

Incarceration and High-Risk Sex Partnerships among Men in the United States

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ABSTRACT *Incarceration is associated with multiple and concurrent partnerships, which are determinants of sexually transmitted infections (STI), including HIV. The associations between incarceration and high-risk sex partnerships may exist, in part, because incarceration disrupts stable sex partnerships, some of which are protective against high-risk sex partnerships. When investigating STI/HIV risk among those with incarceration histories, it is important to consider the potential role of drug use as a factor contributing to sexual risk behavior. First, incarceration's influence on sexual risk taking may be further heightened by drug-related effects on sexual behavior. Second, drug users may have fewer economic and social resources to manage the disruption of incarceration than nonusers of drugs, leaving this group particularly vulnerable to the disruptive effects of incarceration on sexual risk behavior. Using the 2002 National Survey of Family Growth, we conducted multivariable analyses to estimate associations between incarceration in the past 12 months and engagement in multiple partnerships, concurrent partnerships, and unprotected sex in the past 12 months, stratified by status of illicit drug use (defined as use of cocaine, crack, or injection drugs in the past 12 months), among adult men in the US. Illicit drug users were much more likely than nonusers of illicit drugs to have had concurrent partnerships (16% and 6%), multiple partnerships (45% and 18%), and unprotected sex (32% and 19%). Analyses adjusting for age, race, educational attainment, poverty status, marital status, cohabitation status, and age at first sex indicated that incarceration was associated with concurrent partnerships among nonusers of illicit drugs (adjusted prevalence ratio (aPR) 1.55, 95% confidence interval (CI) 1.06–2.22) and illicit drug users (aPR 2.14, 95% CI 1.07–4.29). While incarceration was also associated with multiple partnerships and unprotected sex among nonusers of illicit drugs (multiple partnerships: aPR 1.66, 95% CI 1.43–1.93; unprotected sex: aPR 1.99, 95% CI 1.45–2.72), incarceration was not associated with these behaviors among illicit drug users (multiple partnerships: aPR 1.03, 95% CI 0.79–1.35; unprotected sex: aPR 0.73, 95% CI 0.41–1.31); among illicit drug users, multiple partnerships and unprotected sex were common irrespective of incarceration history. These findings support the need for correctional facility- and community-based STI/HIV prevention efforts including STI/HIV education, testing, and care for current and former prisoners with and without drug use histories. Men with both illicit drug use and incarceration histories may experience particular vulnerability to STI/HIV, as a result of having disproportionate levels of concurrent partnerships and high levels of unprotected sex. We hypothesize that incarceration works in tandem with*

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drug use and other adverse social and economic factors to increase sexual risk behavior. To establish whether incarceration is causally associated with high-risk sex partnerships and acquisition of STI/HIV, a longitudinal study that accurately measures incarceration, STI/HIV, and illicit drug use should be conducted to disentangle the specific effects of each variable of interest on risk behavior and STI/HIV acquisition.

KEYWORDS *Incarceration, Drug use, Sexual behavior, HIV, Sexually transmitted infections, US*

BACKGROUND

HIV prevalence among state prison inmates in the US is four to five times higher than in the general population,^{1,2} and inmates experience a disproportionate burden of other sexually transmitted infections (STIs).^{3–8} During incarceration, inmates face the risk of forming new and sometimes coercive sex partnerships with individuals at high risk of infection.⁹ Furthermore, incarceration is a disruptive life event that destabilizes intimate partnerships.^{10–14} The absence of a stable partner, together with the stress of reintegration after incarceration, may lead newly released prisoners to engage in increased levels of multiple partnerships, including concurrent partnerships (multiple partnerships that overlap in time).^{9,15–19} Partnership concurrency is considered to be a particularly important determinant of STI/HIV transmission.²⁰

There is evidence that incarceration history is associated with high-risk sex partnerships including multiple and concurrent partnerships;^{15,17,21–25} however, most studies have been performed in small convenience samples. Given incarceration has become an important social force that likely influences STI/HIV epidemiology,^{9,26,27} a large, nationally representative study of this association is needed to best understand the potential population-level effects of incarceration on relationships and health.

When investigating STI/HIV risk among incarcerated populations, it is important to consider the potential role of drug use as a factor contributing to infection. Drug use is a determinant of high-risk behavior and infection,^{28–47} and substantial proportions of the US prison population report a history of heavy drug and alcohol use.⁴⁸ The effect of incarceration on STI/HIV risk may differ by drug use status. For example, incarceration may be more strongly associated with STI/HIV risk among drug users than nonusers. Incarceration's influence on sexual risk taking may be further heightened by drug-related effects on sexual behavior. In addition, drug users may have fewer economic and social resources to manage the disruption of incarceration than nonusers of drugs, leaving this group particularly vulnerable to the effects of incarceration on sexual risk behavior. In sum, drug use and incarceration may work in concert to influence risk behavior. Conducting analyses of incarceration and high-risk sex partnerships stratified by drug use history allows us to assess differences in these associations among drug users and nonusers and to determine whether STI/HIV prevention resources should be prioritized for specific populations of current and former inmates—those with versus those without drug use histories—or all former inmates regardless of drug use history.

We investigated population-level associations between incarceration and high-risk sex partnerships in a large, nationally representative sample of men aged 15 to 44 years in the US interviewed as part of the 2002 National Survey of Family Growth (NSFG Cycle 6). We aimed to measure associations between recent

incarceration and recent history of multiple and concurrent sex partnerships and unprotected sex, stratified by status of recent illicit drug use.

METHODS

The NSFG is a serial cross-sectional study of reproductive behaviors among US adults living in households. Data collection for Cycle 6 among men took place from March 2002 through March 2003.^{49,50} A total of 78% of the sampled participants responded to the interview, yielding 4,928 completed male interviews. When sample weights are applied in analyses to account for subsampling, nonlocation, nonresponse, and census estimates of the US population, the 2002 NSFG estimates are generalizable to the US household population of adults aged 15 to 44 years.⁵¹

The survey assessed demographic, socioeconomic, and behavioral characteristics including STI/HIV risk factors. Female interviewers administered survey items because there is evidence that both male and female respondents may be more likely to disclose sensitive information to female interviewers than male interviewers.⁵² Most survey items were assessed using computer-assisted personal interview (CAPI) technology. CAPI, a face-to-face interview method, allows the interviewer to build rapport with the respondent. CAPI was used to obtain detailed information on sex partnerships by asking each respondent to report the date (month and year) of first and last sexual intercourse with female sex partners. Because social desirability bias may prevent accurate reporting of sensitive behaviors, the most sensitive NSFG survey items were assessed using audio computer-assisted self-interviewing (ACASI). For example, ACASI was used to assess topics such as same-sex partnerships, incarceration, and illicit drug use history.

Members of our group have used the 2002 NSFG previously to measure factors associated with concurrent partnerships⁵³ and to describe concurrency characteristics⁵⁴ among men in the US.

Measures

Outcomes: High-Risk Sex Partnerships During CAPI, each respondent reported the month and year of first and last sexual intercourse with his current wife or female cohabiting partner and his three most recent female sex partners during the preceding 12 months, and whether a condom was used during the most recent sex act with each partner. Respondents were also asked in the ACASI section to report the number of male and female sex partnerships in the past 12 months. On the basis of these survey items, we defined four dichotomous indicators of high-risk sex partnerships.

A respondent who reported two or more partnerships (male or female) in the past 12 months was considered to have multiple partnerships (based on reports in CAPI and ACASI). A respondent was identified as having concurrent female partnerships in the past 12 months if he had at least two female partnerships that overlapped for at least 1 month in duration (based on reports in CAPI). Because a longer duration of concurrency may allow for a greater number of coital acts with concurrent partners, and hence greater STI/HIV transmission risk, we identified men who experienced at least one episode of long-duration female partnership concurrency in the past 12 months, in which female concurrent partnerships overlapped for 6 months or longer (based on reports in CAPI). We identified men who failed to use a condom during the most recent sex act with every female sex

partner named in the past 12 months as having unprotected sex (based on reports in CAPI). We examined unprotected sex among men with multiple partners in the past 12 months.

Exposure: Incarceration Incarceration was defined as a self-report of incarceration in a jail, prison, or juvenile detention facility in the past 12 months (based on reports in ACASI).

Stratification Variable: Drug Use We examined the association between incarceration and high-risk sex partnership outcomes by status of recent illicit drug use (based on reports in ACASI). We categorized men who used cocaine, crack, and/or injection drugs in the past 12 months as illicit drug users and all other men as nonusers of illicit drugs.

Covariables

On the basis of conceptual models and prior research, we considered the following potential confounders for inclusion in the final model: age, race, education, household income as a percent of the year 2000 poverty line, marital status, cohabitation with a marital or nonmarital partner, frequent binge drinking (defined as drinking five or more drinks within a couple of hours at least once per month) in the past 12 months, frequent marijuana use (at least once per month) in the past 12 months, and age at first vaginal intercourse (referred to from this point forward as age at first sex).

All variables were entered into models as dichotomous or nominal categorical variables with the exception of age at first sex, which was entered as a continuous variable after we confirmed linearity in the log prevalence of outcome variables.

Data Analysis

For all analyses, we used survey commands in Stata version 9.1 (Stata Corp., College Station, TX, USA) to account for the probability-based sampling.

We examined bivariable relationships between demographic, socioeconomic, and behavioral characteristics and illicit drug use status in the past 12 months, calculating Pearson chi-squared tests for survey data to statistically test the association between respondent characteristics and illicit drug use status.

We estimated unadjusted and adjusted prevalence ratios (PRs) and 95% confidence intervals (CIs) for the associations between incarceration and high-risk sex partnerships using a Poisson model with a log link and probability weights.^{55,56}

We included an incarceration by illicit drug use product-interaction term to estimate associations among illicit drug users and nonusers of illicit drugs separately and to evaluate whether associations differed significantly ($p < 0.15$ level). Adjusted models included age, race, educational attainment, poverty status, marital status, cohabitation status, and age at first sex. We also fit models with these variables and, in addition, frequent binge drinking and frequent marijuana use in the past 12 months and report these results where addition of these covariables affected the results.

RESULTS

Illicit Drug Use

Among the full sample of 4,928 respondents, 4,902 respondents had nonmissing data on cocaine, crack, and injection drug use in the past 12 months and were

included in the analysis. A total of 409 men (unweighted 8.3%) reported use of cocaine, crack, and/or injection drugs (illicit drug use) in the past 12 months. Illicit drug users most commonly reported use of cocaine (93%), followed by crack (24%), and injection drugs (7%; Table 1).

Background Characteristics, by Illicit Drug Use

Illicit drug use was not associated with race or income level. Illicit drug users, compared with nonusers of illicit drugs, were more likely to be youth aged 18–24 years (34% versus 23%), less likely to be married (23% versus 44%) or cohabitating (37% versus 53%), and less likely to have received a college education (15% versus 26%; Table 1).

Frequent binge drinking and frequent marijuana use in the past 12 months were much more common among illicit drug users (binge drinking 56%, marijuana use 56%) than among nonusers of illicit drugs (binge drinking 24%, marijuana use 10%).

Prevalence of Incarceration and High-Risk Sex Partnerships, by Illicit Drug Use

Illicit drug users were much more likely than nonusers to have been incarcerated in the past 12 months (16% versus 6%) and to have reported multiple partnerships (45% versus 18%) and concurrent partnerships (16% versus 6%) in the past 12 months (Table 1). All men with concurrent partnerships, regardless of illicit drug use, reported comparable levels of long-duration concurrent partnerships (43–47%). Among men reporting multiple partnerships in the past 12 months, illicit drug users were more likely to report unprotected sex during the most recent sex act with all female sex partners in the past 12 months (32%) than nonusers of illicit drugs (19%).

Associations between Incarceration and Multiple and Concurrent Sex Partnerships, by Illicit Drug Use

Nonusers of Illicit Drugs Among nonusers of illicit drugs, multiple partnerships were much more common among those who reported incarceration in the past 12 months (42%) than among those with no recent incarceration history (16%; Table 2). The unadjusted association between incarceration and multiple partnerships (PR 2.55, 95% CI 2.10–3.09) weakened but persisted after adjustment for sociodemographic characteristics and age at first sex (PR 1.66, 95% CI 1.43–1.93).

Among nonusers of illicit drugs, those who were incarcerated in the past 12 months were much more likely to have had concurrent partnerships (15%) than their counterparts with no recent incarceration history (5%; PR 3.11, 95% CI 2.13–4.57; Table 2). When adjusted for covariables, the association between incarceration and concurrency weakened but remained (PR 1.55, 95% CI 1.06–2.22).

Incarceration was not associated with having a long-duration concurrency among nonusers of illicit drugs (PR 1.00, 95% CI 0.68–1.49; Table 2).

Illicit Drug Users The association between incarceration and multiple partnerships was significantly weaker among illicit drug users than among nonusers of illicit drugs ($p < 0.001$ for the incarceration by illicit drug use interaction term; Table 2). Among illicit drug users, those who were incarcerated in the past 12 months had somewhat higher levels of multiple partnerships (54%) than their counterparts with no incarceration history in the past 12 months (43%). The weak association

TABLE 1 Sociodemographic and behavioral characteristics, by status of illicit drug use in the past year, among US men aged 15 to 44 years (2002 National Survey of Family Growth)

Respondent characteristics	Nonusers of illicit drugs (N = 4,493)		Illicit drug users (N = 409)		p value for differences in characteristics by illicit drug use status
	N	Weighted % ^a	N	Weighted % ^a	
Sociodemographic					
Age					
15–17 years	603	9.6	28	7.0	0.005
18–22 years	957	17.0	98	23.4	
23–24 years	316	5.6	50	11.0	
25–29 years	640	15.1	64	14.8	
30–34 years	667	16.8	54	14.1	
35–39 years	676	17.1	65	18.6	
40–44 years	634	18.7	50	11.1	
Race					
White	2,346	65.3	243	67.5	
Black	875	12.2	46	7.8	
Latino	1,016	16.5	105	19.0	
Other	256	6.1	15	5.7	
Marital/partnership status					<0.001
Married	1,169	43.6	56	23.4	
Formerly married	464	8.3	52	10.0	
Never married	2,860	48.1	301	66.7	
Cohabits with a marital or nonmarital partner					
No	2,986	47.4	313	62.9	
Yes	1,507	52.6	96	37.1	<0.001
Education ^b					0.017
Less than high school	463	13.5	55	13.5	
High school graduate	1,006	32.7	120	41.3	
Some college	898	27.7	74	30.6	
College graduate	750	26.1	49	14.5	

Household income as a percentage of 2000 poverty level ^b						
0–149%	685	20.6	73	21.1	0.9217	
150–249%	600	19.1	57	19.2		
250–399%	753	26.1	72	25.1		
≥400%	1,079	34.2	96	34.6		
Incarcerated in a jail, prison, or juvenile detention facility in the past year						
No	4,192	94.4	330	83.7	<0.001	
Yes	299	5.6	79	16.3		
Substance use						
Used cocaine in the past year						
No	–	–	24	7.1	–	
Yes	–	–	385	92.9		
Used crack in the past year						
No	–	–	309	76.3	–	
Yes	–	–	100	23.7		
Used injection drugs in the past year						
No	–	–	377	93.5	–	
Yes	–	–	32	6.5		
Monthly binge drinking (≥5 drinks in a couple of hours) in the past year						
No	3,372	76.2	163	44.2	<0.001	
Yes	1,113	23.8	245	55.8		
Monthly marijuana use in the past year						
No	3,966	90.0	192	44.5	0.001	
Yes	518	10.0	216	55.5		
Sexual behavior						
Age at first sex						
<12	128	2.1	25	5.5	<0.001	
12–13	337	6.3	50	9.8		
14–15	908	19.4	128	25.9		
16–17	1,213	29.1	113	35.7		
18–19	640	15.8	57	14.6		
20+	506	14.5	24	6.0		
No sexual intercourse	761	12.9	12	2.4		

TABLE 1 (continued)

Respondent characteristics	Nonusers of illicit drugs (N = 4,493)		Illicit drug users (N = 409)		p value for differences in characteristics by illicit drug use status
	N	Weighted % ^a	N	Weighted % ^a	
Multiple male or female partnerships in the past year					
No	3,342	82.2	190	55.1	<0.001
Yes	1,135	17.8	218	44.9	
Concurrent female partnerships in the past year					
No	4,123	94.5	338	83.9	<0.001
Yes	370	5.5	72	16.1	
Long-duration concurrent female partnerships in the past year (≥6 months) ^c					
No	197	53.5	40	56.9	0.700
Yes	173	46.5	32	43.1	
Unprotected sex with female partners ^d					
No	587	80.8	107	68.3	0.014
Yes	138	19.2	39	31.7	

Illicit drug use was defined as use of cocaine, crack, or injection drugs in the past year. Of 4,928 men interviewed during the 2002 NSFG, a total of 4,902 had nonmissing values for cocaine, crack, and injection drug use variables. Of these, 4,493 men were nonusers of illicit drugs and 409 men were illicit drug users. Totals may not sum to 4,493 nonusers of illicit drugs and 409 illicit drug users due to missing values

^aUse of survey commands to account for stratification, clustering, and unequal selection probabilities yielded nationally representative estimates. Percentages may not total 100 due to rounding off of values

^bAmong men aged ≥22 years (N=3,117 nonusers of illicit drugs and N=298 illicit drug users)

^cAmong men reporting any concurrent female partnerships in the past year (N= 370 nonusers of illicit drugs and N=72 illicit drug users)

^dAmong men reporting multiple female partnerships in the past year in CAPI (N=725 nonusers of illicit drugs and N=146 illicit drug users)

TABLE 2 Unadjusted and adjusted prevalence ratios (PR) and 95% confidence intervals (CI) for the associations between incarceration in the past year and high-risk partnerships in the past year, by status of illicit drug use in the past year, among US men aged 15 to 44 years (2002 National Survey of Family Growth)

Sexual partnerships	Nonusers of illicit drugs (N=4,493)				Illicit drug users (N=409)				p value for difference in the association between incarceration and high-risk partnerships by illicit drug use ^c
	Unadjusted		Adjusted ^b		Unadjusted		Adjusted ^b		
	% ^a	PR (95% CI)	PR (95% CI)	PR (95% CI)	% ^a	PR (95% CI)	PR (95% CI)	PR (95% CI)	
Multiple partnerships									
No incarceration in the past year	16.4	1	1	1	43.2	1	1	1	
Incarceration in the past year	41.7	2.55 (2.10–3.09)	1.66 (1.43–1.93)	1.66 (1.43–1.93)	53.7	1.24 (0.91–1.70)	1.03 (0.79–1.35)	1.03 (0.79–1.35)	<0.001
Concurrent partnerships									
No incarceration in the past year	4.9	1	1	1	13.8	1	1	1	
Incarceration in the past year	15.2	3.11 (2.13–4.57)	1.55 (1.06–2.22)	1.55 (1.06–2.22)	27.9	2.02 (1.01–4.03)	2.14 (1.07–4.29)	2.14 (1.07–4.29)	0.295
Long-duration concurrent female partnerships (≥6 months)									
No incarceration in the past year	46.5	1	1	1	30.6	1	1	1	
Incarceration in the past year ^d	46.7	1.00 (0.68–1.49)	1.02 (0.71–1.47)	1.02 (0.71–1.47)	74.9	2.45 (1.38–4.36)	1.51 (0.85–2.67)	1.51 (0.85–2.67)	0.012

Illicit drug use was defined as use of cocaine, crack, or injection drugs in the past year

^aUse of survey commands to account for stratification, clustering, and unequal selection probabilities yielded nationally representative estimates

^bAdjusted for age, race, educational attainment, poverty status, marital status, cohabitation status, and age at first sex

^cThe incarceration by illicit drug use status interaction term was tested in the unadjusted model

^dAmong men reporting any concurrent female partnerships in the past year in CAPI (N=370 nonusers of illicit drugs and N=72 illicit drug users)

between incarceration and multiple partnerships was not statistically significant in the unadjusted analysis (PR 1.24, 95% CI 0.91–1.70). When adjusted for sociodemographic characteristics and age at first sex, the PR was 1.03 (95% CI 0.79–1.35).

The associations between incarceration and concurrent partnerships were comparable among illicit drug users and nonusers of illicit drugs ($p=0.295$ for the incarceration by illicit drug use interaction term; Table 2). Among illicit drug users, the prevalence of concurrent partnerships was higher among those who were incarcerated in the past 12 months (28%) than among those with no recent incarceration history (14%; PR 2.02, 95% CI 1.01–4.03). Adjustment for sociodemographic characteristics and age at first sex somewhat strengthened the association (PR 2.14, 95% CI 1.07–4.29). When further adjusted for binge drinking and frequent marijuana use in the past 12 months, the PR weakened in magnitude but remained above 1.0; however, the estimate was no longer statistically significant (PR 1.71, 95% CI 0.90–3.24).

The association between incarceration and long-duration concurrency was significantly stronger among illicit drug users than among nonusers ($p=0.012$ for the incarceration by illicit drug use interaction term; Table 2). Among the 72 illicit drug users who had concurrent partners in the past 12 months, those who had been incarcerated in the past 12 months were much more likely to have had long-duration concurrency (75%) than did those with no recent incarceration history (31%; PR 2.45, 95% CI 1.38–4.36). When adjusting for sociodemographic characteristics and age at first sex, the association weakened but remained (PR 1.51, 95% CI 0.85–2.67).

Associations between Incarceration and Unprotected Sex, by Illicit Drug Use

Nonusers of Illicit Drugs Among nonusers of illicit drugs with multiple partners in the past 12 months, unprotected sex during the most recent sex act with every sex partner was much more likely among those who had been incarcerated in the past 12 months (33%) than among those with no recent incarceration history (17%; PR 1.89, 95% CI 1.28–2.80; Table 3). The estimate remained when adjusted for covariables (PR 1.99, 95% CI 1.45–2.72).

Illicit Drug Users The associations between incarceration and unprotected sex appeared to be weaker among illicit drug users than among nonusers of illicit drugs; however, the estimates did not differ significantly ($p=0.415$ for the incarceration by illicit drug use interaction term; Table 3). Among illicit drug users who reported multiple partners in the past 12 months, a substantial proportion reported unprotected sex during the last sex act with every sex partner, with comparable levels observed among those who had been incarcerated in the past 12 months (38%) and those with no recent incarceration history (30%; PR 1.30, 95% CI 0.62–2.76; adjusted PR 0.73, 95% CI 0.41–1.31).

DISCUSSION

In this nationally representative sample of adult men aged 15 to 44 years, those who were recently incarcerated were much more likely to report high-risk sex partnerships than those without recent incarceration histories. Use of the 2002 NSFG, a large, nationally representative dataset, enabled us to document the association

TABLE 3 Unadjusted and adjusted prevalence ratios (PR) and 95% confidence intervals (CI) for the associations between incarceration in the past year and unprotected sex, by status of illicit drug use in the past year, among US men aged 15 to 44 years reporting multiple female partnerships in the past year (2002 National Survey of Family Growth)

	Nonusers of illicit drugs (N=725)				Illicit drug users (N=146)				<i>p</i> value for difference in the association between incarceration and condom use by illicit drug use ^c
	Unadjusted		Adjusted ^b		Unadjusted		Adjusted ^b		
	% ^a	PR (95% CI)	POR	(95% CI)	% ^a	PR (95% CI)	PR (95% CI)		
Unprotected sex									
No incarceration in the past year	17.2	1	1		29.5	1	1		
Incarceration in the past year	32.5	1.89	1.28–2.80	1.99	1.45–2.72	1.30	0.62–2.76	0.73	0.41–1.31
									0.415

We identified men who failed to use a condom during the most recent sex act with every female sexual partner in the past 12 months as having unprotected sex. Illicit drug use was defined as use of cocaine, crack, or injection drugs in the past year

^aUse of survey commands to account for stratification, clustering, and unequal selection probabilities yielded nationally representative estimates

^bAdjusted for age, race, educational attainment, poverty status, marital status, cohabitation status, and age at first sex

^cThe incarceration by illicit drug use status interaction term was tested in the unadjusted model

between incarceration and high-risk sex partnerships at the national level and to conduct analyses among illicit drug users and nonusers of illicit drugs separately. Estimating associations stratified by drug use allowed us to unmask differences in associations between incarceration and each sexual risk behavior by drug use status while controlling for confounding related to use of illicit drugs. Our findings support the hypothesis that incarceration may contribute to sexual risk behavior both among illicit drug users, a high-risk sample, and nonusers of illicit drugs, the majority population. These results support existing evidence of an association between incarceration and sexual risk behavior among both high-risk^{22,23,25} and general population samples^{21,24} and highlight the need for STI/HIV prevention and treatment among former and current prisoners regardless of drug use history.

Among men who had not used illicit drugs in the past 12 months, the majority of the sample, recent incarceration was strongly associated with multiple and concurrent partnerships and unprotected sex independent of sociodemographic factors, age at first sex, and frequent binge drinking or marijuana use in the past 12 months. The findings suggest that the association between incarceration and high-risk sex partnerships cannot be discounted as a function of adverse background factors such as poverty, low educational opportunity, or drug use. Among the most important determinants of STI/HIV transmission dynamics are rates of new and multiple partnerships,^{57,58} with multiple concurrent partnerships considered to be a particularly important determinant.^{20,59-64} The experience of incarceration may contribute to both multiple and concurrent partnerships among nonusers of drugs.

The findings also indicated that, among illicit drug users, incarceration was associated with disproportionate levels of concurrent partnerships above and beyond an already high-risk referent group (i.e., illicit drug users with no incarceration history) when adjusting for background sociodemographic characteristics and age at first sex. Furthermore, illicit drug users who had been incarcerated in the past 12 months were twice as likely as their counterparts with no recent incarceration to have had long-duration concurrent partnerships. Because concurrent partnerships are an important determinant of STI/HIV,^{20,59-64} concurrent partnerships that overlap for long periods of time may be associated with greater STI/HIV transmission risk than concurrent partnership episodes of short duration, such as one-time encounters. High prevalence of concurrent partnerships and long-duration concurrency, with high levels of inconsistent condom use, indicated that illicit drug users with incarceration histories and their sex partners likely experience particular vulnerability to STI/HIV.

When estimating the association between incarceration and partnership concurrency among illicit drug users, further adjustment for recent binge drinking and marijuana use attenuated the estimate. Though the association remained well above one, the modest sample size of men who reported illicit drug use (approximately 400 men) limited statistical power and the estimate was no longer statistically significant. The findings suggested that use of alcohol and “soft” drugs such as marijuana may constitute important and modifiable factors underlying disproportionate levels of concurrent partnerships among illicit drug users with incarceration histories. The importance of drug use as a factor associated with STI/HIV risk was even further underscored by the finding that incarceration was not associated with multiple partnerships among illicit drug users; levels of multiple partnerships were disproportionately high among illicit drug users regardless of recent incarceration history. These findings further highlight the vulnerability of drug users to STI/HIV risk that has been documented previously.²⁸⁻⁴⁷ Substance use

treatment and prevention, a public health priority in itself, likely play an important role in STI/HIV prevention. While correctional facilities remain an important venue to reach those in need of STI/HIV testing, care, and prevention, drug treatment centers remain a natural setting to reach populations in need of these interventions.

While we considered binge drinking and marijuana use as potential confounders, it is also possible that incarceration—by increasing disruption and social isolation—contributed to the increased use of alcohol and “soft” drugs upon release from incarceration and hence is a mediator of the relationship. We hypothesize that incarceration works in conjunction with drug use and other adverse social and economic factors to increase sexual risk behavior in this group. Longitudinal studies are needed to follow prisoners after release from incarceration to evaluate whether increases in alcohol and drug use that occur after incarceration mediate the association between incarceration and sexual risk behavior.

Incarceration may contribute to high-risk sex partnerships because incarceration disrupts social and sexual networks. Incarceration destabilizes social ties including primary intimate partnerships,^{10–14} some of which appear to be protective against multiple and concurrent partnerships.^{53,65} Incarceration physically divides partners, resulting in loneliness and emotional division^{10–14} and, in some cases, partnership dissolution.^{12,13} After the incarceration, absence of a stable sex partner with stress of reintegration⁶⁶ may lead newly released prisoners to engage in increased levels of multiple and concurrent partnerships.^{9,15–19}

A number of important study limitations should be noted. First, since this study was cross-sectional, we do not know the temporal relationship between incarceration and sexual risk behavior and hence cannot conclude that incarceration contributed to high-risk sex partnerships. To establish whether incarceration is causally associated with high-risk sex partnerships and acquisition of STI/HIV, a longitudinal study should be conducted to accurately measure incarceration, sexual risk behavior, STI/HIV, and other important covariables such as drug use to disentangle the specific effects of each variable of interest on risk behavior and STI/HIV acquisition. Second, duration of incarceration was not assessed by the NSFG questionnaire. Men who were incarcerated in the past 12 months may have been incarcerated for a large proportion of the year prior to the survey, reducing their time at risk of experiencing postincarceration high-risk sex partnerships. This limitation would have led to an underestimation of the effect of incarceration on risk behaviors, as higher levels of risk behavior in the community may have been detected if men were followed for a full year after release from their incarceration. That said, men face the risk of multiple and concurrent partnerships in jails and prisons. Hence, incarceration may be associated with high-risk sex partnerships that occur both during and after incarceration. Third, the NSFG samples persons in households and excludes homeless or institutionalized, including incarcerated, populations. Drug use and risky sex partnerships are more likely among such persons.^{67,68} Selection bias due to omission of these populations may have affected our estimates. Another limitation is that this survey was not anonymous. While many sensitive topics including incarceration and drug use variables were assessed using ACASI, other topics including sex partnerships and condom use were assessed using CAPI and may have been subject to recall and social desirability biases.⁶⁹ Finally, the low prevalence of injection drug use in this general population sample and the limited measurement of onset, duration, frequency, and level of drug use prevented further investigation of the association between incarceration and high-risk sex partnerships within different subpopulations of drug users. If we had been able to

conduct additional subgroup analyses, we may have found differences in the association between incarceration and high-risk sex partnerships, for example, among injection drug users versus crack users or among those who were drug dependent versus those who were more casual drug users. Future studies conducted in high-risk samples should further explore relationships among incarceration, type and level of drug use, and STI/HIV risk.

The observation of an association between incarceration and sexual risk behavior supports the need for STI/HIV prevention efforts for current and former prisoners. Integration of drug abuse treatment into STI/HIV prevention interventions targeting those with a history of incarceration is needed to reduce drug-related morbidities and potentially improve response to STI/HIV prevention. Given the high rates of recidivism, prison- and jail-based STI/HIV prevention efforts should be strengthened, such as STI/HIV prevention education and STI/HIV testing and treatment. While STI testing based in correctional facilities is cost-effective,⁷⁰ it is estimated that less than half of jails offer routine testing for STI.⁷¹ Failure to test for STI/HIV in jails and prisons constitutes a missed opportunity to improve STI/HIV treatment and prevention in a vulnerable population with elevated risk of infection and decreased access to care relative to the general population. Community-based prevention efforts for former prisoners, upon release, are also needed. Our prior research in North Carolina has suggested that social venues where those with a history of incarceration are likely to socialize and meet sex partners are promising sites for community-based STI/HIV education, testing, and condom promotion.²⁵ In addition, drug treatment centers constitute existing community-based infrastructures that could be used to reach the formerly incarcerated and other vulnerable populations in need of both drug treatment and STI/HIV prevention and treatment.

In this investigation of incarceration and high-risk sex partnerships, we have explored one of the many determinants of STI/HIV among the formerly incarcerated. Additional studies are needed to determine the most important factors of STI/HIV transmission among incarcerated populations and to further investigate the effects of the incarceration itself on acquisition and transmission of infection.

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