

HIV-1 incidence among people seeking voluntary counseling and testing centers, including pregnant women, in Pernambuco State, Northeast Brazil

Incidência do HIV-1 em pessoas atendidas, incluindo gestantes, em um Centro de Testagem e Aconselhamento em Pernambuco, Nordeste do Brasil

Incidencia del VIH-1 en personas atendidas, incluidas las mujeres embarazadas, en un centro de pruebas y asesoramiento en Pernambuco, Noreste de Brasil

Kledoaldo Oliveira de Lima ¹
 Daniela Medeiros Salustiano ²
 Ana Maria Salustiano Cavalcanti ²
 Élcio de Souza Leal ³
 Heloísa Ramos Lacerda ¹

Abstract

The HIV-1 epidemic in Brazil has displayed new characteristics over time, with an increase in heterosexual transmission and a decline in the male-to-female ratio in AIDS cases. HIV screening was offered to patients attending the Voluntary Counseling and Testing Center in Paulista, Greater Metropolitan Recife, Pernambuco State, in Northeast Brazil, to determine HIV-1 incidence. BED capture enzyme immunoassay (BED-CEIA) was used to measure HIV-1 incidence, comparing it to the AxSYM avidity index method (Ax-AI). From 2006 to 2009, 14,014 individuals were tested, and only 18 pregnant women were diagnosed with HIV infection, resulting in 0.15% annual incidence (95%CI: 0-0.33), significantly lower than in men (1.03; 95%CI: 0.45-1.61) and non-pregnant women (0.50; 95%CI: 0.11-0.89). Despite the low HIV-1 incidence in pregnant women, the high rate of recent infection detected during prenatal care emphasizes the need to increase measures to prevent vertical transmission.

*HIV-1; Incidence; Infectious Disease
 Vertical Transmission*

Resumo

No Brasil, a epidemia do HIV-1 adquiriu novas características ao longo do tempo, como o aumento da transmissão heterossexual e um declínio da razão homens:mulheres em casos de AIDS. Foi oferecida triagem para a infecção pelo HIV a todos os pacientes atendidos no Centro de Testagem e Aconselhamento da cidade de Paulista, Região Metropolitana de Recife, Pernambuco, Nordeste do Brasil, com o objetivo de determinar a incidência do HIV-1. Foi usado o ensaio imunoenzimático de captura BED (BED-CEIA) para determinar a incidência do HIV-1, comparando-o com o método de índice de avididade AxSYM (Ax-AI). No período analisado, 2006-2009, 14.014 pessoas foram testadas, e apenas 18 gestantes foram diagnosticadas para a infecção por HIV, resultando em uma incidência de 0,15% ao ano (IC95%: 0,00-0,33), significativamente menor do que os homens (1,03; IC95%: 0,45-1,61) e mulheres não-grávidas (0,50; IC95%: 0,11-0,89). Apesar da baixa incidência de HIV-1 entre as mulheres grávidas, a alta taxa de infecção recente reforça cuidados no pré-natal para esta infecção, para evitar a transmissão vertical.

*HIV; Incidência; Transmissão Vertical de
 Doença Infecçiosa*

¹ Universidade Federal de Pernambuco, Recife, Brasil.

² Laboratório Central de Saúde Pública, Recife, Brasil.

³ Instituto de Ciências Biológicas, Universidade Federal do Pará, Belém, Brasil.

Correspondence

K. O. Lima

Rua Dr. Vicente Gomes 180, apto. 403, Recife, PE 51030-290, Brasil.
 kledoaldo@gmail.com

Estimates of HIV incidence rates are important for evaluating the epidemic's dynamics, targeting the implementation of appropriate preventive measures, monitoring intervention strategies and highlighting the impact of the virus infectivity and its transmission¹. According to the Brazilian Ministry of Health², most cases of HIV-positive pregnant women were reported in the Southeast (43%) and South regions (32%), followed by the Northeast region (14%). An important point for the evaluation of HIV-positive pregnant women is the possibility of mother-to-child transmission³.

Surveillance of the epidemic through the counting of AIDS cases does not reflect the current epidemic dynamics. For this reason, we decided to apply for the first time in the Northeast of Brazil a methodology that uses laboratory assays for the identification of a period of recent seroconversion and estimates HIV-1 incidence, known as RITA (Recent Infection Testing Algorithm)⁴.

The study aimed to determine HIV-1 incidence through immunoassays among individuals attending at the Voluntary Counseling and Testing Center (VCT) in Paulista, city in the Metropolitan Region of Recife, Pernambuco State, Northeast Brazil, in the period from 2006 to 2009. The VCT treated a total of 14,014 individuals, including 5,949 pregnant women, 4,418 non-pregnant females and 4,092 male individuals in that period. Patients arrived at the VCT as a result of being sent by Primary Healthcare Units or through spontaneous demand.

HIV-1 diagnosis was performed according to the guidelines of the Brazilian Ministry of Health. To exclude the possibility of false recent infection results, the following were excluded: individuals who had previously used antiretroviral therapy (ART), those who reported mother-to-child transmission, and those with previous HIV-1 diagnosis detected more than six months from the date of collection of the research sample. These aspects were evaluated by observing the registration of individuals in HIV/AIDS healthcare programs or at medical records of the Central Public Health Laboratory of Pernambuco. Demographic characteristics data were retrieved from medical records at the VCT-Paulista.

A BED-capture enzyme immunoassay (BED-CEIA) was used for HIV-1 incidence (Calyptra Biomedical Corporation, Portland, USA)⁵. Incidence calculations and 95% confidence intervals were performed with the spreadsheet provided by the South African Centre for Epidemiological Modeling and Analysis (SACEMA; <http://www.incidence-estimation.com/page/tools-for-incidence-from-biomarkers-for-recent-infection>)⁶.

The incidence rate was estimated as 100 people per year and presented as a percentage. In addition, samples were tested for another recent HIV infection assay, the Avidity Index AxSYM method (Ax-AI), performed as described previously⁷. All samples were stored at minus 70°C. We examined associations between groups using the Pearson's chi-square test and kappa test to evaluate the degree of agreement between diagnostic assays. The study was approved by the Ethics Research Committee of Agamenon Magalhães Hospital, under registry number 429/2009, in accordance with Brazilian norms for research involving human subjects.

A total of 14,014 individuals were tested serologically for HIV-1, most of whom were women ($n = 9,912$; 70.8%), and pregnant women comprised a total of 5,494 persons. In this study, 167 were diagnosed with HIV-1, among whom sociodemographic and behavioral characteristics were obtained for 159 of them (Table 1). Most HIV-positive individuals were male (54.1%) and heterosexual (78.6%).

We observed a prevalence of 1.18% (95%CI: 1.01-1.37) and incidence of 0.50% per year (95%CI: 0.27-0.73) (Table 2). The prevalence for HIV-1 infection in pregnant women (0.33%; 95%CI: 0.19-0.52) was significantly lower than that observed in men (2.25%; 95%CI: 1.82-2.75) and non-pregnant women (1.29%; 95%CI: 0.98-1.67; $p < 0.000001$). Although the rate of recent infection was around 20% in all study groups, pregnant women had lower incidence rates (0.15% per year; 95%CI: 0.00-0.33) than non-pregnant women (0.50% per year; 95%CI: 0.11-0.89; $p = 0.0015$) and men (1.03% per year; 95% CI: 0.45-1.61, $p < 0.000001$). There are few HIV incidence estimates by serological methods in Brazil; however, it has been demonstrated that in the South and Southeast of the country there are usually higher rates, such as 2.86% (95%CI: 1.04-4.68) in the South⁸ and between 1.2-2.7% for men and 0.6-1.2% for women in the Southeast^{9,10}. We should emphasize that we did not have enough data to determine HIV-1 incidence and prevalence among men who have sex with men (MSM), and as demonstrated by Merçon et al.¹⁰, in Rio de Janeiro, the incidence in this group was five times higher than in heterosexual men, supposing that the presence of MSM may have inflated HIV-1 incidence and prevalence estimates among males.

We tested samples with Ax-AI assay for comparison with BED-CEIA. A higher correlation between the tests was observed in the group of pregnant women (kappa = 0.82), in which only 01/18 samples showed different results. The group of non-pregnant women showed a greater

Table 1

Epidemiological characteristics of individuals diagnosed with HIV infection in one Voluntary and Counseling Testing Center. Metropolitan Region of Recife, Pernambuco State, Northeast Brazil.

Variables	HIV+ individuals (N = 159)	
	n	%
Gender (n = 159)		
Female	73	45.9
Male	86	54.1
Pregnancy (n = 71)		
Yes	18	25.4
No	53	74.6
Age [mean (SE)] (n = 159)	32.4 (10.3)	
Exposure category (n = 179) *		
Bisexual	8	4.5
Heterosexual	125	69.8
MSM	26	14.5
HIV partner	20	11.2
Education (years) (n = 157)		
≤ 8	78	49.7
> 8	79	50.3

ES: standard error; MSM: men who have sex with men.

* Categories can be cumulative.

Table 2

Prevalence, recent infections and HIV-1 incidence estimated at Voluntary and Counseling Testing Center. Metropolitan Region of Recife, Pernambuco State, Northeast Brazil.

Gender	Total *	HIV infected	Prevalence % (95%CI)	Tested samples ** n (%)	Recent infection *** n (%)	Incidence (95%CI) #
Male	4,092	92	2.25 (1.82-2.75)	87 (94.6)	20 (23.0)	1.03 (0.45-1.61)
Female						
Non-pregnant	4,418	57	1.29 (0.98-1.67)	54 (94.8)	11 (20.4)	0.50 (0.11-0.89)
Pregnant	5,494	18	0.33 (0.19-0.52)	18 (100.0)	4 (22.2)	0.15 (0.00-0.33)
Total	14,014	167	1.18 (1.01-1.37)	159 (95.2)	35 (22.0)	0.50 (0.27-0.73)

95%CI: 95% confidence interval.

* Total number of patients tested for HIV-1 serologic diagnosis;

** Total number of available aliquots among the total number of HIV-positive samples eligible for BED-CEIA testing;

*** Proportion of recent infections among total samples tested using BED-CEIA;

Calculated in accordance with Kassanjee et al. 6.

divergence between tests ($\kappa = 0.43$), while for males a κ of 0.69 was obtained.

One advantage of this work is data from two different methodologies for detection of recent HIV infection, the BED-CEIA and Ax-AI. These assays differ in the kinds of antigens and techniques, which increase the specificity for detect-

ing recent infections. We demonstrate an excellent correlation between the results of the BED-CEIA and Ax-AI among pregnant women, therefore the changes in response to anti-HIV antibodies occurring during pregnancy are not sufficient to interfere with the results of these assays 11. Although serological assays have reasonable sen-

sitivity to detect recent HIV infections, one disadvantage of the study is the absence of other laboratory markers for more accurate incidence estimates, such as the CD4+ T lymphocyte count, HIV-RNA detection and quantification of viral load, as well as data on the time interval between the last negative and the first positive HIV serological assay at multi-tested patients.

This is the first study reporting the HIV-1 incidence among pregnant women using a serological strategy in Northeast Brazil. We found an incidence rate of 0.15% per year in pregnant women, very similar to that determined in São Paulo (0.2% per year)¹². Higher incidence estimates were observed in Rio de Janeiro (0.41%; 95%CI: 0.11-0.72) and Rio Grande do Sul (1.93%; 95%CI: 0.88-2.97)¹. A HIV-1 incidence estimate of 0.61 per 1,000 persons-years was found in Central Brazil, smaller than our estimates¹³.

HIV-1 prevalence was significantly higher among males. Although the HIV epidemic is

concentrated in MSM in the Recife metropolitan area¹⁴, there is an increase in the rate of HIV infection in pregnant women since 2000². An appropriate preventive or health intervention must be implemented to prevent the spread of the virus among pregnant women and their partners.

Paulista is part of the metropolitan region of Recife. Its proximity (17km) to the state capital, Recife, means there are significant population flows between the two cities. Data from incidence by serologic methods have been recommended for epidemiological studies because they provide real observations about the current epidemic. Our data demonstrate the large difference between the HIV-1 prevalence and incidence rates in different populations and the importance of serological testing for HIV during antenatal care, where we see a high rate of recent infection, so we assume that a significant proportion of pregnant women were infected at a time close to or during pregnancy.

Resumen

En Brasil, epidemia del VIH-1 adquiere nuevas características con tiempo, como el aumento de la transmisión heterosexual y disminución de la razón hombres:mujeres en los casos de SIDA. La detección de infección por VIH se ofrece a todos los pacientes que acuden al Centro de Asesoramiento y Pruebas (CTA) en la ciudad de Paulista, área metropolitana de Recife, nordeste - Brasil, con objetivo de determinar la incidencia del VIH-1. BED inmunoensayo enzimático de captura (BED-CEIA) se utilizó para determinar la incidencia de VIH-1, comparándolo con el método del índice de avidéz AxSYM (AX AI). En el período de 2006-2009, 14.014 personas se pusieron a prueba, 18 mujeres embarazadas fueron diagnosticadas con infección por VIH, com incidencia de 0.15% anual (IC95%: 0-0.33), inferior a los hombres (1.03; IC95%: 0.45-1.61) y las mujeres no embarazadas (0.50; IC95%: 0.11-0.89). A pesar de la baja incidencia de VIH-1 en las mujeres embarazadas, alta tasa de infección reciente aumenta en la atención prenatal para esta infección para prevenir la transmisión vertical.

VIH; Incidencia; Transmisión Vertical de Enfermedad Infecciosa

Contributors

K. O. Lima, D. M. Salustiano and H. R. Lacerda contributed to the design, data collection, analysis, interpretation and drafting of this paper. A. M. S. Cavalcanti and E. S. Leal contributed to the drafting and critical review.

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