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ASSOCIATION BETWEEN THE SOCIO-DEMOGRAPHIC AND CLINICAL CHARACTERISTICS OF PATIENTS WITH ACQUIRED IMMUNODEFICIENCY SYNDROME IN THE PARÁ STATE

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ABSTRACT

Over the past decade, Brazil has experienced a growth in the number of deaths of patients infected with Human Immunodeficiency Virus. In addition, the Brazilian government's response to the Human Immunodeficiency Virus and to the Acquired Immunodeficiency Syndrome has proved to be inefficient, contributing to the growing emergence of new cases. Researchers have sought to fill in the gaps related to this disease. The present study aims to show the profile of patients with Acquired Immunodeficiency Syndrome in the Pará State, and to verify possible associations between the socio-demographic and clinical variables categories, from 2007 to 2016. It is a descriptive study, in which we used the statistical technique of Exploratory Data Analysis. In order to present the profile of the patients, we performed georeferencing for the spatial distribution of Acquired Immunodeficiency Syndrome cases, as well as the Correspondence Analysis to verify whether or not there was an association between the categories of the socio-demographic and clinical variables. Among the results, we observed that in the period from 2013 to 2016 there was an increase in the number of cases of Acquired Immunodeficiency Syndrome in the Pará State, for both male and female patients. There was also statistical association between the evolution of the case classified as *death* and the *low* schooling of the patient. The results show that there is a huge public health issue regarding this matter and that it is necessary to promote the continuation of disease awareness and prevention projects, alerting the population about the serious risks of contracting HIV, as well as about the importance of identifying the disease in its initial stage, to ensure a more effective treatment and clinically more satisfactory results.

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INTRODUCTION

Acquired Immunodeficiency Syndrome (AIDS) is a global phenomenon that has become a pandemic, since about 35 million people are infected with it (NOGUEIRA, SEIDL, 2016). The disease is caused by the Human Immunodeficiency Virus (HIV), and it is considered the most advanced stage of the infection, attacking and weakening the patient's immune system (BRAZIL, 2015a). HIV infection is characterized by a cluster of clinical manifestations called Acute Retroviral

Syndrome, and usually occurs between the first and third week after the infection. The most common clinical findings of the Acute Retroviral Syndrome include fever, adenopathy, pharyngitis, rash, myalgia and headache (BRAZIL, 2013). The virus reaches the defense cells, leaving the body more vulnerable, whereas other infections caused by diseases considered less complex, such as a cold, can progress to more serious infections like tuberculosis or cancer, damaging the treatment of such diseases (BRAZIL, 2015b). AIDS began to emerge worldwide in 1977 (PEIXOTO; GALVÃO, 2015), and in Brazil the first case occurred in 1980, in the city of São Paulo, where the disease was not yet known at the time. Ever since it has been monitored by Brazilian health authorities, with an average of 30,000 new cases reported annually

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(BRAZIL, 2013). Among the several types of infections, the most frequent are Pneumocystis Pneumonia, Cerebral Toxoplasmosis, Extrapulmonary Cryptococcosis, Disseminated Histoplasmosis and Cytomegalovirus (BRASIL, 2013). Although there is a whole Brazilian effort in the control and monitoring of AIDS, through the treatment of viral infections and the use of antiretroviral therapy, opportunistic pulmonary infections still represent the main cause of morbidity and mortality among patients (COSTA, 2010). According to Cunha, Cruz and Torres (2016) during the period from 2000 to 2014, there was a drop in the incidence of AIDS in the world, while Brazil experienced an increase of new cases in the same period, making it a worrying factor for the country's public health authorities. In this sense, this study aims to verify whether there is an association between the categories of socio-demographic and clinical variables of patients living with AIDS in the Pará State, from 2007 to 2016.

MATERIALS AND METHODS

The research has a quantitative nature, of exploratory and descriptive type. The exploratory research aims to make the problem more explicit, providing greater familiarity with a subject that is still little known (GIL, 2008). Descriptive research is carried out when one intends to describe the facts and phenomena of a certain reality, that is, when the researcher wishes to know a certain community and its characteristics (TRIVIÑOS, 1987). The data obtained refer to confirmed cases of AIDS patients living in the State of Pará, aged 13 or older, within the period from January 2007 to December 2016. The Pará State is the ninth most populous state in Brazil. According to estimates from the Brazilian Institute of Geography and Statistics (IBGE, 2017), the 144 municipalities of Pará have a total of 8,366,628 inhabitants. The data were taken from Individual Notification Forms, filled by the Brazilian care units for each patient with some health problem of compulsory notification or having a national, state or municipal interest. After completing the form, the instrument must be sent to the services responsible for the information and/or epidemiological surveillance of the Municipal Secretariats, which must send the files in magnetic format to the State Secretariats of Health every week (SINAN, 2016).

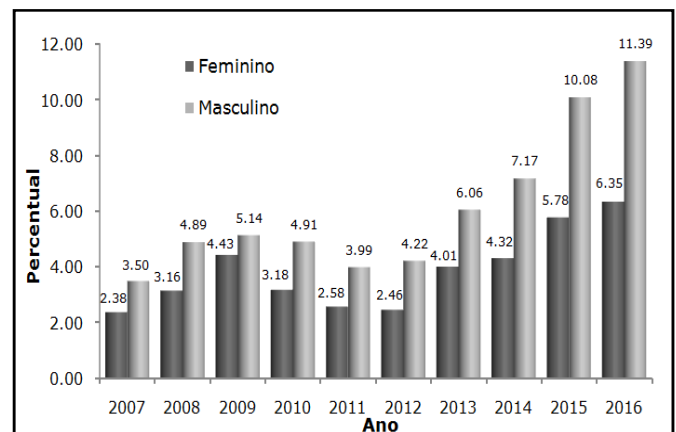
The database was made available on January 31, 2017, to the Statistical and Computational Studies and Research Group (GEPEC) and the Laboratory of Information System and Georeferencing (LASIG), both from the Federal University of Pará (UFPA), and it was provided by the Secretariat of Health of the Pará State (SESPA). It is important to emphasize that the Secretariat did not share the identification of the patients under study, as they were kept in strict secrecy. After selecting the data, the information was exported to a spreadsheet in order to be organized and analyzed. As the data had previously been collected by the patient care units, being therefore secondary data, we previously discarded those cases with incomplete information about the patient in their notification form. In order to identify the profile of patients with AIDS we used the Exploratory Data Analysis, which is a statistical technique aimed at collecting, organizing, synthesizing and presenting the information, by summarizing and describing important characteristics of a set of data (BUSSAB; MORETTIN, 2013).

With a view to present the spatial distribution of the confirmed cases of AIDS in the Pará State we applied the georeferencing

technique, allowing the mapping of a certain characteristic in a certain space and time (CAVICCHIOLI *et al.*, 2014). In this study, the technique was applied by the Excel software, and the data were filtered according to the *number of confirmed cases* and *year* (considering the period from 2007 to 2016) variables, to later form the column of the patient's municipalities (CASTRO, 2018). The data were sorted in ascending order and integrated to the map with the aid of the ArcGis 10.1 program. In addition, we used the statistical technique of Correspondence Analysis, which measures the degree of dependence, that is, the associations between the categories of the variables under study (HAIR JÚNIOR *et al.*, 2005). According to Ramos, Almeida and Araújo (2008), for the application of the Correspondence Analysis technique it is necessary to verify (i) whether or not there is a dependence between the study variables (PESTANA; GAGEIRO, 2005); (ii) whether or not there is a dependence between the categories of the variables; (iii) whether the sum of inertia percentage of dimensions 1 and 2 is equal to or greater than 70% for the results to be valid. In order to know the probability of a variable's category being associated with the category of another variable, it is necessary to calculate the confidence coefficient (γ). The associations between categories are considered significant when the value of the confidence coefficient indicates strongly significant probabilities, that is, when $(\gamma) \geq 70.00\%$ ¹⁶. The Correspondence Analysis was performed with the help of the application software *Statistica*, version 6.0. In all tests, a level of significance (α) was set at 5% ($\alpha = 0.05$ or $p < 0.05$) in order to reject the null hypothesis.

RESULTS

From the 12,087 confirmed cases of AIDS in the Pará State, we noted that there was a growth in the percentage of confirmed cases for both male and female patients from 2007 to 2009, and a decrease between the years of 2010 to 2012 (Figure 1).



Source: SESPA (2017), adapted by the author.

Figure 1. Percentage of confirmed cases of AIDS in the Pará State, between 2007 and 2016, by Year of Occurrence and Gender

In the last four years of this study (2013 to 2016) the percentage of AIDS cases rose again, and in all the years the male gender prevailed (Figure 1). Most patients are in the age group of 19 to 39 (64.98%), and the majority did not complete primary education (67.92%), that is, have less than nine years of schooling. In relation to the municipality of residence of the patients, 47.84% of them live in Belém, and the municipality of Santarém comes next in the list (14.49%) (Table 1).

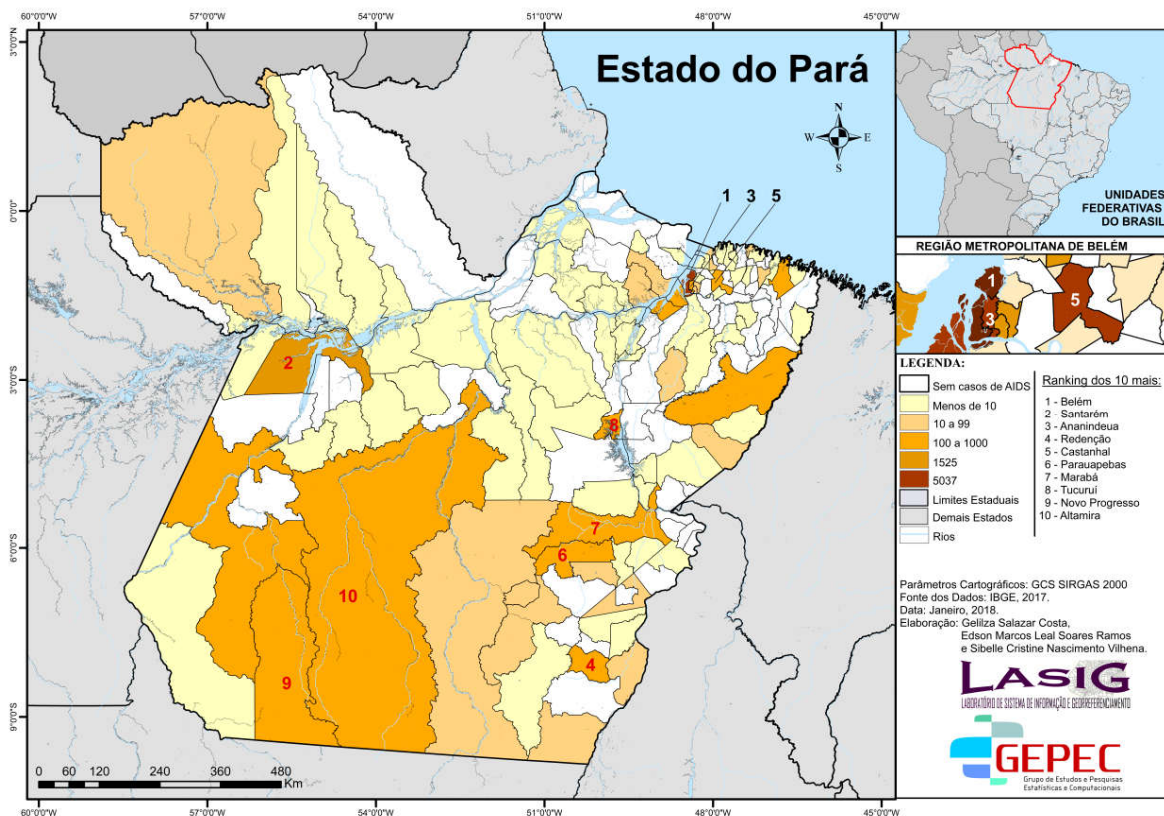


Figure 2. Distribution of Confirmed Cases in the Pará State, in the Period from 2007 to 2016, by Municipality of Residence of Patients

Table 1. Quantity and Percentage of Patients Confirmed with AIDS in the Pará State, from 2007 to 2016, by Age Group, Schooling and Municipality of residence (Ten largest ones)

Variable	Category	Quantity	Percentage
Age Group	13 to 18	355	2,94
	19 to 29	3860	31,94
	30 to 39	3994	33,04
	40 to 49	2415	19,98
	50 to 59	1054	8,72
Schooling	≥ 60	409	3,38
	Illiterate	285	3,04
	I.P.E.	4829	51,53
	C.P.E.	1015	10,83
	I.S.E.	739	7,88
	C.S.E.	1885	20,11
Municipality	I.H.E.	214	2,28
	C.H.E.	406	4,33
	Belém	5037	47,84
	Santarém	1525	14,49
	Ananindeua	781	7,42
	Redenção	734	6,97
	Castanhal	614	5,83
	Parauapebas	523	4,97
	Marabá	516	4,90
	Tucuruí	303	2,88
Novo Progresso	280	2,66	
Altamira	215	2,04	

Source: SESPA (2017), adapted by the author.

Note: I.P.E.: Incomplete Primary Education; C.P.E.: Complete Primary Education; I.S.E.: Incomplete Secondary Education; C.S.E.: Complete Secondary Education; I.H.E.: Incomplete Higher Education; C.H.E.: Complete Higher Education. The 10 municipalities with most AIDS cases are among the 20 most populous, with the exception of Novo Progresso, which is a mining region.

Among the confirmed cases of patients living with AIDS, the majority of them contracted the virus through sexual intercourse (97.50%). With respect to opportunistic infections, Tuberculosis and Toxoplasmosis each stood out in about 6% of patients, whereas Pneumocystis Carinii Pneumonia occurred in 2.17% of them (Table 2).

Table 2. Number and Percentage of Confirmed Cases of Patients with AIDS in the State of Pará, from 2007 to 2016, by Mode of Transmission, Presence of Opportunistic Infections and Evolution of the Case

Variable	Category	Quantity	Percentage
Mode of Transmission	Sexual Intercourse	10894	97,50
	Injectable Drugs	238	2,13
	Accident with Biological Material	33	0,30
	Blood Transfusion	8	0,07
	Tuberculosis	Absence	10544
Tuberculosis	Presence	718	6,38
	Cerebral	Absence	10436
Toxoplasmosis	Presence	641	5,79
Pneumocystis	Absence	10840	97,83
Carinii Pneumonia	Presence	241	2,17
Evolution of the case	Alive	10578	87,52
	Deathby AIDS	1509	12,48

Source: SESPA (2017), adapted by the author.

According to the spatial distribution of the confirmed cases in Pará, with respect to the place of residence of the patients, the ten most affected municipalities were Belém, Santarém, Ananindeua, Redenção, Castanhal, Parauapebas, Marabá, Tucuruí, Novo Progresso and Altamira (Figure 2). In order to verify the association between the variables, we performed the Correspondence Analysis through chi-square test (χ^2), in which the hypothesis H_0 (the variables are independent) is rejected, since $p < 0.05$. In addition, the values of the criterion β were greater than three, meaning that, besides the variables, their categories are also dependent, confirming that the tested variables present conditions for the application of the technique under study (Table 3). There was statistical association between the evolution of case classified as *death* and *male gender* (Table 4). There is also a statistical association between *injectable drugs* as mode of transmission and *female gender*, as well as between the evolution of case of patients classified as *alive* and *female gender* (Table 4).

Table 3. Results of the Tests to Check the Dependence between the Variables: Type of Transmission, Gender, Evolution of the Case and Schooling of AIDS Patients in the Pará State, from 2007 to 2016

Variables	χ^2	<i>p</i>	<i>l</i>	<i>c</i>	β
Type of Transmission and Gender	14,73	0,000	2	2	13,73
Evolution of the Case and Gender	26,96	0,000	2	2	25,96
Schooling and Evolution of the Case	59,19	0,000	7	2	21,72

Note: χ^2 = chi-square test, *p* = descriptive level, *l* = number of lines, *c* = number of columns, β = Beta Criterion.

Table 4. Residue and probability resulting from Correspondence Analysis applied to the variables: Mode of Transmission and Evolution of the Case versus Gender of Patients of Confirmed Cases of AIDS, in the Pará State, from 2007 to 2016

Variable	Category	Gender	
		Male	Female
Mode of	Injectable Drugs	-4,27(0,00)	11,83(100,00)*
Transmission	Sexual Intercourse	0,63(47,07)	-1,74(0,00)
Evolution of	Alive	-1,14(0,00)	1,44(84,91)*
the case	Death	3,02(99,75)*	-3,80(0,00)

Note: *Strongly significant probabilities, since $\gamma \times 100 \geq 70\%$;

**Moderately significant probabilities, since $50,00 \geq \gamma \times 100 \geq 69,99\%$.

It is noted that there is statistical association between the evolution of the case of patients classified as *alive* and schooling referring to nine or more years of education (Table 5). There was also statistical association between the evolution of the case classified as *death* and schooling referring to eight or less years of education (Table 5).

Table 5. Residue and probability resulting from Correspondence Analysis applied to the variables: Schooling versus Evolution of the Case of confirmed AIDS patients, in the Pará State, from 2007 to 2016

Schooling	Evolution of the case	
	Alive	Dead
Illiterate	-0,61(0,00)	1,61(89,24)*
Incomplete Primary Education	-1,20(0,00)	3,14(99,83)*
Complete Primary Education	-0,76(0,00)	2,00(95,41)*
Incomplete Secondary Education	0,75(54,90)**	-1,97(0,00)
Complete Secondary Education	1,31(80,98)*	-3,43(0,00)
Incomplete Higher Education	0,60(45,45)	-1,58(0,00)
Complete Higher Education	1,58(88,56)*	-4,13(0,00)

Note: *Strongly significant probabilities, since $\gamma \times 100 \geq 70\%$;

**Moderately significant probabilities, since $50,00 \geq \gamma \times 100 \geq 69,99\%$.

DISCUSSIONS

Since the beginning of the AIDS epidemic in Brazil in 2000 until June 2014, 757,042 cases have been registered in the country, of which 65.00% are men and 35.00% are women (MERCOSUR, 2015). Studies by Boff and Dallacosta (2016) conducted in the state of Santa Catarina showed that most of the reported cases of AIDS occurred in 2014, and that the increase in the number of occurrences was ratified compared to the previous year. Analyzing the AIDS cases in Brazil, in the period from 2007 to 2015, there was also a highlight of the male gender, which represented 67.30% of the cases (BRAZIL, 2017). A study carried out in two AIDS reference centers in the city of São Paulo showed that the majority of patients were in the age group of 30 to 39 (39.60%), followed by the age group of 40 to 49, who represented 28.30% of the patients (TANCREDI *et al.*, 2017). In Florianópolis (SC) a similar study showed basically the same results, in which the most affected age group of AIDS patients was that of 30 to 44

year-old patients, representing 54.30%, also being the age group with the most number of deaths (48.90%) (TANCREDI *et al.*, 2017). The low educational level of the patients reflects in the increase of AIDS cases, as shown in a study carried out in a reference center located in the city of Caxias (MA). The majority of patients never went to school or have incomplete primary education (54.40%), demonstrating the tendency of a high rate of patients with low educational level, which is an indicative of the irradiation of the epidemic to the less favored strata of society (GALVÃO; COSTA; GALVÃO, 2017). Another similar study was carried out in the Unit of Communicable Diseases of a University Hospital of Londrina-PR. Regarding the schooling of patients, it was detected that most of them did not have complete primary education (55.33%). This shows that the educational level is a relevant factor, and that the awareness about the disease requires a satisfactory level of schooling, since patients with more years attending school have more access to information, prevention methods and knowledge about the importance of the treatment of AIDS (PIERI; LAURENTI, 2012). Studies on the spatial distribution of event incidence have been very important in the area of health, where the dynamic process of data integration and map building establishes a rich set of instruments for public health, by locating events in time and space, monitoring and control of a specific health event, and identification of geographical areas with greater risks of diseases. In addition, the georeferencing technique makes it possible to compare populations from the same geographical area at different times to assess the impact of health interventions (CAVICCHIOLI *et al.*, 2014). According to the results of this study, the municipalities of the Pará State most afflicted with AIDS are among the 19 most populous (according to IBGE), such as Belém, Santarém, Ananindeua, Redenção, Castanhal, Parauapebas, Marabá, Tucuruí and Altamira. The exception is the municipality of Novo Progresso, which is not a very populous municipality but has a high number of cases, which can be explained because it is a mining region. According to local information, most cases are from infected patients who came from mining regions, where there is no prevention (JFP, 2014).

According to the HIV/AIDS Epidemiological Bulletin (BRAZIL, 2017), the type of virus transmission among 13-year-old or older patients continues to occur through sexual intercourse (for both men and women), followed by the use of injecting drugs. Nonetheless, this proportion is decreasing over the years throughout Brazil. Regarding opportunistic infections associated with AIDS, one of the most frequent in Brazil is Tuberculosis, the second highest occurrence among opportunistic diseases in AIDS patients in general. This is due to the high prevalence of the two diseases in the country, and the increase in HIV infection has definitely contributed to the worsening of Tuberculosis infection, especially in regions that already had deficiencies in the public health system (COSTA, 2010). One of the major neurological manifestations in HIV-infected patients is Cerebral Toxoplasmosis, which manifests as subacute disease, presenting focal brain dysfunction or being related to diffuse encephalitic symptoms (MARCHIOTTI, 2017). Studies show that one to three-quarters of the world's population is or has been infected with Toxoplasmosis. In Brazil, this index varies between 40 and 90.00% of the people (BRAZIL, 2013). Since the first case of *Pneumocystis Carinii* Pneumonia in 1980, pulmonary infections present a major challenge in the treatment of HIV patients. Even with the help of the treatments, opportunistic

pulmonary infections are still the main causes of morbidity and mortality (COSTA, 2010). In the period from 2006 to 2014, the number of deaths due to basic causes of AIDS in Brazil increased, with 11,046 deaths reported in 2006. The number continued to grow in the following years until 2014, in which 12,575 deaths were reported, with a slight decrease in 2015, which accounted for 12,298 deaths caused by AIDS (BRAZIL, 2017).

Conclusion

Through this study it was possible to know the profile of AIDS cases in the Pará State, from 2007 to 2016. We conclude that the number of AIDS cases in Pará has increased over the past four years, and that in all years of the study there was a higher incidence of male patients, aged between 19 to 39, and with incomplete primary education, which shows the need for educational programs in public health aimed mainly at the male population with a low level of schooling. The results show that there is a huge public health issue, since the number of confirmed cases of AIDS and the number of deaths, both in Pará and in Brazil, remain high. Thus, it is necessary to promote the continuation of disease awareness and prevention projects, alerting the population about the serious risks of contracting HIV, as well as about the importance of identifying the disease in its initial stage, in order to ensure a more effective treatment and clinically more satisfactory results.

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