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Missed opportunities for HIV diagnosis among incarcerated people in the Federal District, Brasilia, Brazil

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Abstract:

Objective. Evaluate the pattern of contact with the healthcare system, including prison health facilities, and HIV testing. **Method.** This was a quantitative case-control study of HIV infected and uninfected incarcerated people serving time in 2019 in the Federal District, matched by age. **Results.** There was no difference in the pattern of contact with the healthcare system or the pattern of testing between HIV-infected and uninfected incarcerated people. Most of the infected patients were diagnosed in the prison environment and had early

infections, demonstrating the effectiveness of screening in this scenario.

Conclusion: The pattern of contact with the healthcare system among the individuals in this study probably reflects that of young men in general, i.e., less contact with primary care outpatient services and trauma as the main reason for contact in emergency departments.

Keywords: Prisons; prisoners; HIV infections; HIV screening; missed opportunities; inmates.

Resumo:

Objetivo. O estudo avaliou o padrão de contato com o sistema de saúde e de testagem para HIV, incluindo as unidades de saúde prisionais.

Métodos. Trata-se de estudo quantitativo de caso-controle em detentos que cumpriam pena em 2019 no Distrito Federal, pareados por idade. **Resultados.** Não houve diferença no padrão de contato com o sistema de saúde e padrão de oferta de testagem entre detentos infectados ou não com HIV. A maior parte dos infectados teve o diagnóstico realizado no ambiente prisional e de maneira precoce, evidenciando efetividade do rastreamento nesse cenário.

Conclusão. O padrão de contato com o sistema de saúde dos indivíduos neste estudo reflete provavelmente o de homens jovens como um todo: pouco contato com serviços ambulatoriais de atenção primária e trauma como principal motivo de contato, em prontos-socorros.

Palavras-chave: Prisões; Prisioneiros; Infecções pelo HIV; Rastreamento do HIV; Oportunidades perdidas

RESUMEN

Objetivo. Evaluar el patrón de contacto con el sistema sanitario, incluidos los centros sanitarios penitenciarios, y las pruebas del VIH. **Método.** Estudio cuantitativo de casos y controles de personas infectadas y no infectadas por el VIH que cumplían condena en 2019 en el Distrito Federal, emparejadas por edad. **Resultados.** No hubo diferencias en el patrón de contacto con el sistema de salud ni en el patrón de realización de pruebas entre personas encarceladas

infectadas y no infectadas por VIH. La mayoría de los pacientes infectados fueron diagnosticados en el medio penitenciario y presentaron infecciones precoces, lo que demuestra la eficacia del cribado en este escenario. **Conclusiones.** El patrón de contacto con el sistema sanitario entre los individuos de este estudio probablemente refleja el de los hombres jóvenes en general, es decir, menor contacto con los servicios ambulatorios de atención primaria y traumatismos como principal motivo de contacto en los servicios de urgencias.

Palabras clave: Prisiones; presos; infecciones por VIH; detección del VIH; oportunidades perdidas; reclusos.

Introduction

According to 2019 data, Brazil's prison population reached 755.274 people, increasing by 1.49% over the previous year. In the year 2017, 284.065 people were arrested, of which approximately 93% were males.¹

This population, most often from disadvantaged communities, already has poor health conditions even before incarceration. Inadequate hygiene conditions, poorly ventilated and overcrowded cells contribute to the worsening of the health condition.^{2,3}

Prisoners are part of the "key-populations" for tackling HIV pandemics.⁴ In a perverse way, the criminal justice system presents opportunities to provide a service to public health, bringing together members of society at high risk of disease⁵ who often do not seek health services.⁶ The few moments of contact with the health system would be for: non-clinical reasons, such as the moments of imprisonment⁷; or for point clinical encounters for emergency care, resulting from criminal activity, for example.⁸

When an individual has contact with the health care system at its different levels, presents an indication for HIV testing, and HIV testing is not offered, this constitutes a "missed opportunity".⁹ These so-called "missed

opportunities" are key to undiagnosed cases of infection and to the control of HIV transmission.¹⁰

The present study seeks to assess missed opportunities for HIV diagnosis among HIV infected prisoners and compare this health system contact pattern with uninfected controls, in Distrito Federal, Brazil.

Methods

Paired case-control quantitative study using secondary electronic health records and administrative data, retrospectively analysed from 2009 to 2019. Cases were selected from the HIV confirmed infected prisoners that were incarcerated in Federal District's male prison system during June 2019 and controls from a sample of recently arrested HIV intake screening test negative subjects, from July 2018 to June 2019, in 1:2 proportion. There were excluded those cases with HIV diagnoses before 2009 or uncertain HIV diagnosis date.

Prison administrative data and the electronic health records were retrospectively analysed from 2009 to 2019 focusing on previous HIV testing and all clinical encounters in different Federal District's public health system scenarios (Emergency care, ambulatory specialized care, community primary care and prison's primary care). In 2009, Federal District public health system consisted of a large network of self-administrated units, including 12 hospitals, 5 walk-in clinics and 170 primary care clinics, all using integrated electronic health records, which began being implemented in 2008.¹¹

Data were extracted from the electronic health records through a standardized data collection form, composing a data bank with anonymous identifiers. Data were analysed using SPSS (version 22) and STATA (version 16). There were calculated descriptive statistics. Differences among categorical outcomes were analysed as paired data and adjusted by conditional logistic regression. The study protocol was approved by University of Brasilia Medical School Research Ethics committee (CAAE: 28761120.4.0000.5558).

Results

Description of the population

In June 2019, out of a total population of about 17,000 adult male inmates, there were 94 cases of HIV-infected inmates. Of these, 21 were excluded -14 with diagnosis made before 2009 and seven with an undefined date of diagnosis - leaving 73 cases included. For the composition of the control group, of 1999 inmates who entered the unit of the Penitentiary Penitentiary of the Federal District 1 (PDF1) between July 2018 and June 2019, 728 were tested, all of them showing a negative result. Among them were chosen 146 controls paired by age, seeking the closest date of birth of the cases, in a ratio of 1:2, as shown in Figure 1.

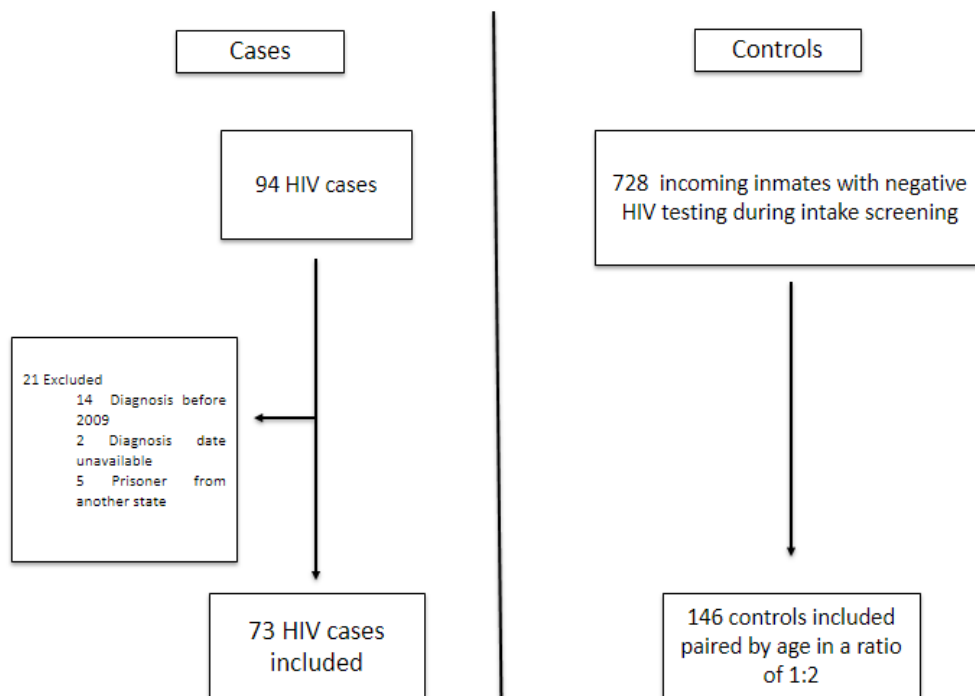


Figure 1. Flowchart of inclusion of study participants.

The median age difference between cases and controls was eight days (IQR=3 to 21 days). Table 1 describes the comparison of demographic characteristics between cases and controls, with statistically significant

differences observed in the proportion of married marital status, the history of homelessness, and being transgender.

Table 1 – Demographic characteristics of HIV-infected and HIV-uninfected inmates, Federal District, 2019.

	Cases (%) n=73	Controls (%) n=146
Age	32 (IQR=27 a 38)	32 (IQR=28 a 38)
Black	52 (71,2)	117 (80,1)
Marital status		
Single/Divorced	53 (72,6)	80 (54,8)
Married	13 (17,8)	48 (32,9) *
Not informed	7 (9,6)	18 (12,3)
Homeless	18 (24,6)	14 (9,6) *
Transgender	5 (6,8)	1 (0,7) *
Tattoo	38 (52,0)	74 (50,7)

*p < 0,05

Table 2 contains the description of the clinical characteristics of the cases. The mean time to diagnosis was 3.4 years, most were diagnosed by rapid test, while imprisoned, by teste ordered by the nurses and CD4 greater than 500 cells/mm³. Diagnoses followed by a diagnosis of tuberculosis were rare. In seven patients (9.5%), there was a previous positive serology test for HIV, in which the patient was not aware of the result, having been diagnosed later on another occasion. Regarding treatment, 83.6% were with last viral load until 2019 undetectable.

Table 2 – Clinical characteristics of the 73 HIV cases included in the study. Federal District, 2019.

Time of diagnosis (years)	3,38 (SD=2,918)
Type of diagnosis	
Rapid tests	41 (56,2%)
Conventional immunoassay	30 (42,3%)
Not possible to determine	2 (2,7%)
Type of confirmation of diagnosis	
Rapid tests	10 (13,7 %)
Conventional immunoassay	20 (27,4%)
Viral load	20 (27,4%)
Not possible to determine	2 (2,7%)
Examination requested for diagnosis of Tuberculosis	4 (5,5%)

Patients with positive serology results who have not been informed of the result		7 (9,5%)
Patients tested within 5 years of diagnosis with negative results		4 (5,5%)
Level of care of the diagnosis		
	Prison	42(57,5%)
	Primary care	19(26,0%)
	Hospital	11(15,1%)
	Walk-in clinic	1(1,4%)
Diagnosis while incarcerated		42 (57,5%)
Diagnosis during intake screening in Prisons		12 (16,4%)
Diagnosis by nurse's orders		46 (63%)
CD4 category at diagnosis		
	Less than 200	11(15,1%)
	200 a 500	31(42,5%)
	Above de 500	30(41,1%)
	Not available	1 (1,4%)
Last viral load undetected until 2019		63 (86,3%)

Missed opportunities and factors related to HIV diagnosis

Table 3 describes the missed opportunities for diagnosing HIV infection of cases in the last five years before diagnosis. In 73% of the cases, there was at least one missed opportunity, in 55% at least one missed opportunity in the triage on arrival in prisons and 38% in emergency care units, being 27% due to trauma. In contacts while not imprisoned, the level of care with the highest proportion of missed opportunities was the emergency room, followed by primary care, with 10% of the cases presenting missed opportunities in this scenario. There was no statistical difference regarding contacts with the health system in relation to the control group in which there was no testing, with 10% of cases and 5.5% of controls with at least one prior contact without testing in primary care, 38% of cases and 43.8% of controls with at least one prior contact in emergency care, 55% of cases and 48.6% of controls with at least one prior contact in intake screening in the prison system.

Table 3 – Missed HIV testing opportunities in the 5 years preceding HIV diagnosis for the 73 cases and contacts in the health care system in which HIV testing was not available from the 146 controls# - period from 2009 to 2019

	Cases			Controls		
	Total of contacts with the health system	Sub-totals	Presence of at least one missed opportunity (% of total 73 cases)*	Total	Sub-totals	Presence of at least one health care contact in which there was no testing (% of total 146 controls)
Level of care						
In the Community	103			144		
Primary Care		12	7 (10)		11	8 (5,5)
Secondary Outpatient Care		03	1 (1)		3	3 (2,1)
Emergency department		88	28 (38)		130	64 (43,8)
Due to trauma	32		20 (27)	60		43 (29,5)
Due to trauma with interpersonal violence		12	11 (15)		22	19 (13)
Due to trauma with ambulance arrival		3	3 (4)		6	6 (4,1)
Due to trauma with alcohol/other drug intoxication		3	3 (4)		2	2 (1,4)
Due to simple trauma		15	11 (15)		39	29 (19,9)
Due to trauma with blood drawn for laboratory testing		1	1 (1)		7	7 (4,8)
Due to trauma with imaging exam		25	17 (23)		43	34 (23,3)
For reasons other than trauma presenting with alcohol/other drug intoxication	7		3 (4)	7		7 (4,8)
For reasons other than trauma in which there were blood drawn for a laboratory testing	14		9 (12)	17		11 (7,5)
During imprisonment						
During prisons' intake screening	89		40 (55)	164		78 (53,4)
During jail intake screening		63	40 (55)		112	71 (48,6)
During long term prison intake screening		26	21 (29)		52	38 (26,0)
Total	191		53 (73)	308		104

*There was no difference with statistical significance in relation to the controls.

Technically there are no "missed opportunities" for controls, because they are not sick.

Table 4 contains the data on testing performed in both groups, showing that in 9.6% of the cases there was at least one negative test in the five-year period before diagnosis, and that 13.7% were ever tested considering the entire period recorded in the electronic medical records since their implementation.

Table 4 – Contacts in the healthcare system in which people detained in the Federal District prison system were tested for HIV

	Cases	Controls
	Proportion of cases with at least one opportunity seized	Proportion of controls with at least one opportunity seized
Opportunities seized in the 5 years preceding the date of diagnosis of HIV cases		
Primary Care	1,4%	4,8%
Secondary outpatient care	0%	0,7%
Emergency department	0%	0%
Emergency department - Trauma	0%	0%
Hospital admissions	1,4%	0%
Total in the community	2,7%	5,5%
During prisons' intake screening	5,5%	9,6%
Toral during imprisonment	8,2%	17,1%
Total by rapid testing	5,5%	6,2%
Total	9,6% *	21,2%
Opportunities seized since the implementation of electronic medical records		
During imprisonment	9,6% *	25,3%
In the Community	5,5%	11,0%
Total	13,7% *	34,2%

*p<0.05

In the bivariate analysis, the conditions of homelessness and being transsexual were related to HIV diagnosis. Of the 5 transsexual cases, 4 were homeless. In multivariate analysis, the only factor that remained associated with diagnosis was history of homelessness. (table 5).

Table 5 – Analysis of characteristics associated with the diagnosis of HIV infection in people detained in the Federal District prison system, 2019.

	Unadjusted odds ratio (CI 95%)	P valor	Adjusted odds (CI 95%)	P value
Black	0.6 (0.3 a 1.2)	0.144	0.6 (0.3 a 1.2)	0.138
Homelessness	3.0 (1.4 a 6.8)	0.005*	2.5 (1.1 a 5.9)	0.028*
Transexual	9.9 (1.2 a 85)	0.036*	6.6 (0.6 a 67.3)	0.112
Tattoo	1 (0.6 a 1.9)	0.841	0.9 (0.5 a 1.8)	0.784
Trauma				
With interpersonal violence	1.2 (0.5 a 2.6)	0.678	1.2 (0.4 a 3.5)	0.659
With ambulance arrival	1.0 (0.2 a 4.3)	1.000	1.0 (0.2 a 5.2)	0.974
With alcohol/other drug intoxication	3.0 (0.5 a 18)	0.229	2 (0.3 a 16)	0.484
Simple trauma	0.7 (0.3 a 1.5)	0.398	0.7 (0.3 a 1.7)	0.459
Emergency department visits for reasons other than trauma presenting with alcohol/other drug intoxication	0.8 (0.2 a 3.5)	0.814	1.2 (0.3 a 5,3)	0.835

Discussion

In this case-control study with secondary data, we found no difference between contact with health services among HIV-positive inmates diagnosed after 2009 and HIV-negative controls, matched by age, in the 5 years before diagnosis. Probably because these were cases of recent infection, since only 12 15.1% had CD4 less than 200 and 9.6% had a negative test in the last 5 years before diagnosis, we speculate that this is one reason why there were not more contacts with the health service in the group of cases. According to the data presented, the risk of acquiring HIV is also not associated with trauma situations.

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the data presented, the risk of acquiring HIV is also not associated with trauma situations.

We chose age matching to control for the effect of age on seeking health services. Age matching also allows us to control for possible historical differences in available technologies for HIV diagnosis and availability of health services. As a disadvantage, it is possible that age matching may have indirectly matched other variables, potentially generating bias. The ratio of 1:2 was chosen to allow increased power for the study, taking into account the limit of operational capacity available for retrospective chart review

There was a considerable proportion of cases with missed opportunities for HIV testing, most of these being in the prison system. In the community, most missed opportunities were in emergency rooms, mostly for trauma, reflecting the pattern of contact with health services in men.¹³ Thus, the scenario of trauma care shows itself as an opportunity to implement HIV screening programs.

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On the other hand, there was non-negligible prior testing for HIV in both groups. Primary care in the community, a rare setting for missed opportunities, proved to be the second most tested setting. The highest proportion of testing was done in prisons, demonstrating that there is a systematic testing effort in this setting. Among controls, 34.2% had been tested at least once in their lives. Data from the United States shows that 45% of the general population has been tested for HIV at least once in their lives.¹⁴ Notably, the largest proportion of cases had a rapid test as the first type of diagnostic test and was requested by a nurse. As the largest proportion are recent cases, this probably reflects the current landscape of HIV testing outside the hospital setting.¹⁵⁻¹⁷ Rapid tests are quite useful in settings such as prison settings, as they lead to a high proportion of results being delivered.¹⁸ This advantage of rapid testing becomes more evident when it is noted that in 7 cases (9.5%) there was a previous

positive serology recorded in the medical record, where the patient was not aware of the result. It is necessary to implement a laboratory system to notify the health service of a positive result, in order to avoid similar situations.¹⁹ Still regarding the circumstances of HIV diagnosis in cases, given the high prevalence of tuberculosis in the prison environment, the low proportion of cases identified in patients diagnosed with tuberculosis was surprising.²⁰⁻²⁴

The study, despite using secondary data from medical records, has the advantage that information from contacts with the health care system and contact settings was used. This information is recorded by different professionals, from the administrative staff at the opening of the care form, through triage, and finally to the care itself. The information from imaging and laboratory tests is also considered reliable. Another advantage is the federal district's own extensive public health network, regularly distributed throughout its territory and using the same medical records. Thus, especially the data referring to trauma, which is notably attended by the public network, there is a low possibility of unavailable records. Even in the other contacts, the prison population is mostly low-income, and the use of private health services is unlikely.

In the same way, the use of data from medical records invariably has as a limitation the possibility of insufficient or even non-recording of some information and/or contacts with the health service. It is possible that technical problems have made impossible some registries or services where at some point electronic medical records had not yet been implemented. It is also not possible to rule out that some individuals have been seen in cities adjacent to the Federal District, although this is unlikely, since these regions have little health services available. Records of rapid tests by nursing professionals are also more susceptible to under-recording, since they are typed by the professional himself. In any case, there are no reasons why under-recording was differential between cases and controls.

The criterion of contact in the last 5 years before diagnosis was used to define missed opportunity. However, given that in this population most of the diagnoses were recent, there was a non-negligible proportion of 9.6% of cases with negative tests within the period studied. The vast majority of these tests were performed in the prison environment, somewhat demonstrating that there

is a supply of testing in this setting. Thus, for populations at higher risk of infection and submitted to more frequent testing, the criterion of missed opportunities can be reduced. Because the Federal District is a federative unit with greater availability of financial resources compared to other Brazilian states, our results probably do not reflect the reality of the country.

Finally, an association was found between having HIV infection and a history of living on the streets and being transgender, populations that are also considered key in the fight against HIV.⁴ Thus, these would be situations of double vulnerability. As secondary data was used, it was not possible to evaluate other relevant exposures, such as the use of crack cocaine (smoked cocaine), drug users being considered another key population for HIV treatment.¹⁵ The low representativeness of the transgender population in the sample studied, and the fact that most of them are also living on the streets, does not allow us to draw further conclusions regarding the magnitude of their association with HIV infection and the effect of adjusting for the exposure of living on the streets.

Conclusion

In the study population, there was no difference in health system contact between HIV cases and controls. There is opportunity for increased testing in all settings studied, with emphasis on trauma care in the emergency room. There was considerable HIV testing in the prison system, although there are still missed opportunities. This considerable testing offer in the prison system may be related to early diagnosis in this population.

Authors' contributions:

All authors contributed to the study conception and design. Material preparation and analysis were performed by Rafael Jardim de Moura and Gustavo Adolfo Sierra Romero. Data collection was performed by Rafael Jardim de Moura. The first draft of the manuscript was written by Rafael

Jardim de Moura and all authors commented on previous versions of the manuscript. All authors read and approved the final manuscript.

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