Predictors of Reincarceration and Disease Progression Among Released HIV-Infected Inmates

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Abstract

We conducted a retrospective cohort study to determine the 3-year reincarceration rate of all HIV-infected inmates ($n = 1917$) released from the Texas prison system between January 2004 and March 2006. We also analyzed postrelease changes in HIV clinical status in the subgroup of inmates who were subsequently reincarcerated and had either CD4 lymphocyte counts ($n = 119$) or plasma HIV RNA levels ($n = 122$) recorded in their electronic medical record at both release and reincarceration. Multivariable analyses were performed to assess predictors of reincarceration and clinical changes in HIV status. Only 20% of all HIV-infected inmates were reincarcerated within 3 years of release. Female inmates (hazard ratio [HR] 0.63; 95% confidence interval [CI], 0.47, 0.84) and inmates taking antiretroviral therapy at the time of release (HR 0.31; 95% CI, 0.25, 0.39) were at decreased risk of reincarceration. African Americans (HR 1.58; 95% CI, 1.22, 2.05), inmates with a major psychiatric disorder (HR 1.82; 95% CI, 1.41, 2.34), and inmates released on parole (HR 2.86; 95% CI, 2.31, 3.55) were at increased risk of reincarceration. A subgroup of reincarcerated inmates had a mean decrease in CD4 cell count of 79.4 lymphocytes per microliter ($p < 0.0003$) and a mean increase in viral load of 1.5 log₁₀ copies per milliliter ($p < 0.0001$) in the period between release and reincarceration. Our findings, although substantially limited by selection bias, highlight the importance of developing discharge planning programs to improve linkage to community-based HIV care and reduce recidivism among released HIV-infected inmates.

Introduction

SINCE THE FIRST REPORTS of HIV/AIDS occurring in U.S. prison populations were published more than 25 years ago,^{1,2} epidemiologic studies have consistently documented a high prevalence of HIV infection and AIDS among prison inmates.^{3–7} Although the number of persons with HIV passing through state and federal prisons has remained stable over the past decade, the prevalence of HIV among incarcerated populations has steadily declined.^{8–11} Nevertheless, the most recent estimates show that the prevalence of HIV infection in the United States prison population is more than three times higher than that of the general population.^{9–11} This high prevalence is attributed largely to the substantial increase in

the number of persons incarcerated for drug-related crimes over the last quarter century.^{12–14} As a group, such individuals tend to engage in behaviors—such as injection drug use and trading or selling sex for drugs—that put them at high risk for HIV infection.^{5,14–16}

Prior to their incarceration, many HIV-infected prisoners have received little or no treatment for their condition. Studies indicate that nearly three quarters of incoming prisoners with HIV infection initiate antiretroviral therapy (ART) only after entering the correctional setting.^{17,18} Two investigations have shown that the majority of HIV-infected inmates demonstrate high levels of adherence to antiretroviral regimens during their incarceration.^{17–19} However, a large proportion fail to maintain this level of adherence after they are released into the

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community.^{18,20–22} Baillargeon et al.²⁰ reported that of 2115 inmates who were receiving ART while in prison, only 5% filled a prescription for ART medications within 10 days after their release, and only 18% did so within 30 days. Additionally, only 20% of the inmates established a linkage to any type of HIV-related outpatient care within 30 days of release.²³

Given the high rates of reincarceration among released inmates in the United States²⁴ as well as the reported poor linkage to HIV care following release from prison, understanding the factors related to recidivism and HIV disease progression among released inmates holds important clinical and public health relevance. Although two studies^{18,22} have shown that inmates had substantial progression of HIV disease following release from prison, no information is available on the clinical and demographic correlates of this outcome. Similarly, no studies have been conducted on the rates and correlates of recidivism among HIV-infected inmates. We therefore conducted a retrospective cohort study to investigate the rates and correlates of both reincarceration and disease progression among released HIV-infected inmates.

Methods

Design and study sample

This was a retrospective cohort study of HIV-infected inmates released from the Texas Department of Criminal Justice (TDCJ) prison system after January 1, 2004. The study had two principal objectives. The first was to determine the overall 3-year reincarceration rate of all HIV-infected TDCJ inmates ($n = 1917$) who were released into the community between January 1, 2004 and March 31, 2006. Reincarceration was defined as a new incarceration in the TDCJ during the defined observation period for either the commission of a new crime or violation of parole. Our second objective was to analyze the post-release clinical outcome of the subgroup of inmates who were released between January 1, 2004 and December 31, 2007 and subsequently reincarcerated at any time before March 31, 2009. We used mean changes in CD4 lymphocyte counts and viral loads (plasma HIV RNA levels) obtained within 120 days of release and subsequent reincarceration to assess clinical outcome. Inmates with missing laboratory values at either or both time points were excluded from the analyses.

This study was reviewed and approved by the Institutional Review Boards at the University of Texas Medical Branch, Baylor College of Medicine, and the Texas Department of State Health Services and by the Office for Human Research Protections, U.S. Department of Health and Human Services. Because the study was confined to an analysis of retrospective electronic data, all Institutional Review Boards waived the requirement to obtain both subject authorization for use and disclosure of personal health information and prior consent of the individual affected. All Institutional Review Boards approved publication of study results in aggregate form to ensure that no individual was at risk of being identified.

Data sources

The primary data source for this study was the TDCJ electronic medical record (EMR) database, which contains demographic information (i.e., gender, age, and race/ethnicity) and medical records of all TDCJ inmates. Race/ethnicity clas-

sification (African American, non-Hispanic white, or Hispanic) was self-reported via a multiple-choice item on the prison intake questionnaire.

HIV screening and treatment

The vast majority of medical and psychiatric care for TDCJ inmates is provided by two of the state's academic medical centers (University of Texas Medical Branch and Texas Tech University Health Sciences Center).²⁵ Private companies provide approximately 10% of the medical care within TDCJ. All demographic and medical data used in this study were collected and maintained by personnel from the aforementioned universities and private companies. During intake into the prison, all inmates undergo medical and psychiatric examinations. This evaluation lasts approximately 60 min and consists of a detailed medical history, mental health screening, physical examination, and a number of laboratory tests. During the study period, all incoming inmates were offered serological screening for HIV infection at intake; approximately 10% refused. HIV screening was also available to all inmates throughout their incarceration (up to two times per year at the inmate's request and whenever medically indicated). In September 2005, in response to a mandate by the Texas state legislature, the TDCJ instituted a policy of mandatory HIV screening at the time of release. Clinical management of HIV-infection in the Texas prison system is based on U.S. Department of Health and Human Services guidelines.²⁶ Medical care is directed by infectious disease specialists and includes standard laboratory and clinical monitoring at least three times a year, initiation of ART when the CD4 lymphocyte count is ≤ 350 cells/mm³, and prevention and treatment for opportunistic diseases.

HIV discharge planning services

The TDCJ Field Services, and Texas Correctional Office on Offenders with Mental and Medical Impairment departments, in collaboration with the University of Texas Medical Branch, provides discharge planning services for soon-to-be-released HIV-infected inmates. On the day of their release, all HIV-infected inmates receive a list of clinicians located in their home community who provide HIV-related health care for returning prisoners; they also receive a copy of their recent HIV laboratory test results. In addition, those who are on an antiretroviral regimen receive: a 10-day supply of their antiretroviral medications, instructions on how to contact a Texas AIDS Drug Assistance Program (ADAP) case worker (via a toll free number) to obtain an initial 30-day supply of medication, and ADAP application materials. In addition, discharge planning coordinators help released inmates access ART from other public and/or private sources following the initial ADAP-funded postrelease period.

Statistical analysis

Predictors of reincarceration. Multivariable survival analysis was performed by use of Cox proportional hazards regression²⁷ with the dependent variable being number of days to reincarceration among all HIV-infected inmates who were released from TDCJ between January 1, 2004 and March 31, 2006. Former inmates who were not reincarcerated were censored at 3 years following their release date. We tested

the assumption of proportionality in the Cox model by determining that the baseline cumulative hazard rates were proportional with follow-up time.²⁷

Predictors of changes in HIV clinical indicators. Paired *t* tests were used to compare the study cohorts' mean values of both CD4 lymphocyte count and viral load at two time points: release (that occurred any time between January 1, 2004 and December 31, 2007) versus subsequent reincarceration (that occurred following release date and before March 31, 2009). Multivariable linear regression analysis was then used to assess predictors of both continuous outcomes: change in CD4 lymphocyte count from release to reincarceration and change in viral load from release to reincarceration. All data analyses were conducted using SAS version 9.7 (SAS Institute, College Station, TX).

Results

Predictors of reincarceration

Twenty percent (*n* = 376) of the 1917 HIV-infected inmates released from prison during the study period were reincarcerated within 3 years of their release date. The results of the proportional hazards model that we used to assess the

independent influence of each of the study factors in predicting 3-year reincarceration are presented in Table 1. Female inmates (HR 0.63; 95% CI, 0.47, 0.84) and inmates receiving ART at the time of their release (HR 0.31; 95% CI, 0.25, 0.39) had a statistically significant decreased risk of being reincarcerated within 3 years of release. African Americans (HR 1.58; 95% CI, 1.22, 2.05), inmates with a major psychiatric disorder (HR 1.82; 95% CI, 1.41, 2.34), inmates released on parole (HR 2.86; 95% CI, 2.31, 3.55), and those released in 2005 (HR 1.67; 95% CI, 1.32, 2.11) and 2006 (HR 2.61; 95% CI, 1.97, 3.45) all had a statistically significant increased risk of being reincarcerated within 3 years of release.

Predictors of changes in HIV clinical indicators

Of the 430 HIV-infected inmates who were reincarcerated during the observation period, a CD4 lymphocyte count obtained at both the time of release and reincarceration was available for 119 inmates. Likewise, a viral load value for both time points was available for 122 inmates. Inmates with missing laboratory values at either or both time points were excluded from the analyses. A χ^2 analysis showed that, with the exception of criminal offense type, the distribution of study characteristics was comparable among inmates who

TABLE 1. HAZARD RATIOS FOR THREE-YEAR REINCARCERATION AMONG ALL HIV-INFECTED INMATES RELEASED BETWEEN JANUARY 1, 2004 AND MARCH 31, 2006

	% Reincarcerated at 3 years	Hazard ratio (95% CI)	p Value
Overall (<i>n</i> = 1917)	20.5	—	—
Gender			
Male (<i>n</i> = 1552)	21.8	1.00 (Referent)	—
Female (<i>n</i> = 365)	15.1	0.63 (0.47–0.84)	0.002
Age, years			
16–29 (<i>n</i> = 226)	20.8	1.00 (Referent)	—
30–49 (<i>n</i> = 1424)	21.0	1.33 (0.98–1.80)	0.07
≥ 50 (<i>n</i> = 267)	17.6	1.10 (0.73–1.66)	0.65
Race/ethnicity			
Non-Hispanic white (<i>n</i> = 447)	16.3	1.00 (Referent)	—
Hispanic (<i>n</i> = 229)	14.4	0.92 (0.61–1.40)	0.71
African American (<i>n</i> = 1241)	23.1	1.58 (1.22–2.05)	0.0006
Major psychiatric disorder			
No (<i>n</i> = 1,626)	19.3	1.00 (Referent)	—
Yes (<i>n</i> = 291)	27.2	1.82 (1.41–2.34)	<0.001
CD4 count at release, cells/mm ³			
<200 (<i>n</i> = 446)	15.5	1.00 (Referent)	—
200–350 (<i>n</i> = 420)	22.9	1.34 (0.99–1.81)	0.06
>350 (<i>n</i> = 994)	22.0	1.11 (0.85–1.44)	0.46
On ART at release			
No (<i>n</i> = 903)	30.2	1.00 (Referent)	—
Yes (<i>n</i> = 1,014)	11.8	0.31 (0.25–0.39)	<0.001
Criminal offense type			
Non-substance abuse (<i>n</i> = 755)	19.7	1.00 (Referent)	—
Substance abuse (<i>n</i> = 1162)	21.0	1.10 (0.89–1.35)	0.39
Released on parole			
No (<i>n</i> = 1000)	13.1	1.00 (Referent)	—
Yes (<i>n</i> = 917)	28.6	2.86 (2.31–3.55)	<0.0001
Date of release			
2004 (<i>n</i> = 807)	14.0	1.00 (Referent)	—
2005 (<i>n</i> = 851)	22.6	1.67 (1.32–2.11)	<0.0001
2006 (<i>n</i> = 259)	34.0	2.61 (1.97–3.45)	<0.0001

CI, confidence interval.

were and were not included in these analyses. For all reincarcerated inmates, the median time to reincarceration was 485 days (interquartile range [IQR] = 280–801). For those not missing a CD4 lymphocyte count value, the median time to reincarceration was 518 days (IQR = 301–879); for those not missing a viral load value, the median time to reincarceration was 449 days (IQR = 292–861). Overall, between the time of release from prison and reincarceration, inmates demonstrated a mean decrease in CD4 lymphocyte count of 79.4 lymphocytes per microliter ($p < 0.0003$) and an increase in viral load of 1.5 log₁₀ copies per milliliter ($p < 0.0001$; Table 2). Of the covariates examined in the multivariable models predicting 1) change in the CD4 lymphocyte count over time (Table 2) change in viral load over time, there were no statistically significant predictors.

Discussion

HIV infection represents one of the most critical and costly conditions confronting the U.S. prison system.^{9–11} The fact that the majority of HIV-infected inmates are initially diagnosed and begin receiving treatment during their incarceration^{17–19} may be indicative of the social, economic, and behavioral barriers to community-based medical care faced by these individuals. Because the vast majority of prisoners with HIV infection will eventually be released to the community, identification of the various factors associated with an increased risk of reincarceration and disease progression among returning prisoners is important.

We found that only 20% of released inmates with HIV infection were reincarcerated within 3 years of release. This proportion is substantially lower than the 3-year reincarceration rates reported for all Texas prison inmates released in 2002 (28.2%) and 2003 (27.9%).²⁸ It is possible that this subgroup's physical condition or contact with HIV caregivers had a positive effect by reducing the potential for criminal or antisocial behavior. HIV discharge planning may have played a particularly important role in this subgroup's reduced recidivism. Studies have shown that linkage to community-based HIV care may increase the likelihood of successful integration into community-based health care systems and supportive social networks.^{29,30} In particular, a study of newly released HIV-infected women in a Rhode Island state prison showed that participation in HIV discharge planning was associated with a significant reduction in the likelihood of recidivism.³¹ Additionally, consideration should be given to the extent to which

unaccounted mortality among released HIV-infected inmates may have caused us to overestimate the number of individuals at risk of reincarceration over the 3-year period.

Our study showed that several demographic and clinical factors were associated with an increased risk of reincarceration within 3 years of release. The elevated risk of reincarceration among HIV-infected males and African Americans is consistent with previous reports of increased recidivism among these demographic subgroups of the general inmate population.²⁴ If future studies continue to report similar demographic findings, the development of targeted HIV discharge planning may be warranted. Peer counseling programs, in which former inmates serve as mentors to newly released inmates, may be particularly effective in fostering a successful transition into the community.^{32,33} Our finding of an increased risk of recidivism among inmates with major psychiatric disorders is consistent with previous studies of the entire Texas prison system which reported that inmates with serious mental illness had higher rates of recidivism³⁴ and parole revocation.³⁵

Given the high prevalence of mental illness among HIV-infected inmates,³⁶ addressing the mental health needs of HIV-infected inmates at the time of release is integral to successful discharge planning. Our observation that HIV-infected inmates released on parole had an increased risk of reincarceration is also consistent with previous reports.²⁴ It is likely that this finding is attributable, at least in part, to the increased monitoring of this subgroup by the criminal justice system.³⁷ Former inmates released on parole are frequently subject to revocation of their parole and subsequent reincarceration due to technical violations. Finally, our finding that inmates who were on antiretroviral therapy were at greatly decreased risk of reincarceration may merit particular attention. It is possible that inmates who received treatment during incarceration were more likely to access HIV medical care following release from prison. Regular and frequent contact with medical providers may have a positive impact on recidivism. The specific pathways that underlie this process are unclear, but increased exposure to substance abuse counseling, mental health treatment, and positive behavioral modeling by individuals in the health care community may all be contributing factors.

This study shows that, among the subgroup of former inmates who were reincarcerated, the benefits of ART provided in the correctional setting were not sustained after the inmate returned to the community. We found that the CD4

TABLE 2. MEAN CHANGES IN CD4 LYMPHOCYTE COUNT AND VIRAL LOAD FROM PRISON RELEASE TO REINCARCERATION AMONG HIV- INFECTED INMATES RELEASED BETWEEN JANUARY 4, 2004 AND DECEMBER 31, 2007

	Mean CD4 ^a (SD) at release	Mean CD4 (SD) at reincarceration	Mean change in CD4 count (SD)	p Value
Overall (n = 119)	416.0 (289.2)	336.7 (274.5)	–79.4 (230.6)	<0.0003
	Mean viral load ^b (SD) at release	Mean viral load (SD) at reincarceration	Mean change in viral load (SD)	
Overall (n = 122)	1.4 (1.9)	2.9 (1.4)	1.5 (2.1)	<0.0001

^aLymphocytes/per microliter.

^blog₁₀ copies/per milliliter.

SD, standard deviation.

lymphocyte count decreased by an average of 76.5 lymphocytes per microliter ($p < 0.0001$) and viral load increased by an average of 1.1 $\log_{10}$ copies per milliliter ($p < 0.0001$) between the time of release and subsequent reincarceration. These findings are comparable to results of two previous reports.^{18,22} An analysis of 292 Connecticut prisoners who received ART in prison and then released and subsequently reincarcerated showed a mean decrease in CD4 lymphocyte count of 80 lymphocytes per microliter ($p < 0.0001$) and a mean increase in viral load of 1.14 $\log_{10}$ copies per milliliter ($p < 0.0001$) at the time of reincarceration.¹⁸ Likewise, a retrospective cohort study conducted by Stephenson et al.²² compared 15 inmates receiving ART who were released and then reincarcerated within 9 months with 15 inmates receiving ART who remained incarcerated during that time period.²² The median change in plasma HIV RNA level was 1.3 $\log_{10}$ copies in the reincarcerated inmates compared with a decrease of $-0.03 \log_{10}$ copies in the group that remained incarcerated. Likewise, the median change in CD4 lymphocyte count was a decline of 67 cells/mm³ compared with an increase of 114 cells/mm³ in the continuously incarcerated group.

Our analyses to identify possible predictors of disease progression during release showed that, among the subgroup of inmates who were reincarcerated, none of the examined study factors were associated with either of the disease progression outcomes in multivariable linear regression. However, given the relatively small sample size and potential selection biases associated with these analyses, additional studies are needed to validate these findings.

Several limitations may have influenced the results of our study. First, we were unable to assess post-release mortality in our cohort. This may have caused us to underestimate reincarceration, and possibly resulted in biased estimates among subgroups that were more or less likely to have died within 3 years of release. However, if unaccounted deaths from AIDS were partially responsible for the lower rate of reincarceration, it is unlikely that this effect was very large.

Under this scenario, we would have expected to see a lower rate of reincarceration as CD4 cell count at release decreased, and we did not observe such a relationship (Table 1). Second, for 72% of the 430 HIV-infected inmates who were reincarcerated during the 4-year study period, a CD4 lymphocyte count was not recorded in the EMR either at the time of release or the time of reincarceration, or at both time points. Likewise an HIV RNA level was not recorded in 73% of the inmates. Although χ^2 analyses did not show statistically significant differences in the distribution of demographic characteristics between inmates with and without missing laboratory values, our analyses did show an elevated rate of missing lab values among inmates released convicted of a non-substance abuse related offense. Third, as is the case of most retrospective studies, our results are highly dependent on the accuracy of our data sources. Although the two academic health centers that oversee health care delivery in the TDCJ rely on standardized and validated data entry procedures, there is the possibility that some data were entered incorrectly or failed to be entered. Fourth, this investigation had limited statistical power with which to assess the independent contribution of clinical and demographic factors on the disease progression outcomes under study. Studies conducted across multiple state prison systems may be needed to

permit assessment of these factors with a greater degree of statistical power. Prospective studies are also needed to conduct a more detailed assessment of behavioral barriers to continuity of care, such as substance abuse and related high-risk behaviors as well as released inmates' perceptions of the social stigma associated with HIV infection.

Our finding that a number of clinical and demographic factors are associated with an increased risk of reincarceration among released HIV-infected inmates holds important clinical and public health relevance. Future studies, particularly those with prospective designs and larger sample sizes, are needed to examine the specific pathways that underlie these associations. Moreover, although our observations of disease progression among reincarcerated inmates are important, they should be interpreted in the context of numerous potential selection biases. Future studies that can assess all released HIV-infected inmates during a given period of time will provide critically important public health information. Such research will play an important role in developing programs to improve the delivery of HIV care within the prison system as well as continuity of care following release into the community.

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