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Incarceration and Risky Sexual Partnerships in a Southern US City

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ABSTRACT *Incarceration is strongly associated with HIV infection and may contribute to viral transmission by disrupting stable partnerships and promoting high-risk partnerships. We investigated incarceration and STI/HIV-related partnerships among a community-based sample recruited for a sexual behavior interview while frequenting venues where people meet sexual partners in a North Carolina city (N=373). Men reporting incarceration in the past 12 months were more likely than men without recent incarceration to experience multiple new sexual partnerships (unadjusted prevalence ratio [PR] 1.8, 95% confidence interval [CI]: 1.1–3.1) and transactional sex defined as trading sex for money, goods, or services (unadjusted PR: 4.0, 95% CI: 2.3–7.1) in the past 4 weeks. Likewise, women who were ever incarcerated were more likely than never-incarcerated women to experience recent multiple new partnerships (unadjusted PR: 3.1, 95% CI: 1.8–5.4) and transactional sex (unadjusted PR: 5.3, 95% CI: 2.6–10.9). Sexual partnership in the past 12 months with someone who had ever been incarcerated versus with partners with no known incarceration history was associated with recent multiple new partnerships (men: unadjusted PR 2.0, 95% CI 1.4–2.9, women: unadjusted PR 4.8, 95% CI 2.3–10.1) and transactional sex (men: unadjusted PR 3.3, 95% CI 1.7–6.6, women: unadjusted PR 6.1, 95% CI 2.4–15.4). Adjustment for demographic and socioeconomic variables had minimal effect on estimates. However, the strong overlap between incarceration, partner incarceration, and substance abuse had substantial effects in multivariable models. Correctional-facility and community-based HIV prevention, with substance abuse treatment, should reach currently and formerly incarcerated individuals and their sexual partners.*

KEYWORDS *Incarceration, Poverty, Sexual behavior, HIV, Sexually transmitted infections, African Americans, Southern U. S., North Carolina*

INTRODUCTION

Incarceration is strongly associated with sexually transmitted infections (STIs) including human immunodeficiency virus (HIV). In 2004, prison inmates were three

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to five times more likely to be HIV-infected than those in the United States (U. S.) general population.[1,2] In 1999, greater than one-fifth of all HIV-positive persons in the U. S. passed through a U. S. correctional facility.[3] HIV infection also appears to be common among the partners of persons with an incarceration history.[4]

The association between incarceration and STI/HIV infection may exist, in part, because incarceration disrupts stable sexual partnerships that protect against new, multiple, and concurrent sexual partnerships, determinants of STI/HIV infection. Both history of incarceration and having a recent sexual partner who was incarcerated were associated with concurrent sexual partnerships[5–7] and sex work[8] in exploratory studies. As incarceration is endemic in many communities, careful investigation into the association between incarceration and risky sexual partnerships, accounting for incarceration exposures that precede sexual partnership outcomes and adjusting for potential confounding factors, is warranted.

We aimed to examine the association between incarceration and risky sexual partnerships in North Carolina, a state with high incidence of STI/HIV.[9] We conducted the study in a moderately sized city affected by elevated levels of STI/HIV, substance abuse, crime, poverty, and incarceration. A research team including representatives of the local Department of Health, local nongovernmental organizations, and the University of North Carolina at Chapel Hill (UNC-CH) Carolina Population Center and Center for AIDS Research implemented the North Carolina Priorities for Local AIDS Control Efforts (NC PLACE) Study to identify social venues within the study area where levels of new, multiple, and concurrent sexual partnerships were high. One PLACE Study objective was to investigate associations between incarceration—both respondent's personal incarceration and sexual partnership with someone who was incarcerated—and risky sexual partnerships among the sample of individuals recruited for a sexual behavior interview at social venues.

METHODOLOGY

Study Design

We conducted the NC PLACE Study from August through October 2005. The PLACE methodology has been described in detail elsewhere.[10] Briefly, field work was implemented in three phases. In the first phase, we interviewed community informants assumed to be knowledgeable about the area ($N=120$ informants) to identify a list of all social venues where people meet new sexual partners in the study city. In the second phase, we visited each venue identified by community informants ($N=146$ venues) to verify the venue address and interview a venue representative about the potential for on-site HIV/AIDS intervention. We attempted to visit each venue at least twice if initially closed. We eliminated venues from the venue list if they could not be located ($N=3$ of 146) or if the venue manager requested that no further interviewing take place at their venue ($N=12$ of 146). In the final phase, we administered a structured face-to-face sexual behavior survey to individuals of unknown-HIV status socializing at a random sample of the verified social venues ($N=54$ of 131 venues). To ensure that the selection of social venues represented different populations within the study area, we selected venues within the strata of different venue types. We attempted interviews at a total of 54 venues to obtain a target number of 500 interviews. The number of social interviews attempted per venue was based on venue size, estimated by the venue representative as the number of men and women who socialized daily at his or her venue. Interviewers attempted to recruit a ratio of two

men to one woman, because data obtained from venue representatives indicated that men comprised a higher proportion of the venue population than women.

To select a representative sample of individuals socializing at each venue, a protocol was followed that distributed interviewers systematically throughout the venue to minimize interviewer discretion in selecting respondents by convenience. Interviewers brought the respondents to a private area to protect confidentiality during the interview, obtained verbal informed consent for an anonymous 15- to 20-min interview, and confirmed that respondents were at least 18 years old and sober. Interviewers did not systematically offer incentives. Potential respondents who reported hunger were offered a small snack. Those who asked to be compensated for the interview were offered a small snack or token gift (value of less than $1).

The UNC-CH School of Public Health Institutional Review Board provided ethical approval for the study.

Measures

Outcome: Sexual Partnerships We examined two dichotomous outcomes. We defined multiple partnerships as report of having at least two new sexual partners in the past 4 weeks. We defined transactional sex as report of having given or received money, goods, or services for sex in the past 4 weeks.

Exposure: Incarceration

Respondent's Incarceration We defined a dichotomous indicator of respondent's personal incarceration as incarceration for longer than 24 h in the past 12 months among men, and lifetime history of incarceration for longer than 24 h among women. The exposure definition differed by gender because of the low prevalence of recent incarceration among women.

Partner's Incarceration We defined a dichotomous indicator of sexual partner's incarceration as having a sexual partner in the past 12 months who had ever been incarcerated for longer than 24 h.

Data Analysis

We performed analyses in Stata, version 8.0 (Stata Corp., College Station, TX). We calculated frequencies and/or means of demographic, socioeconomic, and behavioral variables separately by gender.

We estimated unadjusted and adjusted prevalence ratios (PR) and 95% confidence intervals (CIs) for the associations between each sexual partnership outcome and each incarceration indicator using generalized estimating equations (GEE) to account for clustering by the venue where the individual was interviewed.[11] We specified a log link, a Poisson distribution,[12,13] an exchangeable correlation matrix structure, and a robust variance estimator to correct for overestimation of the error term resulting from the use of Poisson regression with binomial data.[14] As respondent's incarceration was estimated using different variables for men and women, we used two separate models to estimate the association between respondent's incarceration exposures and risky partnership outcomes for men and women separately. For consistency, we also used gender-stratified models to estimate associations between partner's incarceration and risky partnership outcomes;

preliminary analyses indicated that the associations between partner incarceration exposures and sexual partnership outcomes differed by gender.

We considered each of the following, identified as a potential confounding variable based on conceptual models and prior research, for inclusion in each adjusted model: age, black race, less than high school education, currently unemployed, respondent substance abuse (used injection drugs, crack/cocaine, ecstasy, speed, or crystal methamphetamine in past 12 months), and partner crack/cocaine use (had a partner in the past 12 months who used crack/cocaine). We did not assess alcohol during the survey in efforts to minimize questionnaire length; obtaining specific and interpretable data on alcohol consumption necessitated a series of questions. For models examining the association between sexual partnership outcomes and respondent's incarceration history, we assessed confounding by partner's incarceration history. For models examining the association between sexual partnership outcomes and partner's incarceration history, we assessed confounding by respondent's incarceration history. We assessed linearity in the log prevalence by age. The assumption was not upheld, so age was coded as two indicator variables. All other variables were dichotomous.

For each adjusted model, we used a manual change in estimate backward elimination procedure to identify the particular set of confounding variables necessary to include in each final model.[15] We ensured that the PR derived from each final model was no greater than 10% different than the PR derived from the fully adjusted model, which included all potential confounding variables listed above.

RESULTS

Recruitment

The venues identified by community informants from which the study population was recruited were diverse and included bars and clubs, eating establishments, public areas, hotels, parks, parking lots, abandoned fields, and outside of private homes. At five of the 54 venues, no interviews were completed because the one person at each venue who was available and recruited for the interview refused to participate. At the remaining 49 venues, a total of 144 of 185 eligible women (78%) and 229 of 309 eligible men (74%) agreed to participate in the interview. Participation levels were higher among African Americans (79%) than Whites (70%) or other races (54%).

Study Population

Demographic and Socioeconomic Characteristics The mean age among men (33 years) was slightly older than the mean age among women (31 years), although the gender-specific age distributions were similar (Table 1). Approximately two-thirds of the sample was African American. Greater than 90% of respondents resided in the study city. Approximately one-third of men and one-quarter of women had not completed high school. Unemployment was reported by greater than one-third of men and women. Recent worry about food security was common among men (18%) and women (21%).

Substance Abuse A substantial proportion of participants reported using injection drugs, crack/cocaine, ecstasy, speed, or crystal methamphetamine in the past 12 months (33% men, 20% women), with crack/cocaine use reported by the greatest percentages (31% men, 19% women) (Table 1).

TABLE 1 Demographic, socioeconomic, and behavioral characteristics and sexually transmitted infections among men and women aged 18 to 67 years socializing at venues where people meet sexual partners in a North Carolina city (PLACE Method, 2005) (*n* = 373)

	Men *N* = 229	Women *N* = 144
Characteristic	*n** (%)	*n** (%)
Demographic		
Age (years)	17 (7.4)	14 (9.7)
18–19	52 (22.7)	31 (21.5)
20–24	44 (19.2)	29 (20.1)
25–29	25 (10.9)	19 (13.2)
30–34	31 (13.5)	19 (13.2)
35–39	23 (10.0)	16 (11.1)
40–44	37 (16.2)	16 (11.1)
45+	17 (7.4)	14 (9.7)
Race		
African American	154 (67.3)	93 (64.6)
White	53 (23.1)	44 (30.6)
Other	10 (4.4)	4 (2.8)
Residency		
In the study town	214 (93.5)	134 (93.1)
Outside the study town	15 (6.6)	10 (6.9)
Socioeconomic status		
Educational attainment		
8th grade or less	13 (5.7)	3 (2.1)
Some high school	61 (26.6)	34 (23.6)
High school graduate or equivalent	108 (47.2)	62 (43.1)
Vocational or trade school	8 (3.5)	5 (3.5)
Some college or 2 year degree	26 (11.4)	28 (19.4)
Finished college	12 (5.2)	9 (6.3)
Master's or advanced degree	1 (0.4)	0 (0.0)
Employment		
Employed full or part time	142 (62.0)	91 (63.2)
Unemployed	79 (34.5)	49 (34.0)
Slept in homeless shelter or on street the night before the interview		
No	211 (92.1)	136 (94.4)
Yes	17 (7.4)	6 (4.2)
Worried about having enough food for self or family in the past 4 weeks		
No	184 (80.4)	109 (75.7)
Yes	40 (17.5)	30 (20.8)
Substance abuse (Past 12 months)		
Used any illicit drugs†		
No	150 (65.5)	110 (76.4)
Yes	75 (32.8)	29 (20.1)
Injected drugs		
No	214 (93.5)	135 (93.8)
Yes	12 (5.2)	4 (2.8)
Used crack/cocaine		
No	157 (68.6)	112 (77.8)
Yes	70 (30.6)	27 (18.8)

TABLE 1 ***Continued***

Characteristic	Men $N=229$ *n** (%)	Women $N=144$ *n** (%)
Used crystal methamphetamine or ecstasy		
No	211 (92.1)	134 (93.1)
Yes	16 (7.0)	5 (3.5)
Used speed		
No	213 (93.0)	135 (93.8)
Yes	13 (5.7)	4 (2.8)
Exposure to incarceration		
Ever incarcerated for >24 hours‡		
No	125 (54.6)	103 (71.5)
Yes	96 (41.9)	41 (28.5)
Incarcerated in the past 12 months (men only)‡		
No	173 (75.6)	–
Yes	48 (21.0)	–
Had a partner in the past 12 months who was ever incarcerated for >24 hours‡		
No	150 (65.5)	96 (66.7)
Yes	39 (17.0)	26 (18.1)
Sexual behavior		
Visited the social venue daily		
No	125 (54.6)	86 (59.7)
Yes	103 (45.0)	54 (37.5)
Had at least one new sex partner in the past 12 months		
No	63 (27.5)	57 (39.6)
Yes	156 (68.1)	77 (53.5)
Used a condom with the most recent new partner§		
No	22 (14.1)	19 (24.7)
Yes	121 (77.6)	55 (71.4)
Had at least two new sex partners in the past 4 weeks‖		
No	165 (72.1)	104 (72.2)
Yes	57 (24.9)	31 (21.5)
Transactional sex: Gave or received money for sex in the past 4 weeks‖		
No	185 (80.8)	116 (80.6)
Yes	35 (15.3)	25 (17.4)
Sexually Transmitted Infections (STIs) and HIV		
Had a symptom of an STI in the past 12 months		
No	206 (90.0)	112 (77.8)
Yes	18 (7.9)	22 (15.3)
HIV testing		
Been tested for HIV within the past 12 months	115 (50.2)	85 (59.0)
Been tested for HIV more than one 12 months ago	49 (21.4)	22 (15.3)
Never been tested for HIV	62 (27.1)	32 (22.2)

*Totals may not sum to 229 among men or 144 among women because of missing values

†Injected drugs or used crack/cocaine, ecstasy, speed, or crystal methamphetamine.

‡Incarceration exposures examined in bivariable and multivariable analyses (see Table 2). Respondent incarceration history was defined as ever incarceration for >24 h among women and incarceration for >24 h in the past 12 months among men. Partner incarceration history was defined as having a partner in the past 12 months who was ever incarcerated for >24 h among men and women.

§Among the 156 men and 77 women who reported having a new partner in the past 12 months.

‖Sexual behavior outcomes examined in bivariable and multivariable analyses (see Table 2).

Incarceration The incarceration exposures examined in the main analysis—personal incarceration and sexual partnership with someone who spent time incarcerated—were commonly reported (Table 1). Among men, approximately 21% reported incarceration for longer than 24 h in the past 12 months and 17% had a sexual partner in the past 12 months who had ever been incarcerated. Among women, 29% reported ever being incarcerated for longer than 24 h and 18% had a sexual partner in the past 12 months who had ever been incarcerated.

Sexual Behavior and Self-Reported Sexually Transmitted Infections Daily visits to the PLACE social venues were common among the participants (45% men, 38% women) (Table 1). The majority of the sample reported having at least one new sexual partner in the past 12 months (68% men, 54% women). Substantial proportions of participants reported the sexual partnership outcomes examined in the main analysis: multiple new sexual partnerships in the past 4 weeks (25% men, 22% women) and transactional sex in the past 4 weeks (15% men, 17% women).

Among persons with a new partner, reported condom use at last sex with a new partner was high (78% men, 71% women). Approximately 15% of women and 8% of men reported symptoms suggestive of an STI in the past 3 months, including pain on urination (men), discharge from the penis (men), unusual vaginal discharge (women), lower abdominal pain (women), and/or genital ulcers (men and women). Half of men and 59% of women received an HIV test in the past 12 months, and an additional 21% of men and 15% of women were tested more than 1 year ago.

Associations: Incarceration and Sexual Partnerships

Men Men who were incarcerated in the past 12 months had a higher prevalence of multiple new sexual partnerships in the past 4 weeks than men without a recent history of incarceration (unadjusted PR 1.83, 95% CI 1.07–3.11) (Table 2). After adjustment for demographic and socioeconomic variables, respondent substance abuse in the past 12 months, partner crack/cocaine use in the past 12 months, and incarceration of a recent sexual partner, the association remained although the precision decreased and the estimate was no longer statistically significant (adjusted PR 2.09, 95% CI 0.91–4.81).

Similarly, men who were incarcerated in the past 12 months were four times more likely to report transactional sex in the past 4 weeks than men without recent incarceration history (unadjusted PR 4.01, 95% CI 2.28–7.07, Table 2). After adjustment, the PR was reduced to 2.62 (95% CI 1.42–4.83). The decrease in the PR was primarily because of adjustment for respondent substance abuse history.

Among men, partner's incarceration was associated with twice the prevalence of multiple new sexual partnerships in the past 4 weeks *versus* no partner's incarceration (unadjusted PR 2.01, 95% CI 1.39–2.90). After adjustment, the PR became 1.02 (95% CI 0.57–1.83). When sexual partner's crack/cocaine use and respondent's incarceration were excluded from the model, but other confounding variables were included, the adjusted PR for sexual partner's incarceration and multiple new sexual partnerships was 1.82 (95% CI 1.29–2.57), indicating the strong confounding effect of these two variables. Partner incarceration status was highly correlated with partner substance abuse and the individual's own incarceration status. Among men reporting incarceration of a recent partner, 72% had a recent partner who used crack/cocaine and 39% reported personal incarceration in the past 12 months. In contrast, among men not reporting partner's incarceration, 19% reported partner's crack/cocaine use and 15% reported recent personal incarceration.

TABLE 2 Prevalence ratios (PRs) and 95% Confidence intervals (CIs) for the associations between incarceration and risky sexual partnerships among men and women aged 18 to 67 years socializing at venues where people meet sexual partners in a North Carolina city (PLACE Method, 2005) ($n=373$)

	≥2 New sex partners in the past 4 weeks			Transactional sex in the past 4 weeks		
	Percent	Unadjusted*	Adjusted*†‡§	Percent	Unadjusted*	Adjusted*†‡§
Men						
Ever been incarcerated for >24 h within the past 12 months						
No ($N=173$)	21.4	Ref	Ref	8.7	Ref	Ref
Yes ($N=48$)	37.5	1.83 (1.07, 3.11)	2.09 (0.91, 4.81)	41.7	4.01 (2.28, 7.07)	2.62 (1.42, 4.83)
Had a sexual partner in the past 12 months who was ever incarcerated for >24 h						
No ($N=150$)	19.3	Ref	Ref	6.7	Ref	Ref
Yes ($N=39$)	38.5	2.01 (1.39, 2.90)	1.02 (0.57, 1.83)	25.6	3.32 (1.67, 6.62)	1.34 (0.75, 2.39)
Women						
Ever been incarcerated >24 h						
No ($N=103$)	12.6	Ref	Ref	7.8	Ref	Ref
Yes ($N=41$)	43.9	3.13 (1.80, 5.44)	1.54 (0.59, 4.06)	41.5	5.34 (2.61, 10.90)	3.22 (0.70, 14.71)
Had a sexual partner in the past 12 months who was ever incarcerated for >24 h						
No ($N=96$)	10.4	Ref	Ref	6.3	Ref	Ref
Yes ($N=26$)	50.0	4.81 (2.28, 10.12)	5.27 (2.19, 12.68)	38.5	6.07 (2.39, 15.42)	1.64 (0.71, 3.80)

*All PRs were estimated using the generalized estimating equations methodology, which takes into account nonindependence of responses resulting from clustering by site of the interview.

†Adjusted for any of the following demographic, socioeconomic, and substance abuse variables, if identified as confounders using the backward elimination strategy of model building: age, race, education, employment, respondent's substance abuse, and partner crack/cocaine use.

‡In models examining respondent's incarceration as an exposure, we assessed confounding by sexual partner's incarceration.

§In models examining sexual partner's incarceration as an exposure, we assessed confounding by respondent's incarceration.

Partner's incarceration was also strongly associated with transactional sex in the past 4 weeks (unadjusted PR 3.32, 95% CI 1.67–6.62). After adjustment, the PR was 1.34 (95% CI 0.75–2.39). Again, adjustment for partner's substance abuse and respondent's incarceration affected the adjusted estimate. Interestingly, among men who reported partner's incarceration and transactional sex ($n=10$), *all* reported partner's substance abuse. Excluding partner's substance abuse and personal incarceration from the model, the association between partner's incarceration and transactional sex was robust (PR 2.46, 95% CI 1.23–4.90).

Women Women who had ever been incarcerated were three times more likely to have had multiple new sexual partnerships in the past 4 weeks than women with no incarceration history (unadjusted PR 3.13, 95% CI 1.80–5.44) (Table 2). After adjustment, the PR was 1.54 (95% CI 0.59–4.06). If substance abuse and partner's incarceration status were excluded from the model, the PR was 2.47 (95% CI 1.11–5.47), demonstrating the profound effects of adjusting for these two variables. Substance abuse and partner's incarceration were strongly associated with incarceration status among women. Among women who had ever been incarcerated, 54% reported substance abuse and 50% reported having a partner who had been incarcerated (among women with non-missing values on these covariates). In contrast, among women without a history of incarceration only 8% reported substance abuse and 10% reported incarceration of a sexual partner.

History of incarceration was also strongly associated with transactional sex among women (unadjusted PR 5.34, 95% CI 2.61–10.90). The adjusted PR was 3.22 (95% CI 0.70–14.71). Once again, adjustment for substance abuse and partner's incarceration status had a pronounced effect on the estimate. When adjusting for all confounding variables except substance abuse and partner's incarceration, the association between incarceration history and transactional sex was strong (PR 4.38, 95% CI 2.14–8.96). Among women who reported both incarceration history and transactional sex ($n=17$), all but one woman abused substances in the past 12 months and 77% had a partner who was incarcerated (among women with non-missing values on these covariates).

Partner's incarceration was strongly associated with multiple new sexual partnerships in the past 4 weeks *versus* no partner's incarceration (unadjusted PR 4.81, 95% CI 2.28–10.12). After adjusting for confounding variables, including the woman's own incarceration history, sexual partner's incarceration was strongly associated with multiple new sexual partnerships (adjusted PR 5.27, 95% CI 2.19–12.68).

Among women, partner's incarceration was also associated with transactional sex in the past 4 weeks (PR 6.07, 95% CI 2.39–15.42). The adjusted PR was 1.64 (95% CI 0.71–3.80). The strong interrelationship described above between partner's incarceration with the woman's own incarceration and substance abuse was primarily responsible for the marked change. If we excluded personal incarceration history and substance abuse from the model, the PR would be 5.51 (95% CI 2.27–13.37).

DISCUSSION

STI/HIV-related sexual behaviors clustered among the formerly incarcerated and their sexual partners in this urban NC setting. Men and women reporting recent incarceration or recent sexual partnership with someone who spent time incarcer-

ated were much more likely to report multiple new sexual partnerships and transactional sex in the past 4 weeks than those without recent exposure to incarceration. Adjustment for demographic and socioeconomic confounding variables had little effect. In fully adjusted models adjusting for substance abuse variables, men's personal incarceration and women's sexual partnership with someone who had been incarcerated appeared to be independently associated with multiple new partnerships. However, the strong overlap between incarceration, partner incarceration, and substance abuse had substantial effects in some multivariable models.

Estimating an association between incarceration and sexual risk behaviors independent of confounding factors was a primary study objective. However, the reality is that incarceration and substance abuse were highly correlated among our respondents and the members of their sexual networks. We hypothesize that incarceration, substance abuse, and partner influences reciprocally contributed to one another and worked in tandem to increase sexual risk behaviors.

Although the NC PLACE Study was cross-sectional in design, incarceration exposures likely preceded sexual partnership outcomes. Therefore, we interpret these findings to suggest that incarceration not only was associated with but contributed to the development of risky sexual partnerships concurrently with other adverse factors. To disentangle the relationships among incarceration, substance abuse, and partner influences, a large longitudinal study would be necessary, although estimating independent effects of each of these factors on sexual risk behavior would still be difficult given the high correlation among them. The high prevalence of incarceration among this sample indicates the population-level importance of incarceration as a potential factor of STI/HIV transmission and highlights the need for more careful investigation of these relationships.

Our results confirm the association between personal incarceration and risky sexual partnerships observed in previous exploratory analyses. History of incarceration was associated with concurrent sexual partnerships among HIV-positive[6] and HIV-negative[7] African Americans in North Carolina and among a household sample of Seattle residents[5] and with sex workers among intravenous drug users in Vancouver.[8] These previous studies were limited by the broad categorization of incarceration as ever incarceration in the past 10 years or during the lifetime. The incarceration may have occurred much earlier than the sexual behavior outcomes measured, limiting the interpretation of the relationship.

We improved measurement of the association between personal incarceration and risky sexual behaviors by capturing recent exposure to incarceration, within the past 12 months for most measures, and obtaining data on sexual partnership outcomes in the past 4 weeks. In addition, we controlled for potential confounding factors identified through conceptual models representing the hypothesized causal effect of incarceration on sexual partnership. However, measurement of partner's incarceration was based on respondent report, an important limitation because many respondents may not be able to accurately report on their partners' prior experiences. Further, constraints on questionnaire length prevented more refined measurement of the timing and duration of the partner's incarceration. Another measurement limitation was the failure to measure recent incarceration among women. Because of the high prevalence of male incarceration at the national level,[16] when designing the NC PLACE Method sexual behavior survey, we were primarily interested in exploring the effect of male incarceration on partner vulnerability to STI/HIV infection.

The NC PLACE Study results also confirm prior findings that incarceration of a recent partner is an important factor associated with risky sexual partnerships.

Having a recent partner who was ever incarcerated was associated with concurrent sexual partnerships among HIV-positive and HIV-negative African Americans in North Carolina.[6,7] The current study suggested that multiple sexual partnerships and transactional sex, in addition to partnership concurrency, were likely important variables in the pathway between incarceration and elevated levels of STI/HIV infection among those whose sexual partners had a history of incarceration.

The disruptive effect of incarceration on relationships has been well documented and provides a rationale for why incarceration may be causally associated with risky sexual partnership. Incarceration physically separates partners in stable relationships, which can lead to loneliness and emotional division[17–24] and could result in partnership dissolution.[20,22,25] For example, among the NC PLACE Study sample, approximately 10% reported that incarceration was a reason that a serious sexual partnership of 1 year or longer in duration permanently ended. Absence of a stable partnership may contribute to multiple, new, or concurrent partnerships among the partners of prisoners during the incarceration[20] or among the prisoners at the time of release.[26] During an incarceration, the prisoner's partner may seek other partners to fill an emotional or financial void.[20] Absence of a partner, combined with freedom from restrictions on sexual behavior, may lead newly released prisoners to risky sexual partnerships.[26]

Isolating an effect of incarceration independent of factors such as substance abuse and partner characteristics not only is difficult methodologically, but may be inappropriate from a public health perspective. Numerous studies have indicated the strong associations between substance abuse and both incarceration[27] and risky behaviors and/or sexually transmitted infections.[28–43] When interpreting results for the purpose of planning interventions, whether substance abuse preceded or resulted from incarceration is irrelevant. The reality is that these two adverse experiences were highly interconnected, and that HIV interventions, whether based in the community or in prisons, should include substance abuse programs to improve uptake of HIV prevention.

The NC PLACE Study recruited individuals socializing at sites identified as places where people meet new sexual partners, a sample expected to have risky sexual behaviors and, likely, elevated levels of other adverse experiences such as incarceration and substance abuse. Estimates were therefore not representative of the general population living in the NC study city, a study limitation. However, a distinct strength of the PLACE method is access to a high-risk population in particular need of STI/HIV intervention. High prevalence of both incarceration and sexual risk behaviors among the NC PLACE Study sample enabled estimation of the associations between incarceration and risky sexual partnership variables, despite the modest sample size. The NC PLACE Study indicated that the subpopulation of individuals exposed to incarceration experienced particular vulnerability to STI/HIV-related sexual behaviors *above and beyond* an already high-risk referent group.

The observation of a strong association between incarceration history and sexual risk behaviors supports the need for STI/HIV prevention efforts targeting former prisoners and their partners. Given high rates of recidivism, prison- and jail-based STI/HIV interventions should be strengthened, such as STI/HIV testing and STI/HIV prevention education based in correctional facilities. In addition, community-based efforts should be designed for partners of those incarcerated and newly released prisoners. In particular, whereas it is encouraging that reported condom use with recent new partners was high among this sample, condom use

misreporting because of recall or social desirability biases is also likely;[44] HIV prevention targeting those affected by incarceration should include increased access to condoms and promotion of condom use. Social venues where those with a history of incarceration are likely to socialize and meet new sexual partners, such as those identified in the NC PLACE Study, are prime candidates for community-based interventions including condom promotion and HIV/AIDS education and HIV testing. Inclusion of substance abuse treatment in HIV/AIDS prevention programming developed for those affected by incarceration will likely be a critical component of decreasing HIV-related sexual behaviors and improving health.

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