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HIV Transmission Among Male Inmates in a State Prison System — Georgia, 1992–2005

The estimated prevalence of human immunodeficiency virus (HIV) infection is nearly five times higher for incarcerated populations (2.0%) (*1*) than for the general U.S. population (0.43%) (*2*). In 1988, the Georgia Department of Corrections (GDC) initiated mandatory HIV testing of inmates upon entry into prison and voluntary HIV testing of inmates on request or if clinically indicated. GDC offered voluntary HIV testing to inmates annually during July 2003–June 2005 and currently offers testing to inmates on request. During July 1988–February 2005, a total of 88 male inmates were known to have had both a negative HIV test result upon entry into prison and a subsequent confirmed positive HIV test result (i.e., seroconversion) during incarceration. Of these 88 inmates, 37 (42%) had had more than one negative HIV test result before their HIV diagnosis. In October 2004, GDC and the Georgia Division of Public Health invited CDC to assist with an epidemiologic investigation of HIV risk behaviors and transmission patterns among male inmates within GDC facilities and to make HIV prevention recommendations for the prison population. This report describes the results of that investigation, which identified the following characteristics as associated with HIV seroconversion in prison: male-male sex in prison, tattooing in prison, older age (i.e., age of >26 years at date of interview), having served ≥5 years of the current sentence, black race, and having a body mass index (BMI) of ≤25.4 kg/m^2 on entry into prison. Findings from the investigation demonstrated that risk behaviors such as male-male sex and tattooing were associated with HIV transmission among inmates, highlighting the need for HIV prevention programs for this population.

To describe the state's male inmate population and the 88 inmates known to have become HIV positive while in prison (i.e., seroconverters), investigators analyzed summary demographic data for all inmates and prison-movement and HIV-testing histories of seroconverters, all of which had been routinely collected for GDC administrative purposes. The HIV-testing and prison-movement histories of seroconverters were also analyzed to identify the facility in which HIV transmission occurred, defined as one in which a seroconverter had a negative HIV test followed by a subsequent positive HIV test confirmed by Western blot while incarcerated in the same facility.

To identify demographic characteristics and behavioral risk factors associated with HIV seroconversion, both an unmatched and a matched case-control study were conducted. Male inmates aged ≥18 years were eligible to participate in both studies. Case inmates had documented HIV seroconversion during the incarceration period. Control inmates had a negative result on their most recent HIV test (during 1997–2005) and had their HIV-negative status confirmed by repeat HIV testing on enrollment in the investigation. For the unmatched study, control inmates were randomly selected from a list of eligible inmates in the seven prisons in which the largest proportion of seroconverters were believed to have become infected with HIV. For the matched case-control study, to compare inmates with the same duration of exposure to risk for HIV transmission, control inmates were selected from the 31 prisons currently housing the case

INSIDE

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inmates and matched by sentence length (±2 years) and time already served (±2 years). After giving written, informed consent, inmates completed audio computer-assisted self-interviews (ACASI). No personally identifying information was collected in these interviews. To determine how behavioral risks for HIV infection changed during incarceration, the interview asked about sex, drug use, and tattooing behaviors during the 6 months before incarceration and during the incarceration period. Questions were also asked about knowledge regarding HIV transmission. Exact multivariate logistic regression was used to analyze unmatched data, and exact multivariate conditional logistic regression was used to analyze matched-pair data. After ACASI, investigators asked open-ended questions about strategies to reduce HIV transmission among inmates.

In October 2005, GDC housed 44,990 male inmates in 73 facilities; median age was 34 years (range: 15–88 years). A total of 28,350 (63%) were black, 16,364 (36%) were white, 50 were American Indian (0.1%), and 47 (0.1%) were Asian; race was not reported for 179 (0.4%). A total of 856 (1.9%) were known to be HIV infected, of whom 780 (91%) were infected before incarceration, and 732 (86%) were black.* During July 1988–February 2005 (the month in which the last seroconverter included in the investigation was identified), 88 male inmates had both a negative HIV test result upon entry into prison and a subsequent HIV seroconversion during incarceration. Of these 88 inmates, the median age at time of HIV diagnosis was 32 years (range: 21–58 years). Fifty-nine (67%) were black, and 29 (33%) were white. Diagnoses were made during September 1992–June 2003 for 47 (53%) inmates and during July 2003–February 2005 for 41 (47%). For 26 (30%) of the 88 seroconverters, the facility in which HIV transmission occurred was identified; for 34 (39%) seroconverters, the facility in which transmission occurred was narrowed to two. Of the 88 seroconverters, 11 were released from prison and two died before the start of the case-control study. Of the remaining 75 inmates, 68 (91%) were enrolled in both the unmatched and matched case-control studies as case inmates. Sixty-five (87%) unmatched control inmates and 70 (79%) matched control inmates who were eligible agreed to participate.

In multivariate analysis of the unmatched study, variables significantly associated with HIV seroconversion were male-male sex in prison, older age, having served ≥5 years of the

* Black persons are disproportionately affected by HIV/AIDS. Although blacks represent 12% of the U.S. population, an estimated 43% of all persons living with AIDS in the United States are black (*3*). In Georgia, an estimated 76% of new AIDS cases reported in 2004 were among blacks (additional information is available at http://dhr.georgia.gov/DHR/DHR_FactSheets/AIDS%20in%20Georgia%20Jan%2006%20rev.pdf).

current sentence, and having a BMI of ≤25.4 kg/m^2 on entry into prison.

Univariate analysis of matched case-control study data identified multiple demographic characteristics and risk behaviors as significantly associated with HIV seroconversion (Table 1). However, in the final multivariate logistic regression model, only four covariates were significantly associated with HIV seroconversion during incarceration: male-male sex in prison, receipt of a tattoo in prison, BMI of ≤25.4 kg/m^2 on entry into prison, and black race (Table 2).

Among 54 inmates (45 case and nine control) reporting male-male sex while in prison, 35 (78%) of 45 case inmates and four (44%) of nine control inmates reported no male-male sex during the 6 months immediately before incarceration. Among 54 inmates (case and control) who reported any male-male sex during incarceration, 39 (72%) reported consensual sex and 48 (89%) reported sex with other inmates. Exchange sex (e.g., for money, food, or cigarettes) and rape were also reported. Of 43 inmates (34 case and nine control) who reported any consensual sex, 13 (30%) reported using condoms or other improvised barrier methods (e.g., rubber gloves or plastic wrap). Of 14 (12 case and two control) inmates who reported any exchange sex, three (21%) reported using improvised barrier methods but not condoms; no barrier methods were used during rape. Of 59 inmates (48 case and 11 control) who reported having sex in prison, 36 (75%) case inmates and six (55%) control inmates reported intent to tell sex partners outside prison about unprotected sex in prison.

Of 68 inmates who reported receiving a tattoo in prison, 59 (87%) used clean tattooing equipment for at least one tattoo, 52 (76%) used bleach to clean tattooing equipment, two (3%) used tattooing equipment that was not cleaned, and seven (10%) did not know whether tattooing equipment was cleaned before they received at least one tattoo. Most inmates correctly identified that HIV can be transmitted through unprotected sex (88%), needle sharing (83%), and infected blood (78%). In 181 responses to open-ended questions about how to reduce HIV transmission in prison, inmates suggested that condoms be made available in prison (38%), that inmates receive HIV education (22%), and that inmates practice safe tattooing (13%).

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Editorial Note: This report indicates that HIV transmission among inmates in Georgia's prison system was associated with male-male sex and tattooing and highlights the need for more effective HIV prevention among inmates. Sex among inmates occurs (*4*), and laws or policies prohibiting sex among inmates have been difficult to implement or enforce. However, GDC might consider certain HIV prevention options (e.g., education, testing, and prevention counseling) proven to be effective for nonincarcerated populations; some of those prevention measures are being used in correctional settings within and outside the United States (*4*).

CDC recommends that HIV education, testing, and prevention counseling be made available to populations at increased behavioral or clinical risk for HIV infection, including inmates in correctional facilities (*5,6*). HIV prevention education in state prisons should address male-male sex, tattooing, and injection drug use that occurs during incarceration and risk behaviors that occur after release. Case studies of inmate-led HIV prevention interventions suggest that these interventions might engender more inmate trust of and cooperation with intervention staff (*4*). HIV education might also benefit correctional facility staff.

CDC recommends that HIV screening be provided upon entry into prison and before release and that voluntary HIV testing be offered periodically during incarceration. This investigation demonstrates that annual voluntary testing is useful; 41 (47%) of 88 HIV seroconverters were identified during the 2 years in which annual testing was offered. Prison HIV testing programs allow inmates to learn their HIV status and, if not infected, to learn protective behaviors to reduce their HIV infection risks (*7*). Inmates who test HIV positive should receive antiretroviral treatment and care in addition to prevention counseling to protect future sex partners; before release, they should receive discharge planning and linkages to care in the community. GDC provides treatment and care for HIV-infected inmates, provides a 30-day supply of antiretroviral drugs on release and, in 12 of 73 facilities, undertakes enhanced HIV discharge planning, which includes individualized case management, housing placement, substance abuse and mental health treatment referrals, enrollment in benefit programs, and referrals for assistance with employment and other social services.

Approximately 15% of inmates reported using improvised barrier protection methods during sex, and 38% recommended making condoms available in prisons. Providing condoms to sexually active persons is an integral part of HIV prevention interventions outside prisons. However, in most prison and jail settings, condoms are considered contraband (*4*). Condoms are provided to some inmates in state prisons in Mississippi and Vermont and jails in Los Angeles, New York, Philadel-

TABLE 1. Characteristics and self-reported human immunodeficiency virus (HIV) risk behaviors of prison inmates* who became HIV positive during incarceration, compared with matched controls* — Georgia state prison system, 2005

Characteristic/Behavior	Case inmates* No.	(%)	Controls* No.	(%)	Exact odds ratio	(95% CI†)	p-value
Age (yrs)							
Median (range)	36 (21–65)		42 (24–77)		—	—	**<0.01§**
≤26	10	(15)	3	(4)	Referent		
>26	58	(85)	65	(96)	0.3	(0.1–1.2)	0.09
Race¶							
White	23	(34)	28	(41)	Referent		
Black	45	(66)	40	(59)	1.4	(0.6–3.1)	0.47
Ethnicity							
Non-Hispanic	63	(93)	64	(94)	Referent		
Hispanic	4	(6)	4	(6)	1.3	(0.2–9.1)	1.0
Body mass index (kg/m^2) at entry							
Median (range)	23.8 (18.5–40.3)		27.4 (19.3–38.5)		—	—	**<0.01§**
>25.4**	17	(25)	45	(66)	Referent		
≤25.4	51	(75)	23	(34)	**4.5**	**(2.1–11.2)**	**<0.01**
Mental illness diagnosed in prison††							
No	40	(59)	52	(76)	Referent		
Yes	28	(41)	16	(24)	**2.7**	**(1.1–7.6)**	**0.03**
Had sex in prison							
No	20	(29)	57	(84)	Referent		
Yes	48	(71)	11	(16)	**10.3**	**(3.7–39.4)**	**<0.01**
Sex partners§§							
Any male-male sex	45	(66)	9	(13)	**8.2**	**(3.2–26.6)**	**<0.01**
New¶¶ male-male sex	*35*	*(73)*	*4*	*(36)*			
Any sex with other male inmate	40	(59)	8	(12)	**7.4**	**(2.9–24.1)**	**<0.01**
Any sex with male prison staff	22	(32)	4	(6)	**5.5**	**(1.9–22.0)**	**<0.01**
Any sex with female prison staff	15	(22)	6	(9)	2.8	(1.0–9.9)	0.06
Any sex with visitors or prison volunteers	6	(9)	0	(0)	**8.2**	**(1.2–>999.9)**	**0.03**
Any sex with other	7	(10)	0	(0)	**9.6**	**(1.4–>999.9)**	**0.02**
Nature of sexual encounter(s)***							
No sex	20	(29)	57	(84)	Referent		
Consensual sex only	31	(46)	8	(12)	**9.4**	**(3.0–40.0)**	**<0.01**
Exchange sex††† (no rape)	11	(16)	2	(3)	**9.5**	**(1.7–105.9)**	**<0.01**
Any rape as victim	6	(9)	1	(1)	10.1	(1.0–575.1)	0.05
Type of sex act§§§							
No sex	20	(29)	57	(84)	Referent		
Oral sex only	9	(13)	4	(6)	10.3	(1.0–589.6)	0.05
Insertive anal or vaginal sex (no receptive sex)	20	(29)	4	(6)	**10.6**	**(2.4–97.5)**	**<0.01**
Any receptive anal sex	19	(28)	3	(4)	**9.0**	**(2.1–80.0)**	**<0.01**
Injection drug user in prison							
No	61	(90)	67	(99)	Referent		
Yes	7	(10)	1	(1)	7.0	(0.9–315.5)	0.07
New¶¶ injection drug user	*4*	*(57)*	*1*	*(100)*			
Received tattoo in prison							
No	28	(41)	40	(59)	Referent		
Yes	40	(59)	28	(41)	**4.0**	**(1.3–16.4)**	**0.01**
New¶¶ tattoo recipient	*20*	*(50)*	*19*	*(68)*			

NOTE: Bolded values are statistically significant.

* Case inmates (n = 68) were male prison inmates who seroconverted to HIV in prison; controls (n = 68) were HIV-uninfected male prison inmates with comparable sentence lengths (±2 years) and time served (±2 years).

† Confidence interval.

§ Signed rank test.

¶ Races other than black or white were not included because no case inmates or matched control inmates were from other racial groups.

** A body mass index of ≤25.4 kg/m^2 approximately corresponded to the lowest quartile of body mass index among control inmates.

†† Received a diagnosis of mental illness at any time during the current incarceration; a mental illness was a condition included within the *Diagnostic and Statistical Manual of Mental Disorders, 4th Edition*, American Psychiatric Association, 1994.

§§ The referent group for each subcategory (i.e., any male-male sex, any sex with other male inmate, any sex with male prison staff, any sex with female prison staff, any sex with visitors or prison volunteers, and any sex with other) was the group of inmates who reported no sex with a person in that subcategory.

¶¶ Did not engage in the respective behavior (male-male sex, injection drug use, or tattoo receipt) during the 6 months before incarceration. The denominators for the three "new" categories were the total numbers of persons who engaged in the respective behavior (sex in prison, injection drug use in prison, and receipt of tattoo in prison).

*** Sexual encounters were assigned a risk hierarchy in order of increasing risk: no sex; consensual sex only; sex in exchange (with or without consensual sex but no rape); and sex as a rape victim (with or without consensual sex and/or sex in exchange).

††† Sex that was bartered in exchange for items (e.g., food, drugs, or cigarettes), money, social reasons (e.g., protection or gang initiation), or other unspecified reason.

§§§ Type of sex act was assigned a risk hierarchy in order of increasing risk: no sex, oral sex only, insertive anal or vaginal sex (with or without oral sex and with no receptive anal sex), and receptive anal sex (with or without insertive sex and/or oral sex).

TABLE 2. Exact multivariate conditional logistic regression analysis of characteristics and risk behaviors among prison inmates* who became HIV† positive during incarceration, compared with matched controls* — Georgia state prison system, 2005

	Case inmates*		Controls*				
Characteristic/Behavior	No.	(%)	No.	(%)	AOR§	(95% CI¶)	p-value
Any male-male sex in prison	45	(66)	9	(13)	10.1	(3.0–54.9)	<0.01
Received tattoo in prison	40	(59)	28	(41)	13.7	(1.5–390.6)	0.01
Body mass index ≤25.4 kg/m^2 at entry	51	(75)	23	(34)	3.8	(1.2–15.2)	0.02
Black race	45	(66)	40	(59)	3.7	(1.1–16.7)	0.03

NOTE: All values are statistically significant.
* Case inmates (n = 68) were male prison inmates who seroconverted to HIV in prison; controls (n = 68) were HIV-uninfected male prison inmates with comparable sentence lengths and time served.
† Human immunodeficiency virus.
§ Adjusted odds ratio.
¶ Confidence interval.

phia, San Francisco, and the District of Columbia (*4*). A recent survey in a large jail in a U.S. city reported that condom distribution was acceptable to most inmates and correctional officers (*8*). Departments of corrections with existing condom distribution programs should evaluate those programs to determine their effectiveness; departments of corrections without condom distribution programs should assess relevant state laws, policies, and circumstances to determine the feasibility and benefits and risks of implementing such programs.

Although no case of HIV transmission via tattooing has been documented, the procedure carries a theoretical risk for transmission if nonsterile equipment is used. In this investigation, receipt of a tattoo was associated with HIV seroconversion. Further investigation is required to explore commonalities in time frames, tattoo artists, or equipment among HIV-infected inmates who reported tattooing as their only risk behavior and to determine whether the association between tattooing and HIV seroconversion identified in this investigation is causal.

Black race was significantly associated with HIV seroconversion, although no differences in risk behaviors were identified among racial groups. HIV disproportionately affects blacks in the general population, and 86% of males who were already infected with HIV when they entered GDC facilities were black. Black-only sex or tattooing networks might exist in prisons, given that 63% of all male inmates and 86% of HIV-infected men in GDC facilities are black. If so, then black race might be a marker in the analysis for the choice of sex or tattooing partners within these networks. Having a BMI of ≤25.4 kg/m^2 also was significantly associated with HIV seroconversion, but the implications of this finding for HIV transmission and prevention are unclear. Although BMI was explored in the analysis as a physical characteristic associated with HIV seroconversion, insufficient data are available to determine whether a statistically significant association existed between lower BMI and reported rape.

The findings in this report are subject to at least three limitations. First, risk behaviors might differ between seroconverters identified through voluntary HIV testing and those refusing voluntary HIV testing, limiting representativeness. Second, recall bias might have affected the reporting of HIV risk behaviors. Finally, although ACASI interviews were conducted to provide privacy and reduce social desirability bias, inmates might have inaccurately reported HIV risk behaviors because sex between inmates, sex with correctional staff, injection drug use, and tattooing are illegal or forbidden by policy in this prison system.

In response to this investigation, GDC is evaluating options to modify existing HIV prevention education and house HIV-infected inmates in a limited number of facilities. Three state prison systems (Alabama, Mississippi, and South Carolina) house HIV-infected inmates in separate facilities to provide focused medical care. At least three other state prison systems (California, Florida, and Texas) house some HIV-infected inmates with advanced disease or those requesting separate housing in "centers of excellence" for medical care; HIV-negative and HIV-infected inmates mix for education, vocational training, religious, and other prison programs. However, separate housing of HIV-infected inmates is limited in that it 1) does not reduce the spread of other sexually transmitted, opportunistic, and bloodborne infections, 2) might increase the risk for tuberculosis outbreaks (*9*), 3) raises concerns about disclosure of inmates' HIV status and access to prison programs, and 4) does not prevent transmission by inmates who are unaware that they are infected or by HIV-infected corrections staff. No data are available on the effectiveness of separate housing for HIV-infected inmates as an HIV prevention strategy.

Although this investigation was conducted in a single state prison system, incarcerated populations in other correctional settings are at risk for HIV infection, both while in prison and after release into the community. Corrections officials, in partnership with public health officials, should assess the adequacy of existing programs and services for incarcerated populations and develop strategies to reduce HIV infection, both in prisons and in the community. This recommendation is consistent with one recently issued by the Presidential Advisory Council on HIV/AIDS, which called for improved HIV prevention in U.S. prisons, jails, and correctional facilities (*10*).

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Monitoring Poison Control Center Data to Detect Health Hazards During Hurricane Season — Florida, 2003–2005

Eight hurricanes made landfall in Florida from August 13, 2004, through October 24, 2005.* Each hurricane caused flooding and widespread power outages (*1–4*). In the fall of 2004, the Florida Department of Health (FDOH) began retrospectively reviewing data collected by the Florida Poison Information Center Network (FPICN) during the 2004 hurricane season. During the 2005 hurricane season, FDOH, in consultation with FPICN, initiated daily monitoring of FPICN records of exposures that might reflect storm-related health hazards. Analysis of these data determined that 28 carbon monoxide (CO) exposures were reported to FPICN in the 2 days after Hurricane Katrina made its August 25, 2005, landfall in Florida, en route to a second landfall on the Gulf Coast. Data on CO and other exposures were used to develop and distribute public health prevention messages to Florida communities affected by hurricanes.

FPICN, created by the Florida legislature in 1989, consists of poison control centers in Jacksonville, Miami, and Tampa and a data analysis unit in Jacksonville. Health professionals and the public can contact FPICN by calling a toll-free hotline available 24 hours a day. Specialists in poison information at each center collect exposure and substance information from callers and enter it into a local database; this information is then uploaded to a statewide database.

The statewide database includes a case narrative and patient identification information provided by the individual caller or clinician from a health-care facility. Information is coded following American Association of Poison Control Centers (AAPCC) guidelines regarding harmful substances, circumstances of exposure, clinical findings, disposition, and follow-up.† FPICN defines exposure as contact with a substance that could be harmful to health via ingestion, inhalation, injection, or mucosal membrane/dermal exposure.

FDOH selected the following hurricane-related exposures for daily monitoring in 2005 and retrospective review of data from 2004: CO; hydrocarbon fuels; batteries and fire/matches/explosives; bites/stings and snake bites; contaminated, polluted, or sewage water; and food poisoning (Table). For this analysis, exposures to smoke or exhaust gas (e.g., from motor vehicles) were not included as CO exposures. FDOH compared exposures from 30 days before and up to 1 week

* Hurricanes Charley, Frances, Ivan, and Jeanne in 2004 and Dennis, Katrina, Rita, and Wilma in 2005. Although Rita did not make a direct landfall, the hurricane swept past the Florida Keys, causing flood damage and power outages.
† Available at http://www.aapcc.org/poison1.htm.