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The Association of Recent Incarceration and Health Outcomes Among HIV-infected Adults Receiving Care in the United States

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Abstract

Purpose—We described factors associated with incarceration as well as the association between recent incarceration and HIV-related sexual risk behaviors, access to insurance, healthcare utilization (emergency department and hospital use), antiretroviral therapy (ART) prescription, and viral suppression.

Design/methodology/approach—Using 2009–2010 data from a cross-sectional, nationally representative three-stage sample of HIV-infected adults receiving care in the United States, we assessed the demographic characteristics, healthcare utilization and clinical outcomes of HIV-infected persons who had been recently incarcerated (detention for >24 hours in the past year) using bivariate analyses. We used multivariable logistic regression to examine associations of recent incarceration with insurance status as well as clinical and behavioral outcomes.

Findings—An estimated 22,949 (95% confidence interval [CI] 19,062–26,836) or 5.4% (CI:4.7–6.1) of all HIV-infected persons receiving care were recently incarcerated. Factors associated with recent incarceration were age <50 years, being a smoker, having high school diploma or less, being homeless, income at or below the poverty guidelines, having a geometric mean of CD4 count <500 cells/µL, and using drugs in the past 12 months. Results from multivariable modeling indicated that incarcerated persons were more likely to use emergency department services, and to have been hospitalized, and less likely to have achieved viral suppression.

Originality/value—Recent incarceration independently predicted worse health outcomes and greater use of emergency services among HIV-infected adults currently in HIV care. Options to improve the HIV continuum of care, including pre-enrollment for healthcare coverage and discharge planning, may lead to better health outcomes for HIV-infected inmates post-release.

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Keywords

HIV; Incarceration; Viral suppression

INTRODUCTION

By year end 2010, there were approximately 7.1 million offenders supervised under the U.S. adult correctional system including those in state or federal prison, local jails and on probation or parole (Glaze L, 2011). Approximately 2.2 million of the offenders were incarcerated in a state or federal prison or a local jail (Glaze L, 2011) and of those incarcerated in State and Federal prisons, over 20,000 had HIV or AIDS (Maruschak LM, 2012). HIV prevalence among incarcerated persons is estimated to be twice as high as of non-institutional U.S. population (Wilper et al., 2009). Medical care and discharge planning in correctional institutions varies by local facility (Springer & Altice, 2005). Around 10 million persons are released from jails and prisons annually in the United States (Beckwith C et al., 2006; Sabol WJ & Couture H, 2008), and the vast majority of inmates return to their communities and families (Hammett et al., 2002; Spaulding et al., 2009). Incarceration affects the health, social and economic well-being of incarcerated persons (Blankenship et al., 2005; Freudenberg, 2001; Wohl DA, 2012), however there is limited knowledge on the impact of incarceration on management of chronic conditions, including HIV. While transitioning to community life, recently incarcerated HIV-infected persons may face social and economic challenges (Baillargeon et al., 2009a; Mallik-Kane K & Visher CA, 2008). In addition, the majority of persons released from prisons have lapses in health insurance (Baillargeon et al., 2009b; Mallik-Kane K & Visher CA, 2008) that may delay timely access to antiretroviral therapy (ART) and other HIV care. Moreover, one study reported that recently incarcerated HIV-infected persons had increased sexual risk behavior post-release (MacGowan et al., 2003).

Interventions to connect incarcerated HIV infected individuals to healthcare and promote continuity of ART post-release have been implemented (Springer et al., 2011), but questions remains about whether these interventions are generalizable and lead to improved health outcomes. Few studies have assessed the effect of recent incarceration on HIV care and clinical outcomes among HIV-infected persons after their release. Using data from a nationally representative probability sample of U.S. HIV-infected adults receiving medical care, we assessed the percentage of HIV-infected persons who were incarcerated in the past 12 months (recent incarceration). We described factors associated with incarceration as well as the association between recent incarceration and HIV-related sexual risk behaviors, access to insurance, healthcare utilization (emergency department and hospital use), ART prescription, and viral suppression.

METHODS

Sample design and setting

The Medical Monitoring Project (MMP) uses a three-stage sampling design to obtain nationally representative, annual cross-sectional samples of HIV-infected adults receiving

outpatient medical care for HIV (Blair et al., 2011; Frankel et al., 2012; McNaghten et al., 2007). For the 2009 and 2010 data collection cycles, U.S. states and territories were sampled, followed by facilities providing HIV care, and finally adults aged 18 years or older receiving at least one medical care visit in participating facilities between January and April in 2009 and 2010. The probability of selecting states and territories was proportionate to AIDS prevalence; the probability of selecting healthcare facilities was proportionate to facilities' HIV-infected patient census. Data were collected through face-to-face interviews and medical record abstractions from June 2009 to May 2011. Sixteen states and one territory (Puerto Rico) participated in MMP. In the selected geographic areas in 2009 and 2010, 691 and 689 facilities were sampled, respectively. Among the sampled facilities, 461 and 474 participated, resulting in facility response rates of 76% and 81% for 2009 and 2010, respectively. Of nearly 9,400 sampled persons per data collection year, completed interview and linked medical record abstraction data were available for 4,217 (adjusted patient-level response rate, 51%) in 2009 and 4,474 (adjusted patient-level response rate, 50%) in 2010. In addition, using information collected on all sampled facilities and sampled patients with complete information (88%), we conducted an analysis to compare respondents and non-respondents. Data were weighted to adjust for nonresponse by using predictors of response, including facility size, facility type (public or private), patient race/ethnicity, time since HIV diagnosis, and age group. Of the 8,691 participants, this analysis was limited to 8,520 participants who answered the question to recent incarceration, and had been diagnosed with HIV for 12 months to ensure that participants were aware of their HIV diagnosis at the time of incarceration.

Ethics statement

In accordance with federal human subjects protection regulations, 45 Code of Federal Regulations 46.101c and 46.102d (U.S. Department of Health and Human Services, 2009) and with the Guidelines for Defining Public Health Research and Public Health Non-Research (Centers for Disease Control and Prevention, 2010), the Centers for Disease Control and Prevention (CDC) determined MMP to be a non-research, public health surveillance activity. Participating states or territories and facilities obtained local institutional review board approval, if required locally. Informed consent was obtained from all interviewed participants.

Measures

a. Outcome variables—Self-reported outcome measures assessed in the interview were: 1) uninsured or lapse in health insurance (Yes vs. No); 2) time since last HIV care visit (3 vs. >3 months); 3) any visit to emergency department (ED) or urgent care visit (0 vs. 1 visit); 4) any hospitalization (0 vs. 1 visit); 5) any sex (Yes vs. No); 6) any unprotected sex (Yes vs. No); 7) any unprotected sex with a discordant or unknown status partner (Yes vs. No). Outcome measures assessed from medical record abstraction were: 1) ART prescription, defined as documented prescription of any ART; 2) viral suppression, defined as documented most recent HIV viral load, undetectable or 200 ml/copies. The reference period for all measures was defined as 12 months prior to the interview. Any sex in the past 12 months was defined as any self-reported anal, vaginal, or oral sex in the 12 months before the interview. Unprotected sex was defined as vaginal or anal sex without a condom or a

condom used for part of the time during sex in the 12 months prior to interview. To estimate the number of participants who had unprotected sex with a discordant or unknown status partner, the number of HIV-positive status partners was subtracted from the total number of partners with whom the participant reported unprotected sex, and if the numbers were not equal (i.e., not all partners were HIV-positive), then the participant was considered to have had sex with a partner of negative or unknown HIV status.

b. Independent variables—The primary independent measure was recent incarceration, defined as responding ‘Yes’ in the interview to the question “During the past 12 months, have you been arrested and put in jail, detention, or prison for longer than 24 hours?” Demographic and health-related covariates included were sex; age in years; race/ethnicity; education; current smoking status; binge drinking; any drug use during the past 12 months; HIV diagnosis within the past 5 years; and homelessness during the past 12 months. Participants were asked questions from the eight-item Patient Health Questionnaire (PHQ-8) (Kroenke et al., 2009). These questions represent an eight-item scale used to measure frequency of depressed mood in the past 2 weeks. Second, a score-based method, calculated as the sum of scores from the responses in the scale, was used to determine the presence of current depression of moderate or severe intensity, which was defined as a sum score of 10 (Kroenke et al., 2009). Sexual risk category was defined based on the participants and their reported sexual partner’s gender, or self-identified sexual orientation for those reporting no sexual activity in the past 12 months. The number and percentage of participants meeting current poverty guidelines was determined using the U.S. Department of Health and Human Services (HHS) (U.S. Department of Health and Human Services, 2009) poverty guidelines that corresponded to the year of interview. The stage of HIV infection, a measure of disease severity, was defined according to the CDC’s 2008 revised surveillance case definition for HIV infection using data from participant medical records (Schneider et al., 2008). For each participant, the geometric mean of all CD4+ count results documented in the medical record in the 12 months before the interview was calculated. This was done to summarize all CD4+ counts for the 12 months before the interview as a single measure for a given participant.

Data analysis

We combined data from the 2009 and 2010 MMP data collection cycles for the analysis. The analysis consisted of two phases. The goal of the first phase was to identify factors associated with recent incarceration. A chi-square test was performed to measure the association between each factor and incarceration status. Predictors which were significantly associated with recent incarceration at the $P=0.25$ level were retained in the multivariable logistic regression models. A final multivariable model was specified using a forward selection algorithm with an entry criterion of alpha=0.10. Prevalence ratios (PR) and adjusted prevalence ratios (aPR) along with 95% confidence intervals (CIs) were derived from the logistic regression model.

The goal of the second phase of the analysis was to assess the association between recent incarceration and outcome measures while adjusting for the potential confounders identified in the first phase of the analysis, as well as those factors selected a priori for inclusion based on literature review (McDonagh et al., 2008). Adjusted and unadjusted model estimates were

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compared to determine the extent to which incarceration serves as an independent predictor of each health outcome. We assessed model fit using the Hosmer-Lemeshow Goodness-of-fit test with a p-value >0.05 indicating adequate model fit (SAS/STAT(R) 9.2 User's Guide, Second Edition, 2014). All the data were analyzed using SAS (SAS Institute, Cary, NC) and SAS-callable SUDAAN 10.0.1 (Research Triangle Institute, Research Triangle Park, NC) statistical software, which accounts for the complex sample survey design of MMP.

RESULTS

This analysis of MMP data revealed an estimated 22,949 (95% CI: 19,062–26,836) or 5.4% (95% CI: 4.7–6.1) of all HIV-infected persons in care were recently incarcerated. A total of 45.3% of recently incarcerated individuals were aged 40–49 years, and a majority was male (74.9%) and non-Hispanic black (54.4%) (Table 1). A considerable percentage of recently incarcerated persons were current smokers (70.1%) and binge drinkers (25.4%), had only high school education or less (70.0%), had incomes at or below the poverty guidelines (71.5%), had major depression (19.8%), and had been homeless (30.1%) or used drugs (51.4%) in the past 12 months. Over one-quarter had been diagnosed with HIV in the past 5 years, and 20.9% had a geometric mean of <200 CD4 cells/ μ L.

In bivariate analysis, factors associated with recent incarceration were age <50 years, being non-Hispanic black, Hispanic, and other race compared to being non-Hispanic white, being a smoker or a binge drinker, being a man who have sex with women only (MSW) or women who have sex with men (WSM) compared to being men who have sex with men (MSM), having high school education or less, being homeless, having major or other depression compared to those with no depression, and income at or below the poverty guidelines, having a geometric mean of CD4 count <500 cells/ μ L, using drugs in the past 12 months, and being diagnosed with HIV in the past 5 years (Table 2). All these factors, except race/ethnicity, being MSW or WSM, being a binge drinker or having a depression, and being diagnosed with HIV in the past 5 years, remained significantly associated with incarceration in the adjusted regression models.

Compared to persons who were not recently incarcerated, recently incarcerated persons were more likely to have been uninsured or to have had a lapse in health insurance, to have used ED services in the past 12 months, had been hospitalized in the past 12 months, and had any sex, and unprotected sex with a discordant or unknown status partner in the past 12 months (Table 3). In addition, recently incarcerated persons were less likely to have achieved viral suppression. After adjusting for factors associated with incarceration in this analysis or identified a priori from the literature, recently incarcerated persons were significantly more likely to have used ED services, and to have been hospitalized. Moreover, recently incarcerated persons were significantly less likely to have achieved viral suppression.

DISCUSSION

Almost 23,000 HIV-infected adults in care had been recently incarcerated based on 2009–2010 MMP data. Recently incarcerated individuals were more likely to be young, less educated, poor, homeless, smokers, have a geometric mean of CD4 count <500 cells/ μ L, and

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to have used drugs. Persons who were recently incarcerated were less likely to have achieved viral suppression, and more likely to use higher intensity medical services such as emergency departments and hospitals.

The incarceration rate in the United States is one of the highest in the world at 962 inmates per 100,000 adults by the end of 2010 (Glaze L, 2011). Due to limited data on HIV-infected incarcerated individuals in care, it is difficult to come up with precise estimates.

Nonetheless, our crude estimate of recent incarceration (5.4% of HIV-infected persons in care for a crude rate of 5,400 per 100,000 HIV-infected persons in care per year) suggests that HIV-infected persons might be more likely to have a history of incarceration than HIV-uninfected persons. Risk factors such as being young, poor, black or Latino, homeless, and less educated have been associated with increased incarceration risk in the general population (Gelberg et al., 1988; Greenberg & Rosenheck, 2008; Kushel et al., 2005), and per our analysis these factors are also associated with recent incarceration among HIV-infected adults in care in the United States.

After release from jail or prison, HIV-infected adults may have disruption in social networks and family relationships, economic vulnerability, limited access to public income maintenance and health programs (Blankenship et al., 2005), and experience challenges like finding stable housing, employment, and reestablishing social networks and family relationships (Baillargeon et al., 2009b). Further, previous studies have shown that a majority of recently incarcerated persons were uninsured or had a lapse in health insurance during the first several months post-release (Baillargeon et al., 2009b). In our analysis, which focused on recently incarcerated HIV-infected individuals who surmounted obstacles to care upon their release and are currently receiving HIV care, the association between incarceration and insurance coverage was not significant in the adjusted models, meaning that the prevalence of lapses in insurance coverage was similar among the recently incarcerated and those who were not incarcerated, after adjusting for other factors associated with incarceration. Nonetheless, lack of insurance is likely a key deterrent to those attempting to access health care services and receive quality medical care (Shapiro et al., 1999).

Recently incarcerated HIV-infected individuals were more likely to have used ED services and to have been hospitalized. Disruption in care caused by incarceration might lead to increased use of more intensive medical services such as ED visits and inpatient hospitalizations. HIV-infected individuals transitioning from prisons and jails to the community are more likely to have substance use disorders, mental illness, and homelessness, and thus might be more likely to use ED services as compared to those with stable living conditions (Meyer et al., 2012). The finding that HIV-infected, recently incarcerated persons were more likely to be hospitalized is in line with previously published data (Meyer et al., 2012).

Moreover, we found that incarceration in the past year was significantly associated with lower viral suppression even after adjusting for sexual risk category, education, homelessness, poverty, drug use, age, and race. Previous studies have documented that HIV-infected prisoners have multiple social and economic challenges post-release which may

delay access to ART (Baillargeon et al., 2009b) and in turn delay viral suppression. We did not find any association between incarceration and ART prescription, but this may be because dates of incarceration were not collected, which would have allowed us to distinguish ART prescription before vs. after release from incarceration.

Although not assessed in our analysis, a previous study found that the duration of incarceration is an important predictor of timely ART prescription post-release, with only 23.6% of persons who had been incarcerated less than 12 months filling an ART prescription within 60 days post-release compared to 35.6% of persons who had been incarcerated 12 months or more (Baillargeon et al., 2009b). This suggests an important interaction between duration of incarceration and HIV care post-release.

In our study, in addition to finding significantly lower prevalence of viral suppression among recently incarcerated HIV-infected individuals, one quarter of these individuals reported unprotected sex and over 16% reported unprotected sex with a discordant or unknown status partner in the past 12 months, highlighting opportunities for ongoing transmission of HIV. Sexual behavior associated with transmitting HIV may be more common among subgroups. A study by MacGowan et al., found that 36% of young men recently released from prison engaged in risky sexual behaviors such as having two or more sex partners and unprotected sex (MacGowan et al., 2003). Recently incarcerated HIV-infected individuals may benefit from a sexual risk-reduction intervention pre-and post-release that has shown to be effective among young recently incarcerated men (Wolitski, 2006). In addition, health care reform offers opportunities for jails and prisons to enroll inmates in health insurance to improve the HIV continuum of care (Goode E, 2014). For recently incarcerated HIV-infected persons, forestalling a lapse in insurance coverage may improve post-release health outcomes and reduce the chance of transmitting HIV infection.

This analysis, in combination with previously published data, suggests a need for effective transitional community release programs to maintain continuity of HIV care and treatment. Transitional programs using case management to assist HIV-infected persons post-release have been developed, and have shown some benefit in risk reduction, such as self-efficacy to use condoms and to reduce the substance abuse (Bauserman et al., 2003), decrease in sexual risk-behaviors (Wolitski, 2006), and keeping HIV-positive individuals in HIV care post-release (Rich et al., 2001). This analysis is subject to several limitations. First, we were not able to assess causality or directionality between incarceration and outcomes due to the cross-sectional nature of the analysis. Second, we could not determine the duration of incarceration, individuals included in the analyses may have been incarcerated for a day to the full 12 months before the interview. Third, we are not able to assess the number of times persons had been incarcerated in the past 12 months. Fourth, we were unable to assess whether persons were incarcerated in jails, detention facilities, or prisons. Fifth, MMP is a national HIV surveillance system designed to produce representative estimates of behavioral and clinical characteristics of HIV-infected adults receiving medical care, and therefore our findings are not generalizable to people who are not receiving HIV medical care or to incarcerated populations.

Conclusions

MMP data identified almost 23,000 HIV-infected adults receiving care have been recently incarcerated; these persons were more likely to use higher intensity medical services, such as emergency departments and hospitals, and less likely to achieve viral suppression.

Options to improve the HIV continuum of care, including pre-enrollment for healthcare coverage and effective discharge planning, may lead to better health outcomes for HIV-infected inmates post-release.

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Characteristics of HIV-infected persons receiving medical care in the United States, by recent incarceration status, Medical Monitoring Project, 2009–

Table 1

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	Total population (N=8520)	Incarcerated persons (N=443)	Non-incarcerated persons (N=8077)	Sample n	Weighted% (CI)	Sample n	Weighted% (CI)	Sample n	Weighted% (CI)	p-value [§]
Gender^{††}										0.43
Male	6109	72.7 (69.3, 76.0)	330	74.9 (69.5, 80.3)	5779	72.6 (69.1, 76.0)				
Female	2288	27.3 (24.0, 30.7)	108	25.1 (19.7, 30.5)	2180	27.4 (24.0, 30.9)				
Age in years										<0.01
18-29	586	7.2 (6.0, 8.3)	47	10.5 (7.0, 13.9)	539	7.0 (5.7, 8.2)				
30-39	1364	15.9 (15.0, 16.9)	99	21.6 (17.7, 25.5)	1265	15.6 (14.7, 16.5)				
40-49	3252	38.4 (37.2, 39.6)	201	45.3 (41.1, 49.5)	3051	38.0 (36.8, 39.3)				
50	3318	38.5 (37.2, 39.7)	96	22.7 (18.2, 27.1)	3222	39.4 (38.1, 40.7)				
Race/Ethnicity^{†††}										<0.01
Non-Hispanic white	2837	34.6 (27.2, 42.0)	89	20.1 (15.0, 25.3)	2748	35.4 (27.8, 43.0)				
Non-Hispanic black	3484	41.4 (32.1, 50.7)	243	54.4 (45.7, 63.1)	3241	40.7 (31.3, 50.0)				
Hispanic	1808	19.2 (13.4, 25.0)	80	18.2 (11.9, 24.6)	1728	19.3 (13.4, 25.2)				
Other	391	4.7 (3.7, 5.8)	31	7.2 (3.3, 11.2)	360	4.6 (3.6, 5.6)				
Sexual risk category^{††††}										<0.01
Men who have sex with men	4003	49.1 (43.3, 54.9)	136	31.8 (25.4, 38.2)	3867	50.1 (44.3, 56.0)				
Men who have sex with women only	2040	23.8 (21.0, 26.7)	191	43.3 (37.1, 49.4)	1849	22.7 (19.9, 25.6)				
Women who have sex with men	2226	27.0 (23.7, 30.3)	104	24.9 (19.7, 30.2)	2122	27.1 (23.7, 30.6)				
Education										<0.01
Less than high school diploma	1921	21.6 (19.0, 24.1)	169	36.5 (31.2, 41.9)	1752	20.7 (18.2, 23.2)				
High school diploma	2300	26.5 (24.2, 28.7)	144	33.5 (29.1, 37.9)	2156	26.1 (23.8, 28.3)				
More than high school diploma	4296	52.0 (47.5, 56.5)	130	30.0 (24.1, 35.8)	4166	53.2 (48.8, 57.7)				
Homeless in past 12 months										<0.01
No	7795	91.7 (90.7, 92.7)	303	69.9 (64.9, 74.8)	7492	92.9 (92.0, 93.9)				
Yes	724	8.3 (7.3, 9.3)	140	30.1 (25.2, 35.1)	584	7.1 (6.1, 8.0)				
Income at or below poverty guidelines^{†††††}										<0.01

	Total population (N=8520)	Incarcerated persons (N=443)	Non-incarcerated persons (N=8077)	p-value [§]		
	Sample n	Weighted% (CI)	Sample n	Weighted% (CI)		
Above poverty level	4490	56.2 (52.2, 60.3)	119	28.5 (23.3, 33.8)	4371	57.8 (53.7, 61.9)
At or below poverty level	3773	43.8 (39.7, 47.8)	306	71.5 (66.2, 76.7)	3467	42.2 (38.1, 46.3)
First positive HIV test at correctional facility						<0.01
Correctional facility	61	3.4 (2.3, 4.5)	18	15.2 (8.6, 21.9)	43	2.6 (1.7, 3.5)
Others	1684	96.6 (95.5, 97.7)	90	84.8 (78.1, 91.4)	1594	97.4 (96.5, 98.3)
Current smoker						<0.01
No	4974	58.4 (56.6, 60.2)	133	29.9 (25.2, 34.5)	4841	60.0 (58.2, 61.9)
Yes	3525	41.6 (39.8, 43.4)	310	70.1 (65.5, 74.8)	3215	40.0 (38.1, 41.8)
Binge drinker						<0.01
No	7095	84.3 (83.4, 85.2)	319	74.6 (70.7, 78.4)	6776	84.9 (84.0, 85.8)
Yes	1365	15.7 (14.8, 16.6)	115	25.4 (21.6, 29.3)	1250	15.1 (14.2, 16.0)
Drug use in past 12 months						<0.01
No	6214	72.6 (70.4, 74.7)	221	48.6 (43.8, 53.4)	5993	73.9 (71.7, 76.1)
Yes	2281	27.4 (25.3, 29.6)	220	51.4 (46.6, 56.2)	2061	26.1 (23.9, 28.3)
Depression						<0.01
No depression	6348	74.9 (73.3, 76.5)	275	64.4 (59.4, 69.5)	6073	75.5 (73.9, 77.1)
Other depression	1056	12.8 (12.0, 13.7)	73	15.8 (13.0, 18.6)	983	12.7 (11.7, 13.6)
Major depression	1019	12.2 (11.0, 13.4)	88	19.8 (15.8, 23.8)	931	11.8 (10.6, 13.0)
Time since diagnosis (in years)						0.03
<5	1741	21.1 (19.4, 22.7)	114	27.3 (21.6, 33.1)	1627	20.7 (19.1, 22.4)
5	6779	78.9 (77.3, 80.6)	329	72.7 (66.9, 78.4)	6450	79.3 (77.6, 80.9)
Stage of Disease						0.34
Stage 1: No AIDS and nadir CD4 >500	540	6.9 (6.0, 7.7)	23	5.2 (2.7, 7.8)	517	6.9 (6.1, 7.8)
Stage 2: No AIDS and nadir CD4 200–500	2054	24.4 (23.0, 25.9)	113	26.2 (22.1, 30.2)	1941	24.3 (22.9, 25.8)
Stage 3: AIDS or nadir CD4 0–199	5907	68.7 (67.4, 70.0)	307	68.6 (63.9, 73.3)	5600	68.7 (67.4, 70.0)
Geometric mean of CD4 count in past 12 months						<0.01
0–199	1082	12.6 (11.7, 13.6)	93	20.9 (16.5, 25.3)	989	12.2 (11.2, 13.1)
200–499	3394	41.5 (40.3, 42.8)	190	45.2 (39.1, 51.2)	3204	41.3 (40.2, 42.5)
500	3722	45.8 (44.3, 47.4)	140	34.0 (29.0, 38.9)	3582	46.5 (45.1, 47.9)

[†]Intersex and transgender persons are not included

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^{†††}Other race/ethnicity includes Asian, native Hawaiian and other Pacific Islander, American Indian/Alaska native, multiracial^{††††}Persons in other or unknown sexual risk categories are not included^{†††††}Based on Department of Health and Human Services poverty guidelines[§]Rao-Scott chi-square test

Abbreviations: CI= 95% confidence interval; AIDS=Acquired Immune Deficiency Syndrome; CD4=CD4+ T-lymphocyte cell count.

Table 2
Results from multivariable logistic regression modeling: Factors associated with recent incarceration among HIV-infected persons receiving medical care in the United States, Medical Monitoring Project, 2009–2010 (N=8,520)

	Incarcerated persons n/N	Weighted% (CI)	Unadjusted Prevalence Ratio (CI) (N=8520)	p-value	Adjusted Prevalence Ratio (CI) (N=7914)	p-value [§]
Age in years				<0.01		<0.01
18–29	47/586	7.9 (5.1, 10.7)	2.48 (1.58, 3.87)		1.97 (1.21, 3.20)	
30–39	99/1364	7.4 (5.8, 8.9)	2.30 (1.70, 3.12)		2.02 (1.50, 2.71)	
40–49	201/3252	6.4 (5.4, 7.4)	2.00 (1.55, 2.58)		1.73 (1.31, 2.28)	
50	96/3318	3.2 (2.4, 4.0)	Reference		Reference	
Race/Ethnicity^{††}				<0.01		
Non-Hispanic white	89/2837	3.2 (2.4, 3.9)	Reference			
Non-Hispanic black	243/3484	7.1 (6.1, 8.2)	2.26 (1.71, 2.99)			
Hispanic	80/1808	5.1 (3.6, 6.6)	1.63 (1.10, 2.41)			
Other	31/391	8.3 (4.9, 11.6)	2.62 (1.53, 4.48)			
Sexual risk category^{†††}				<0.01		
Men who have sex with men	136/4003	3.5 (2.8, 4.3)	Reference			
Men who have sex with women only	191/2040	9.9 (8.2, 11.6)	2.80 (2.09, 3.76)			
Women who have sex with men	104/2226	5.0 (3.9, 6.2)	1.43 (1.02, 1.99)			
Education				<0.01		<0.01
Less than high school diploma	169/1921	9.2 (7.7, 10.7)	2.94 (2.34, 3.70)		1.66 (1.25, 2.22)	
High school diploma	144/2300	6.9 (5.7, 8.1)	2.20 (1.76, 2.74)		1.53 (1.20, 1.96)	
More than high school diploma	130/4296	3.1 (2.6, 3.6)	Reference		Reference	
Homeless in past 12 months				<0.01		<0.01
No	303/7795	4.1 (3.5, 4.8)	Reference		Reference	
Yes	140/724	19.6 (16.3, 23.0)	4.75 (3.75, 6.03)	<0.01	2.75 (2.15, 3.52)	<0.01
Income at or below poverty guidelines^{†††††}						
Above poverty level	119/4490	2.7 (2.1, 3.3)	Reference		Reference	
At or below poverty level	306/3773	8.7 (7.6, 9.8)	3.22 (2.55, 4.07)		2.00 (1.55, 2.58)	
Current smoker				<0.01		0.01
No	133/4974	2.8 (2.2, 3.4)	Reference		Reference	

	Incarcerated persons		Unadjusted Prevalence Ratio (CI) (N=8520)	P-value	Adjusted Prevalence Ratio (CI) (N=7914)	p-value [§]
	n/N	Weighted% (CI)				
Yes	310/3525	9.2 (8.0, 10.4)	3.30 (2.67, 4.08)	<0.01	1.98 (1.57, 2.51)	
Binge drinker						
No	319/7095	4.7 (4.1, 5.4)	Reference			
Yes	115/1365	8.7 (7.0, 10.4)	1.83 (1.51, 2.22)	<0.01		
Drug use in past 12 months						
No	221/6214	3.6 (3.0, 4.2)	Reference			
Yes	220/2281	10.1 (8.5, 11.8)	2.80 (2.37, 3.29)	<0.01	1.98 (1.66, 2.36)	
Depression						
No depression	275/6348	4.6 (3.9, 5.4)	Reference			
Other depression	73/1056	6.6 (5.2, 8.1)	1.43 (1.13, 1.81)			
Major depression	88/1019	8.7 (6.8, 10.7)	1.88 (1.49, 2.38)			
Time since diagnosis (in years)						
<5	114/1741	7.0 (5.5, 8.5)	1.41 (1.06, 1.88)			
5	329/6779	5.0 (4.2, 5.8)	Reference			
Geometric mean of CD4 count in past 12 months						
0-199	93/1082	8.9 (7.2, 10.7)	2.23 (1.72, 2.89)	<0.01	1.45 (1.16, 1.83)	
200-499	190/3394	5.9 (4.7, 7.1)	1.47 (1.17, 1.84)		1.36 (1.09, 1.70)	
500	140/3722	4.0 (3.3, 4.7)	Reference		Reference	

[†] Other race/ethnicity includes Asian, native Hawaiian and other Pacific Islander, American Indian/Alaska native, multiracial

[‡] Persons in other or unknown sexual risk categories are not included

^{†††} Based on Department of Health and Human Services poverty guidelines

[§] Adjusted for age, education, homelessness, poverty level, smoking status, drug use, and mean of CD4 counts. Factors were selected based on association with incarceration at p<0.10 or selected a priori based on literature review.

Abbreviations: CI = 95% confidence interval; AIDS = Acquired Immune Deficiency Syndrome; CD4 = CD4+ T-lymphocyte cell count

Table 3
 Results of multivariable logistic regression examining the associations of health insurance, HIV-related sexual risk behaviors, and healthcare utilization with recent incarceration among HIV-infected persons receiving medical care in the United States, Medical Monitoring Project, 2009–2010

Outcome of interest	Incarcerated persons (N=443)		Non-incarcerated persons (N=8077)		Association between incarceration status and outcome of interest			
	n/N	Weighted% (CI)	n/N	Weighted% (CI)	Unadjusted Prevalence Ratio (CI)	p-value	Adjusted Prevalence Ratio (CI)	p-value [§]
Uninsured or lapse in health insurance in past 12 months	171/441	38.7 (32.4, 45.0)	2234/8057	28.0 (23.8, 32.2)	1.38 (1.17, 1.63)	<0.01	1.10 (0.93, 1.31)	0.27
Time since last HIV care visit 3 months	352/434	81.8 (77.7, 85.9)	6442/8000	80.2 (77.9, 82.4)	1.02 (0.97, 1.07)	0.44	1.00 (0.94, 1.06)	0.97
Emergency department use in past 12 months	82/442	17.8 (13.8, 21.7)	788/8051	9.2 (7.7, 10.7)	1.93 (1.56, 2.38)	<0.01	1.30 (1.00, 1.70)	0.05
Hospitalization in past 12 months	62/442	14.2 (11.1, 17.3)	545/8055	6.5 (5.6, 7.5)	2.18 (1.71, 2.77)	<0.01	1.35 (1.05, 1.74)	0.02
Prescribed antiretroviral therapy in past 12 months	382/443	87.3 (84.3, 90.3)	7310/8077	90.0 (89.2, 90.9)	0.97 (0.94, 1.00)	0.06	0.99 (0.95, 1.02)	0.43
Most recent viral load test undetectable or <=200 copies/ml	245/443	55.8 (51.9, 59.7)	6002/8077	74.2 (72.2, 76.3)	0.75 (0.70, 0.81)	<0.01	0.90 (0.86, 0.95)	<0.01
Any sex in past 12 months	310/441	69.8 (65.1, 74.5)	5048/8039	61.8 (59.9, 63.6)	1.13 (1.05, 1.21)	0.02	1.05 (0.97, 1.14)	0.21
Any unprotected sex in past 12 months	122/425	26.5 (22.2, 30.8)	1868/7876	23.4 (21.0, 25.8)	1.14 (0.95, 1.36)	0.17	0.99 (0.80, 1.21)	0.91
Any unprotected sex with a discordant or unknown status partner in past 12 months	75/421	16.2 (13.1, 19.4)	907/7858	11.3 (10.1, 12.4)	1.44 (1.15, 1.80)	0.02	1.14 (0.89, 1.46)	0.30

[§] Adjusted for age, education, homelessness, poverty level, smoking status, drug use, and mean of CD4 counts. Factor selection was based on association with incarceration at p<0.10 or selected a priori based on literature review.

Abbreviations: CI= 95% confidence interval