in the illiterate category and incomplete elementary school, as well as between illiterate and complete high school ($p<0.05$).

In the schooling scenario, it is noted that, in Ceará, there is a paradigm shift, since it is expected that due to lack of formal education information, there will be a greater number of cases among the illiterate population. However, the HIV rates in the state are higher in the social portion with median education, indicating that there are other factors with greater influence on the HIV infection process, such as unprotected sexual intercourse, sharing of syringes between injecting drug users and vertical transmission.

The literature states that socioeconomic vulnerability, low level of knowledge and education are closely associated and act as risk factors for HIV transmission[21]. A study conducted in the USA corroborates this theory, since poverty and low education are also associated with the incidence of HIV in the country[22].

According to Table 1, the age group of 20 to 29 years represents 41.03% (3,456) of the cases, discarding those who were not informed (66%). The number of adults detected with HIV declines throughout the age group, since in 30 to 39 years it represents 27.97% (2,356), from 40 to 49 years 15.20% (1,280) and +50 years 10.03% (845). The lowest index found in the analysis is in people aged 13 to 19 years, reflecting 5.77% (486 cases). The difference observed in the distribution of cases in the period between the age group with the highest number of cases and the one with the lowest number was statistically significant ($p<0.05$). Similarly, significant differences also occurred between the age group of 30-39 years and 13-19 years.

The prevalence of HIV detectionin young adults (20 to 29 years) observed in Ceará is similar to that of Brazil[7]. This can be explained by the fact that this group is in the more sexually active phase.

Table no 1: Epidemiological characteristics of HIV cases detected in the state of Ceará, Brazil, from 2017 to 2021.

Characteristics*	Cases detected per year					
	2017	2018	2019	2020	2021	Total
Sex (n=8.489)		**p-value**	**0.0374**			
Male	1473	1514	1510	1065	1023	6.585
Female	398	417	443	336	310	1.904
Race/ethnicity(n=8.182)	**p-value**	**< 0.0001**	**a x e**	**c x d**	**c x e**	
White (a)	249	219	235	148	157	1.008
Black (African descedent) (b)	85	83	156	66	84	474
Pardo (Mulatto) (c)	1.437	1.523	1.459	1.140	1.050	6.609
Yellow (d)	17	14	8	9	3	51
Indigenous (e)	12	12	7	6	3	40
Educationlevel(n=5.913)		**p-value**	**< 0.05**	**a x b**		**a x e**
No schooling (a)	46	41	57	27	22	193
Incompleteelementaryschool** (b)	264	327	324	254	201	1.370
Complete elementaryschool (c)	96	85	116	67	80	444
Incompletehighersecondary (d)	123	122	146	109	108	608
Complete highersecondary (e)	449	453	454	268	311	1.935
Incompletehighereducation (f)	183	171	152	81	80	667
Complete highereducation (g)	167	173	160	104	92	696
Age range in years (n=8.423)		**p-value**	**< 0.05**	**a x b**		**a x c**
13-19 (a)	105	107	141	68	65	486
20-29 (b)	800	793	790	563	510	3.456
30-39 (c)	520	537	531	398	370	2.356
40-49 (d)	258	304	295	209	214	1.280
50+ (e)	174	174	188	152	157	845

* For the development of the table, the cases "Ignored" and "Not informed" were discarded
** To constitute "Incomplete elementary school", information from "1st to 4th incomplete grade", "4th complete grade" and "5th to 8th incomplete grade" was joined.

Table 2 shows the HIV data detected in adults according to the exposure category according to sex. For the construction of this table, the cases with answers "no" and "ignored" were removed. The proportion of cases recorded in men and women who were exposed to the virus by type of sexual intercourse showed a significant difference ($p<0.0001$), reinforcing this as the main category of exposure to HIV in adults, representing 96.8% (7,381) of the reported cases.

Among the records, sexual relations between heterosexuals corresponded to the highest number of contamination, corresponding to 45.26% (3,341). Relations between men represented the second largest HIV detection in relation to sexual transmission, with 3,321 reported cases (44.99%) and homosexual relations between women presented the lowest value of this category with 0.45% (33). Among bisexuals, 686 (9.29%) cases were recorded. For the analysis of this category, cases reported as "It was not sexual transmission", represented by 13 cases, were excluded.

A study conducted in a region of South Africa points out that the behavioral attitudes of the population aggravate and/or maintain the HIV epidemic. Among the behaviors are the high levels of substance use and multiple heterosexual partners as risk factors for the disease[23]. These risk behaviors became more common after the emergence of treatment for AIDS, culminating in the increased incidence of STIs, especially in the sexual minorities of men who have sex with men (homosexuals and bisexuals), as occurs in China and the USA[22, 24, 25].

Considering other forms of exposure different from sexual intercourse, males stood out for presenting the highest proportions of cases among these modalities, corresponding to 73.68% for injectable drugs and 68.38% for vertical transmission. As for blood transfusions, the cases are equally distributed between the sexes. And haemophilic transmission was reported in this study only in males (only three cases). Regarding these exposure categories, although there is a predominance of cases in males, there is no evidence of statistical significance, that is, our data indicate that the differences observed are not dependent on gender (p=0.1769) (Table 2).

According to another Brazilian study, it is portrayed that exposure to the virus by the use of injectable drugs is predominant in people with low education[26]. Still, it is important to emphasize that the longer time of use of an injection and sharing of syringe with other people, besides the risk of HIV infection, it is associated with the possibility of co-infection with other STIs, being closely linked to the low income of users, due to the difficulty in acquiring new syringes and needles[27].

Exposure by vertical transmission of HIV in the population of Ceará is worrying, as it was reflected in 155 cases (2.3%) detected in people older than 13 years, which highlights a late diagnosis of the virus in these individuals (Table 2). According to Mollinar[28], the prophylaxis of this form of transmission can be carried out even in the prenatal period. Thus, the number of cases can be curbed and the emergence of complications during pregnancy can be prevented. On the other hand, the absence of screening during pregnancy contributes to the transmission of the virus during childbirth and breastfeeding[29].

Table no 2: Detected cases of HIV in adults according to exposure category (2017-2021).

	Total numberofdetected cases		
Exposurecategory	Men	Women	Total
Sexual Relationships	**p-value**	**< 0.0001**	
Heterosexual	1.705 (51.03%)	1.636 (48.96%)	3.341
Homosexual	3.321 (99%)	33 (0.98%)	3.354
Bisexual	651 (94.89)	35 (5.10%)	686
Other ways	**p-value**	**= 0.1769**	
Injectingdrug use	42 (73.68%)	15 (26.31%)	57
Bloodtransfusion	8 (50%)	8 (50%)	16
Hemophilia	3 (100%)	-	3
Vertical transmission	106 (68.38%)	49 (31.61%)	155
Total	5.794	1.761	7.612

Study Limitations:

The study was conducted with secondary data source. Although the data belong to a reference center for notification, it is subject to underreporting of cases. It is likely that the COVID-19 pandemic may have interfered in this process from 2020, due to restrictive measures and reduction of health service professionals. In addition, many people stopped seeking these services for fear of becoming infected with the coronavirus.

IV. Conclusion

In this study, there was a reduction in HIV detection in the adolescent and adult population in the state of Ceará since the beginning of the COVID-19 pandemic, precisely in the years 2020 and 2021, probably due to underreporting, considering the sudden decline. The highest proportions of cases were observed in groups of males, young people, self-declared brown people and in the group with median education.

Sexual relations represent the main form of HIV transmission in the studied area, indicating the need to

strengthen HIV/AIDS prevention and control programs to break this transmission link in the epidemiological chain. Likewise, prenatal care should be encouraged, along with detection tests, in order to increasingly reduce vertical transmission. There must be investment in biosafety actions, aiming to guarantee users a blood transfusion free of infections.

Considering the high percentage of transmission by injectable drugs in the male group, it is necessary to invest in multisectoral policies, given the complexity involved in drug use.

Epidemiological studies are important for the knowledge of an unknown scenario, but also for monitoring trends in health problems. Therefore, we believe that other studies, from secondary or primary data, are necessary to guide interventions in favor of the reduction of HIV/AIDS cases in the state of Ceará, Brazil.

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