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# HIV testing and clinical status upon admission to a specialized health care unit in Pará, Brazil

## Testagem anti-HIV e estadió clínico na admissão de indivíduos em serviço de saúde especializado. Pará, Brasil

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### ABSTRACT

**OBJECTIVE:** To analyze the clinical and laboratory characteristics of HIV-infected individuals upon admission to a reference health care center.

**METHODS:** This cross-sectional study was conducted between 1999 and 2010 on 527 individuals with confirmed serological diagnosis of HIV infection who were enrolled in an outpatient health care service in Santarém, PA, Northern Brazil. Data were collected from medical records and included the reason for HIV testing, clinical status, and count of peripheral CD4+ T lymphocytes upon enrollment. The data were divided into three groups, according to the patient's year of admission – P1 (1999-2002), P2 (2003-2006), and P3 (2007-2010) – for comparative analysis of the variables of interest.

**RESULTS:** In the study group, 62.0% of the patients were assigned to the P3 group. The reason for undergoing HIV testing differed between genders. In the male population, most tests were conducted because of the presence of symptoms suggesting infection. Among women, tests were the result of knowledge of the partner's seropositive status in groups P1 and P2. Higher proportion of women undergoing testing because of symptoms of HIV/AIDS abolished the difference between genders in the most recent period. A higher percentage of patients enrolling at a more advanced stage of the disease was observed in P3.

**CONCLUSIONS:** Despite the increased awareness of the number of HIV/AIDS cases, these patients have identified their serological status late and were admitted to health care units with active disease. The HIV/AIDS epidemic in Pará presents specificities in its progression that indicate the complex characteristics of the epidemic in the Northern region of Brazil and across the country.

**DESCRIPTORS:** Acquired Immunodeficiency Syndrome, epidemiology. HIV Infections, epidemiology. AIDS Serodiagnosis, trends.

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## RESUMO

**OBJETIVO:** Analisar as características clínicas e laboratoriais de indivíduos infectados pelo HIV na admissão em serviço de referência em saúde.

**MÉTODOS:** Estudo transversal realizado entre 1999 e 2010, com 527 indivíduos com diagnóstico sorológico confirmado de infecção pelo HIV, matriculados em serviço de saúde ambulatorial, em Santarém, PA, Brasil. Foram coletadas informações de prontuários referentes à população estudada sobre o motivo de realização da testagem anti-HIV, estadió clínico e número de linfócitos T CD4+ periféricos, no ato da matrícula. Os dados foram distribuídos em três grupos, segundo ano de admissão do paciente: 1999 a 2002 (P1), 2003 a 2006 (P2) e 2007 a 2010 (P3), para a análise comparativa das variáveis de interesse.

**RESULTADOS:** Do total estudado, 62,0% dos pacientes foram admitidos no grupo P3. O motivo de realização da testagem anti-HIV diferiu entre os sexos. Houve preponderância da realização do teste por presença de sintomas sugestivos da infecção na população masculina e pelo conhecimento da soropositividade do parceiro entre as mulheres nos grupos P1 e P2. A maior proporção de mulheres testadas por apresentarem sintomas de infecção pelo HIV/aids fez desaparecer essa diferença entre os gêneros no período mais recente. Observou-se maior participação de matriculados em fase mais avançada da doença no grupo P3.

**CONCLUSÕES:** Apesar do maior reconhecimento de casos de HIV/aids, os pacientes seguem descobrindo seu status sorológico tardiamente e apresentando-se à admissão no serviço de saúde com doença em atividade. A epidemia de HIV/aids no Pará apresenta especificidades em evolução que compõem o complexo mosaico da epidemia na região Norte e no Brasil.

**DESCRIPTORIOS:** Síndrome de Imunodeficiência Adquirida, epidemiologia. Infecções por HIV, epidemiologia. Sorodiagnóstico da AIDS, tendências.

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## INTRODUCTION

The Brazilian AIDS epidemic has developed as a mosaic of different regional epidemics for four decades.<sup>3</sup> The detection rate of HIV/AIDS is gradually increasing in the Northern region, in contrast to the Southeast region, where the rate is gradually decreasing.<sup>a</sup> This increased detection rate is observed in cities with more than 500,000 inhabitants, including Belém, in the state of Pará, where disease incidence increased from 14.3 to 53.5 cases/100,000 inhabitants between 1997 and 2009.<sup>a</sup> A similar trend has been observed in towns with fewer than 50,000 inhabitants, where the incidence increased from 1.3 to 6.0 cases/100,000 inhabitants between 1997 and 2007.<sup>b</sup> The spread of HIV/AIDS infection in Northern Brazil is a recently identified public health problem. This spread is a cause for concern and a challenge because of social,

environmental, cultural, and economic factors that characterize this region and make the population particularly vulnerable on individual, social, and program levels.<sup>12</sup>

Various changes in the socioeconomic scenario have been observed in the region in recent decades. The opening of new agricultural frontiers for soybean production, extensive livestock raising, and the growth of the timber industry caused environmental changes and a significant migration flow to western Pará.<sup>7,19</sup> Highway BR-163 connects the city of Santarém to Cuiabá. In addition, the Tapajós and Amazon Rivers are important routes between Santarém, the cities located in Western Pará, and other cities in Northern Brazil. These routes are used for the circulation of goods and people

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<sup>a</sup> Boletim Epidemiológico AIDS/DST. Brasília (DF): Ministério da Saúde; 2013;2(1).

<sup>b</sup> Ministério da Saúde. Secretaria de Vigilância em Saúde. Departamento de DST, Aids e Hepatites Virais. Brasília (DF); [s.d.].

and contribute to the spread of infectious diseases within the Brazilian Amazon region.<sup>1</sup>

The influence of these factors in the spread of HIV/AIDS should be considered. The constant assessment of specialized health care centers that assist individuals living with HIV/AIDS may be useful for the planning of health care strategies. The identification of the reasons that have led users of the Brazilian Unified Health System (SUS) in the Santarém region to undergo HIV testing and identify the infection stage can help identify vulnerabilities and clinical status due to HIV infection in the region.

The present study aimed to analyze the clinical and laboratory characteristics of HIV-infected individuals upon admission to a reference health care center.

## METHODS

This cross-sectional study evaluated individuals with serologically confirmed diagnosis of HIV infection who were enrolled in an outpatient medical service at the *Centro de Testagem e Aconselhamento* (CTA – Testing and Counseling Center) in Santarém between January 1999 and December 2010. This period corresponded to the date of patient admission to the health care unit where the study was conducted.

Specialized health care to individuals living with HIV/AIDS began in Western Pará in 1998 with the implementation of a CTA nine years after the first official report of an AIDS case in the municipality of Santarém. This initiative started 10 years after the establishment of the first CTA in Southeastern Brazil.<sup>c</sup> Santarém's CTA offers testing and counseling services and, since its creation, has become a reference center for outpatient monitoring and treatment of individuals living with HIV/AIDS in the cities located in the Lower Amazon and Southwest Pará regions, which have an area of 722,358 km<sup>2</sup> and approximately one million inhabitants.<sup>d</sup> This unit offers several multidisciplinary services including pharmaceutical and psychological care and involves physicians and nurses.

Outpatient consultations, dispensing of antiretroviral drugs, sample collection for laboratory testing, epidemiological surveillance of HIV/AIDS infection, and application of immunobiological agents have been offered at the Santarém CTA since 1999. This CTA became a *Serviço de Assistência Especializada*

(SAE – Specialized Assistance Service) according to the guidelines proposed by the Brazilian Ministry of Health in 2008.<sup>e</sup>

This study included individuals with a serologically confirmed diagnosis of HIV infection, according to the criteria established by the Ministry of Health.<sup>f</sup> Patients transferred from other units, and those under 13 years infected with HIV were excluded.

The data were extracted from the medical records of the health care unit, which has a standardized form for recording information collected upon patient admission. Data on the patient status upon admission to the health care unit were systematically collected up to 90 days after enrollment.

The variables of interest in the study were as follows: reason for undergoing serological HIV testing, clinical stage of HIV infection according to the criteria established by the Centers for Disease Control in 2008,<sup>5</sup> count of peripheral CD4+ T lymphocytes, and period in which the subjects enrolled in the Santarém CTA/SAE.

The variable “reason for HIV testing” was classified on the basis of the participants' statement recorded in the medical history using the following mutually exclusive categories: presence of signs and symptoms suggestive of HIV/AIDS, asymptomatic patient with seropositive partner, occurrence of sexually transmitted disease, prenatal serological screening, perceived risk based on reports of suspected exposure to HIV, serological screening at a blood bank, child's serological diagnosis, or information not provided.

The variable “period enrolled in the service” was classified into three periods: 1999-2002, 2003-2006, and 2007-2010, and comprised groups P1, P2, and P3, respectively. These periods were operationally defined considering the programmatic changes in the health care units provided to individuals living with HIV/AIDS in the region. In this respect, the center at Santarém was restructured and became a reference center for the 25 municipalities during P1; novel diagnostic routines were implemented, including a rapid serological testing; two CTA were opened in neighboring municipalities containing the largest population in the region (Oriximiná and Itaituba) during P2 and in four other municipalities in Western Pará during P3.

The frequency of the variables “reason for HIV testing” and “clinical and laboratory status upon admission” and

<sup>c</sup> Ministério da Saúde. Programa Nacional DST e AIDS. Contribuição dos centros de testagens e aconselhamento para universalizar o diagnóstico e garantir a equidade no acesso aos serviços. Brasília (DF); 2008.

<sup>d</sup> Instituto Brasileiro de Geografia e Estatística. Censo demográfico 2010. Brasília (DF); 2010 [cited 2014 Feb 15]. Available from: <http://www.censo2010.ibge.gov.br/>

<sup>e</sup> Ministério da Saúde. Departamento Nacional DST/AIDS. Serviço de assistência especializada em HIV/Aids. Brasília (DF);[s.d.] [cited 2014 Feb 15]. Available from: [http://www.aids.gov.br/tipo\\_endereco/servico-de-assistencia-especializada-em-hiv/aids](http://www.aids.gov.br/tipo_endereco/servico-de-assistencia-especializada-em-hiv/aids)

<sup>f</sup> Ministério da Saúde. Programa Nacional DST e AIDS. Recomendações para terapia antirretroviral em adultos infectados pelo HIV. Brasília (DF); 2008.

the peripheral CD4+ lymphocyte count (dependent variables) were compared during P1, P2 and P3 (independent variables). The variable “reason for undergoing HIV testing” also was compared between the genders.

The variables were distributed using the Kolmogorov-Smirnov test. The Chi-square test was used to investigate the association between the reason for HIV testing and patient gender, and between the clinical stage of HIV and the enrollment period in the CTA in each of the periods studied. In cases where the Chi-square test results indicated differences between the groups, the association between the clinical stage and each evaluation period was investigated in the period 1999-2001. Logistic regression used odds ratios (OR) and their respective 95% confidence intervals. The CD4+ T lymphocyte counts were compared between each period evaluated using the Kruskal-Wallis test. A statistical significance level of 5% was adopted for all analyses.

The EpiData version 2.1 software was used to prepare the data and SPSS software version 15.0 was used for statistical analysis.

The study was approved by the Ethics Committee for Review of Research Projects (CAPPesq) at the *Hospital das Clínicas* of the *Faculdade de Medicina* of the *Universidade de São Paulo*. Obtaining terms of informed consent was not necessary because the study was based on review of medical records. Subject anonymity and information confidentiality were ensured.

## RESULTS

Between 1999 and 2010, 613 patients considered eligible for the study were enrolled in the Santarém CTA/SAE. Of these, 23 patients aged < 13 years at admission and 63 individuals who were transferred to

other health care units were excluded, leaving a total of 527 subjects.

The distribution of the participants according to the period of admission in the health care unit was as follows: 71 patients were assigned to P1 (1999-2002), 127 were assigned to P2 (2003-2006), and 329 were assigned to P3 (2007-2010).

The reason for undergoing HIV testing (Table 1) differed significantly between the genders ( $p < 0.002$ ). Although 57.6% of men and 48.3% of women underwent testing because of the presence of signs and symptoms suggestive of HIV/AIDS infection, 34.2% of women and 18.1% of men were tested because they had a partner who was seropositive for HIV. Testing during prenatal care was excluded from the comparative analysis between the genders because it exclusively applied to women. However, 30.5% of women discovered their seropositive status during prenatal care. This was the second most frequent reason for testing among women, surpassed only by the presence of signs suggestive of HIV/AIDS infection (33.3%).

Comparative analysis of the reason for undergoing HIV testing according to gender and period of enrollment in the service is presented in Table 2. The category “other reasons for testing” was taken as a reference for calculation, aggregating all the categories for this variable except “signs and symptoms suggestive of HIV/AIDS” and “prenatal screening”, which were intentionally excluded. A statistically significant difference was observed in P1 and P2; among men belonging to P1, this difference was observed in the predominance of tests conducted due to the presence of signs and symptoms suggestive of HIV infection. Meanwhile, women were tested because of “other reasons for testing” in 83.3% and 55.6% of the cases in P1 and P2, respectively. The reasons for HIV testing were similar between the

**Table 1.** Distribution of individuals living with HIV/AIDS by gender and reason for HIV testing upon admission to CTA/SAE. Santarém, PA, Northern Brazil, 1999-2010.

Reason for HIV testing <sup>a</sup>	Gender				Total		p
	Male		Female		n	%	
	n	%	n	%			
Signs and symptoms of HIV/AIDS infection	178	57.6	72	48.3	250	54.6	<b>0.002<sup>b</sup></b>
Asymptomatic with seropositive partner	56	18.1	51	34.2	107	23.4	
Perceived risk	41	13.3	13	8.7	54	11.8	
Other reasons <sup>c</sup>	34	11.0	13	8.7	47	10.3	

CTA/SAE: Testing and Counseling Center/Specialized Assistance Service

<sup>a</sup> The “prenatal screening” category was excluded from the analysis because it applied exclusively to women.

<sup>b</sup> Chi-square test.

<sup>c</sup> Occurrence of sexually transmitted disease; HIV seropositive status identified at a blood bank; child's serological diagnosis. Data were absent for three patients.

Values with statistical significance are shown in bold.

**Table 2.** Distribution of individuals living with HIV/AIDS enrolled in CTA/SAE, according to the reason for HIV testing, gender, and registration period. Santarém, PA, Northern Brazil, 1999-2010.

Registration period	Reason for HIV testing <sup>a</sup>	Gender				Total	p <sup>c</sup>
		Male		Female			
		n	%	n	%	n	
P1	Signs and symptoms suggesting HIV/AIDS infection	29	61.7	3	16.7	32	<b>0.003</b>
	Other reasons for testing <sup>b</sup>	18	38.3	15	83.3	33	
P2	Signs and symptoms suggesting HIV/AIDS infection	48	64.9	16	44.4	64	<b>0.044</b>
	Other reasons for testing <sup>b</sup>	26	35.1	20	55.6	46	
P3	Signs and symptoms suggesting HIV/AIDS infection	101	53.7	53	55.8	154	0.742
	Other reasons for testing <sup>b</sup>	87	46.3	42	44.2	129	

CTA/SAE: Testing and Counseling Center/Specialized Assistance Service. P1: 1999-2002

P2: 2003-2006

P3: 2007-2010

<sup>a</sup> The "prenatal screening" category was excluded from the analysis because it applied exclusively to women.

<sup>b</sup> Other reasons for testing: asymptomatic seropositive partner; perceived risk; other reasons.

<sup>c</sup> Chi-square test.

Data were absent for three patients.

Values with statistical significance are shown in bold.

genders in P3. However, the categories for this variable showed inverse order, so that women in P3 were tested because of the presence of signs and symptoms suggestive of HIV/AIDS infection in 55.8% of the cases.

When considering the entire study period, 52.0% of the individuals were classified as stage III at the time of admission to the unit as per CDC guideline, characterized by count of < 200 peripheral CD4+ T lymphocytes/mm<sup>3</sup> and/or the presence of at least one AIDS-defining disease.<sup>f</sup> CD4+ T lymphocytes were counted in the peripheral blood in 390 patients, with a median count of 306 cells/mm<sup>3</sup> (range between 3 and 1,665).

Table 3 shows the frequency distribution of each clinical stage according to the CDC classification of 2008 in the three periods studied. Differences in the clinical stages were observed in each period, with a

decrease of stage 1 and increase of stages 2 and 3 in P3, between 1999 and 2002 (Table 4).

The median number of peripheral CD4+ T cells at the time of admission to the unit in P1, P2, and P3 was 461, 357, and 261 cells/mm<sup>3</sup>, respectively. There was a significant difference between each period ( $p < 0.001$ ) (Figure 1): the medians in P1 were higher than those in P3 ( $p < 0.001$ ), and the median in P2 was higher than that in P3 ( $p = 0.0037$ ).

## DISCUSSION

The increase in the number of individuals enrolled in the Santarém CTA/SAE in the study period confirms national epidemiological data related to the growth of the epidemic in the Northern region.<sup>15,17</sup> Grangeiro et al<sup>10</sup> (2011) stated that programmatic interventions such as the opening of CTA, development of

**Table 3.** Distribution of individuals living with HIV/AIDS enrolled in CTA/SAE, according to the clinical stage of HIV infection and enrollment period. Santarém, PA, Northern Brazil, 1999-2010.

Clinical stage of HIV	Enrollment period						Total		p*
	P1		P2		P3		n	%	
	n	%	n	%	n	%			
Stage 1	24	36.4	33	28.7	65	21.2	122	25.1	<b>0.008</b>
Stage 2	13	19.7	16	13.9	83	27.1	112	23.0	
Stage 3	29	43.9	66	57.4	158	51.6	253	52.0	

CTA/SAE: Testing and Counseling Center/Specialized Assistance Service

P1: 1999-2002

P2: 2003-2006

P3: 2007-2010

\* Result of Chi-square test.

Values with statistical significance are shown in bold.

**Table 4.** Comparative analysis between the periods of enrollment and the clinical stage in individuals living with HIV/AIDS enrolled in CTA/SAE. Santarém, PA, Northern Brazil, 1999-2010.

Registration period	Clinical stage	OR	95%CI	p*
P2	1	1		
	2	0.90	0.36;2.20	0.810
	3	1.66	0.84;3.28	0.148
P3	1	1		
	2	2.36	1.11;4.99	<b>0.025</b>
	3	2.01	1.09;3.71	<b>0.025</b>

CTA/SAE: Testing and Counseling Center/Specialized Assistance Service

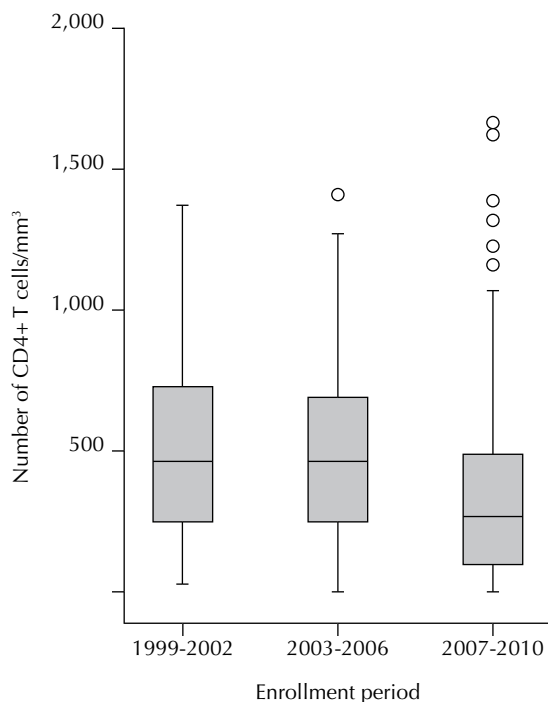
P2: 2002-2006

P3: 2007-2010

\* Logistic regression.

P2 (1999-2002) was adopted as a reference.

Values with statistical significance are shown in bold.



CTA/SAE: Testing and Counseling Center/Specialized Assistance Service

\* Kruskal-Wallis ( $p < 0.001$ ).

**Figure 1.** Box plot of the median count of peripheral TCD4+ lymphocytes according to enrollment periods of individuals living with HIV/AIDS admitted to CTA/SAE. Santarém, PA, Northern Brazil, 1999-2010.

the rapid HIV test, and changes in program management involving the decentralization of health care activities contributed to the increased reporting of cases in Northern Brazil. The mean incidence of AIDS was 25 cases/100,000 inhabitants in cities with CTA, compared with 17.5 cases/100,000 in other cities.<sup>8</sup> Of the 25 municipalities in the region in which Santarém

is a reference health care center for people living with HIV/AIDS, seven had CTA within their borders by 2011, four of which opened between 2007 and 2010.

Few studies have assessed the reasons that have led SUS users to undergo serological testing for HIV.<sup>2,9</sup> The acknowledgment of an individual's serological status has a direct impact on prognosis and on the sexual partners' vulnerability to virus acquisition. This study showed that the most frequent reason for testing among men and women in health care units in Santarém was the presentation of signs and symptoms suggestive of HIV/AIDS infection. Other reasons for testing that could lead to earlier access to diagnosis were also investigated and were described independently for both genders. The increased frequency of testing in asymptomatic women with a seropositive partner indicates gender inequalities in the study population and reveals conditions of greater vulnerability among the women assisted in these units. Gender differences associated with the reasons for HIV testing were also found in a cohort of patients monitored in Sao Paulo, SP, Southeastern Brazil. Braga et al<sup>2</sup> (2007) analyzed 1,229 patients between 1998 and 2002 and noted that 43.0% of men underwent testing because of the presence of signs and symptoms of HIV/AIDS whereas 36.0% of women were tested because they had an HIV-positive partner. Gender inequalities in health care services in regions with distinct social and programmatic characteristics, such as Sao Paulo and Amazonia, suggest that women's vulnerability to HIV is associated with the way they relate to their partners, their role in society, and how programmatic responses are prepared to confront the issues that affect their health.<sup>12</sup> Pascom et al<sup>13</sup> (2011) investigated sexual behavior in a sample of 8,000 men and women in all regions of Brazil and observed a lower frequency of sexual activity among women, fewer casual partners, and less frequent condom use compared with men.

For women in the sexually active age group, prenatal serological HIV testing represented an opportunity to identify their serological status in the early stages of infection. However, prenatal HIV testing is comparatively less frequent in the region studied compared with other Brazilian regions. The Northern region has the worst HIV testing coverage: 55.0% of pregnant women do not have access to prenatal HIV testing, according to 2006 data.<sup>18</sup> This finding is reinforced by studies that have found the highest proportional rates of maternal-fetal HIV transmission in Northern Brazil<sup>4,16</sup> and indicates the lower efficiency of prenatal and perinatal care for women in this region.

This study allowed the comparison of reasons for HIV testing upon admission to the health care unit over a 12-year period and found gender differences. The identification of HIV status in women in P1 and P2 was dependent on the HIV infection status of their partners, who in turn most often presented with signs and symptoms related to HIV/AIDS in the three periods. In P3, women identified their HIV status mainly because of the presence of signs and symptoms of HIV/AIDS. Therefore, HIV/AIDS infection may have been present for longer in men compared with women, and this would explain why women exhibited the disease primarily in P3.

Programmatic interventions have a greater scope in Western Pará and were characterized by the decentralization of diagnostic HIV testing and opening of four new CTA in P2 and P3, respectively. Nevertheless, more than 50.0% of the registered individuals learned their HIV status in a late stage in the comparative temporal analysis. The increase in HIV testing in the region between 1999 and 2010 was not limited to Santarém but spread to other locations where CTA were opened. Many patients have limited geographical access to reference health care units, which would justify the diagnosis of infection in more advanced stages of the disease. Late diagnosis of infection in the study population is consistent with the increased mortality rate due to AIDS in Northern Brazil.<sup>6,19</sup>

These results are similar to those found in other cities in the Northern region. Silva et al<sup>15</sup> (2009) evaluated 1,400 patients admitted with HIV/AIDS in Manaus, AM, Northern Brazil, between 1986 and 2000; of these, 50.8% had late diagnosis, with increased frequency of subjects admitted at later stages of the disease. Approximately 40.0% of HIV-positive individuals were admitted to reference health care units located in *favela* communities in Rio de Janeiro, RJ, Southeastern Brazil,

in late stages.<sup>14</sup> At an outpatient clinic in central Sao Paulo, 52.0% of seropositive individuals were found to have at least one opportunistic AIDS-defining disease prior to admission.<sup>2</sup> Late diagnosis of HIV/AIDS infection does not seem to be exclusive to Brazilian services: the median CD4+ T lymphocyte count upon admission to reference health care units in a multicenter study in the United States was between 167 and 175 cells/mm<sup>3</sup>.<sup>11</sup>

Clinical data were obtained from medical records, which could have limited the internal validity of this study. However, the records analyzed had a standardized form for data collection upon patient's admission. Consequently, potential information bias may have been minimized. We chose to analyze the clinical stages and the median CD4+ T lymphocyte count separately because the latter variable exclusively included laboratory data that were ignored for a significant number of individuals (137). Although this strategy is standard procedure according to Ministry of Health norms, the limitations of laboratory infrastructure in the region limited the access to the procedure between 1999 and 2006 (P1 and P2). The assessment of the clinical stage by evaluation of the clinical status of the patient upon admission allowed more subjects to be included in the analysis, considering that the data from 40 patients had been ignored. Only patients living with HIV/AIDS who had access to the specialized unit in the region were evaluated. The clinical and laboratory characteristics of these individuals may differ from other subjects who did not have access to HIV testing or to the Santarém CTA/SAE for various reasons, although they resided in the same region.

Programmatic interventions such as the opening of CTA, provision of rapid diagnostic testing, decentralization of activities, and transfer of funds to municipalities, may have increased the access to serological diagnosis of infection in the period evaluated. Consequently, these interventions may have increased the demand for care in reference health care units in Western Pará. Therefore, future second-generation epidemiological surveillance studies should be conducted to assess the impact of these interventions and identify the groups most vulnerable to HIV infection in the region, in terms of viral acquisition and risk of developing AIDS. This could help establish effective strategies for the early diagnosis, and these strategies should be implemented to improve the quality of life of people living with HIV/AIDS, reduce mortality associated with AIDS, and reduce the transmission of HIV.

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