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High prevalence and incidence of human immunodeficiency virus 1 among men who have sex with men at the voluntary counselling and testing center in Northeast Brazil

Alta prevalência e incidência do Vírus da Imunodeficiência Humana tipo 1 entre homens que fazem sexo com homens em um Centro de Testagem e Aconselhamento no Nordeste do Brasil

Alta prevalencia e incidencia del Virus de Inmunodeficiencia Humana tipo 1 entre hombres que tienen sexo con hombres en un Centro de Pruebas y Asesoramiento en el Noreste de Brasil

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Abstract
The human immunodeficiency virus (HIV) Brazil epidemic had shown an increase in heterosexual transmission and decrease in vertical transmission. However, its incidence has increased among men who have sex with men. Serological screening of patients at a voluntary counselling and testing center in Cabo de Santo Agostinho city, Pernambuco province, Northeast Brazil, was performed to determine the HIV-1 prevalence and incidence. The HIV-1 incidence in the frozen serum aliquots obtained from 2006-2009 was determined using BED-capture enzyme immunoassay. This study evaluated 23,862 individuals, who were serologically tested for HIV-1. HIV-1 infection was diagnosed in 318 individuals (1.33%). MSM showed a higher prevalence of infection (6.8%; 95% confidence interval [CI]: 4.9-9.5) as compared to heterosexual men (2.8%; 95% CI: 2.35-3.36) and women (0.9%; 95% CI: 0.76-1.0) ($p < 0.0001$). MSM also showed a higher rate of incidence with 3.93 per 100 people/year. Early diagnosis and preventive measures can reduce the pandemic spread.
Keywords: Incidence; HIV-1; Recent infection; Epidemiology; MSM.

Resumo
A epidemia do vírus da imunodeficiência humana (HIV) no Brasil havia revelado um aumento na transmissão heterossexual e diminuição na transmissão vertical. Entretanto, sua incidência aumentou entre homens que fazem sexo com homens. Foi realizada triagem sorológica de pacientes em um centro de testagem e aconselhamento, na cidade de Cabo de Santo Agostinho, Pernambuco, Nordeste do Brasil, para determinar a prevalência e incidência do HIV-1. A incidência de HIV-1, nas alíquotas de soro congelado obtidas de 2006-2009, foi determinada usando ensaio imunoenzimático de captura BED. Este estudo avaliou 23.862 indivíduos, os quais foram serologicamente testados para o HIV-1. A infecção pelo HIV-1 foi diagnosticada em 318 indivíduos (1,33%). HSH demonstraram uma maior prevalência da infecção (6,8%; IC95%: 4.9-9.5) quando comparados aos homens heterossexuais (2,8%; IC95%: 2.35-

3.36) e mulheres (0.9%; IC95%: 0.76-1.0) (p < 0.0001). HSH também mostraram uma maior taxa de incidência com 3.93 por 100 pessoas/ano. O diagnóstico precoce e as medidas preventivas podem reduzir a propagação da pandemia.
Palavras-chave: Incidência; HIV-1; Infecção recente; Epidemiologia; HSH.

Resumen
La epidemia del virus de la inmunodeficiencia humana (VIH) en Brasil había revelado un aumento de la transmisión heterosexual y una disminución de la transmisión vertical. Sin embargo, su incidencia ha aumentado entre los hombres que tienen sexo con hombres. Se realizó un cribado serológico de los pacientes en un centro de pruebas y asesoramiento en la ciudad de Cabo de Santo Agostinho, Pernambuco, noreste de Brasil, para determinar la prevalencia e incidencia del VIH-1. La incidencia de VIH-1 en las alícuotas de suero congelado obtenidas entre 2006 y 2009 se determinó mediante un inmunoensayo enzimático de captura BED. Este estudio evaluó a 23,862 personas, que fueron sometidas a pruebas serológicas para VIH-1. La infección por VIH-1 se diagnosticó en 318 personas (1,33%). Los HSH demostraron una mayor prevalencia de infección (6,8%; IC del 95%: 4,9-9,5) en comparación con los hombres heterosexuales (2,8%; IC del 95%: 2,35-3,36) y las mujeres (0,9%; IC del 95%: 0,76-1,0) (p <0,0001). Los HSH también mostraron una tasa de incidencia más alta con 3,93 por 100 personas-año. El diagnóstico temprano y las medidas preventivas pueden reducir la propagación de la pandemia.
Palabras clave: Incidencia; HIV-1; Infección reciente; Epidemiología; HSH.

1. Introduction

The human immunodeficiency virus (HIV) pandemic continues to spread, with approximately 37.9 million people infected with HIV worldwide (Statistics, 2020). Since 1980 to June 2019, 966,058 cases of acquired immunodeficiency syndrome (AIDS) were identified in Brazil. Annually, the country has registered an average of 39,000 new AIDS cases in the last 5 years, and the majority of the cases (65.6%) occurred in men. From 2002 to 2009, the sex ratio (male:female) of AIDS cases remained at 1:5; however, as of 2010, there has been a gradual reduction in the number of AIDS cases in women and an increase in cases in men (HIV/AIDS Epidemiological Bulletin, 2019). New approaches, such as the Recent Infection Testing Algorithm (RITA), have been developed to help identify individuals newly infected with HIV (Robinson et al., 2019).

According to the Ministry of Health of Brazil, there has been a drop in the incidence of AIDS cases in the country since 2011 at 17.8 cases/100,000 inhabitants (HIV/AIDS Epidemiological Bulletin, 2019). On the other hand, from 2007 to 2019, more than 300,000 cases of HIV were diagnosed, and the majority of which were detected in the Southeast (45.6%), South (20.1%), and Northeast (18.3%) regions. In Brazil, RITA is not routinely applied in the epidemiological surveillance of cases of HIV-1 infection. However, some studies have been conducted, such as one by Szwarcwald et al. (2013) that reported recent infection rates of 13.1% and 10.5% in Recife and Curitiba, respectively. De Castro et al. (2010) detected an incidence of 1.68%/year of HIV-1 infection in individuals visiting the voluntary testing and counselling centre (VTC) in Rio de Janeiro. This incidence was higher in men who have sex with men (MSM) than in heterosexuals. Lima et al. (2015) demonstrated an HIV-1 incidence of 0.15%/year in pregnant women, 1.03%/year in men, and 0.50%/year in non-pregnant women in Pernambuco.

Although it is not an epidemiological routine in Brazil, RITA is an important tool with vast benefits such as identifying populations most vulnerable to infection, monitoring prevention programs and assessing the behaviour of the epidemic in real-time. Additionally, it can clinically benefit individuals, because the early detection of infection favours the prognosis and treatment (Girardi et al., 2012). Based on the clinical and epidemiological importance of RITA, this study aimed to determine the rate of recent infection and incidence of HIV-1 in individuals at the VCT in the city of Cabo de Santo Agostinho, Pernambuco, Northeast Brazil.

2. Methodology

This cross-sectional study used frozen serum samples from patients diagnosed with HIV-1 infection at the VCT of Cabo de Santo Agostinho, Pernambuco (Northeast, Brazil) to determine the annual incidence of this infection from January

2006 to December 2009. The diagnosis of HIV-1 was based on the guidelines of the Ministry of Health of Brazil. To avoid the possibility of false recent infection results, we excluded individuals who had previously undergone antiretroviral therapy, those who reported mother-to-child transmission, and those with a previous diagnosis of HIV-1 that was detected more than 6 months from the date of collection of the research sample. The samples originated from serum repositories of HIV-positive patients at the VCT under analysis. The researchers did not use any additional data, neither did they gather any new samples. There was, therefore, no direct contact with the patients, nor was any information used that would allow identification of the individuals in this study, thereby ensuring anonymity. The present study was approved by the Ethics in Research Committee of Agamenon Magalhães Hospital, State Health Department of Pernambuco, under registry number: 429/2009, following Brazilian norms for research involving human subjects.

3. Results and Discussion

In total, 318 patients were diagnosed with HIV-1 infection, and 217 serum aliquots were obtained to perform the enzyme capture immunoassay (BED-CEIA) (Calypte Biomedical Corporation, Portland, USA) according to the manufacturer's recommendations (Dobbs et al., 2004). The BED-CEIA assay was performed to determine the number of recent infections, as well as estimate the annual incidence HIV-1 in heterosexuals (both males and females) and men who have sex with men (MSM) at the study site. The incidence of HIV-1 was calculated according to the criteria of the US Centers for Disease and Control Prevention (Lima et al., 2012) adjusted for the sensitivity and specificity factors of the test (McDougal et al., 2004).

This study evaluated 23,862 individuals, who were serologically tested for HIV-1. Majority of them were women (n = 19,265, 80.7%), while men and MSM corresponded to 17.3% and 2%, respectively, as shown in table 1. HIV-1 infection was diagnosed in 318 individuals (1.33%). MSM showed a higher prevalence of infection (6.8%; 95% confidence interval [CI]: 4.9-9.5) as compared to heterosexual men (2.8%; 95% CI: 2.35-3.36) and women (0.9%; 95% CI: 0.76-1.0) ($p < 0.0001$). In contrast, the rate of recent HIV-1 infection was higher among women (38.5%) as compared to heterosexual men (23.4%) ($p = 0.02$), but the same statistical correlation was not evident in MSM (27.3%) ($p = 0.35$), according to table 1. Moreover, MSM showed a higher rate of incidence in every 100 people/year (Robinson et al., 2019).

Table 1 - Frequency of prevalence, recent infection, and incidence of human immunodeficiency virus-1 at a Voluntary Counselling and Testing Centre in Pernambuco, Northeast – Brazil.

Genre	Total*	HIV positive	Prevalence % (95% CI)	BED-CEIA tested samples n (%) **	Recent infection n (%) ***	Incidence (95% CI)
Heterosexual men	4128	116	2.8 (2.35-3.36)	71 (61.2)	17 (23.4)	1.33 (0.84-1.3)
Women	19265	170	0.9 (0.76-1.0)	117 (68.8)	45 (38.5)	0.74 (0.56-0.51)
MSM	469	32	6.8 (4.9-9.5)	11 (34.4)	3 (27.3)	3.93 (1.32-6.54)

Legend: HIV: Human immunodeficiency virus; CI: Confidence interval; BED-CEIA: BED-capture enzyme immunoassay; MSM: Men who have sex with men
* Total patients tested for HIV-1 serological diagnosis
** Total rate of positive samples among those eligible for BED-CEIA testing
*** Proportion of recent infections among the total samples tested for BED-CEIA
Source: Authors.

The highest incidence of HIV-1 reported in MSM in the studied population and shown in the table above corroborates with data from the Ministry of Health of Brazil (HIV/AIDS Epidemiological Bulletin, 2019). This reveals an increase in the prevalence of AIDS cases in this category of sexual exposure in the last 10 years. On the other hand, the higher frequency of

recent HIV-1 infections in women reveals that this group is more susceptible to HIV-1 infection diagnoses in the first 6 months of infection since the BED-CEIA determines recent HIV-1 infection in this period. However, it is known that early diagnosis is essential for better treatment prognosis, and as a prophylactic measure to curb the virus spread with pharmacological and non-pharmacological strategies. Other Brazilian studies have also shown that MSM presents higher HIV-1 incidence rates, as observed in Recife (1.47%), Curitiba (0.92%) (Szwarcwald et al., 2016), and Rio de Janeiro (8.5-11.9%) (de Castro et al. ,2010). Although our work presented the methodological limitation of lower male representation, both heterosexual and MSM, it is one of the few studies conducted outside the Southeast region of the country.

4. Conclusion

It is worth noting that Brazil is experiencing a 'second wave' of the HIV-1 epidemic (Mangal et al., 2019); hence, for future research and work, we emphasize the importance of early diagnosis of HIV, as well as the implementation of preventive measures and adequate clinical management in order to reduce the spread of the pandemic. Therefore, methods determining the incidence of HIV-1, especially in the most affected population groups, are extremely useful for that reduction.

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