

HIV seroprevalence and associated risk factors among male inmates at the Belize Central Prison

Ethan Gough¹ and Paul Edwards²

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ABSTRACT

Objectives. To determine the seroprevalence of HIV and identify associated risk factors among inmates at the Belize Central Prison, managed by the Kolbe Foundation, Belize.

Methods. A voluntary sample of 623 participants was obtained from the male inmate population incarcerated during the period from 15 January to 5 March 2005. HIV serostatus was determined on location using the Abbott Determine Assay for HIV-1/2 for screening, and the MedMira MiraWell Rapid HIV-1/2 Test for confirmatory testing. Remaining serum was tested by ELISA at the Central Medical Laboratory, Belize. Demographic and risk behavior data were collected using an interviewer administered pre-tested questionnaire. A multivariate logistic regression was used to adjust for potential confounders and to identify independent associations with HIV seropositivity.

Results. Of the 623 inmates in the sample, 25 tested positive for HIV-1/2 antibody for a seroprevalence of 4.0% (95% Confidence Interval 2.7, 6.0). After adjustment for confounding, HIV serostatus was positively associated with male-to-male sexual activity outside prison, age, and district of residence before current incarceration.

Conclusions. The seroprevalence in the Central Prison was almost twice that estimated for the adult population of Belize in 2004 (2.4%). However, the social variables of importance to inmates appeared to reflect the epidemic in the general population, with the exception that male-to-male sex outside prison is likely more important to the male inmate population in Belize. The findings suggest that HIV is likely contracted by most inmates before their incarceration, largely due to same-sex activity.

Key words

Acquired immunodeficiency syndrome, HIV seroprevalence, prisons, Belize.

The HIV/AIDS epidemic in Latin America and the Caribbean is well established. Of the estimated 39.4 million people living with HIV/AIDS globally at the end of 2004, approximately 2.1 million were

located in Latin America and the Caribbean (1). Contributing factors are diverse and include: unprotected sexual contact, multiple partners, early sexual initiation, male-to-male sex, intravenous drug use (IVDU), mother-to-child transmission, migration and mobility, population mixing, and bridging between high-risk subgroups and the general population (2).

An important fact about the epidemic in Latin America is that four of the six countries with the highest adult prevalence in 2004 were located in Central

America. Belize was ranked first, with an estimated 2.4% of the adult population infected with HIV at the end of 2004 (1, 3). In Belize, the ninth leading cause of death in the year 2000 was AIDS-related. By 2004, AIDS was the third leading cause of death in the country and ranked as the first leading cause of death among the age groups 30–39 years and 40–49 years (4). Death related to AIDS also ranked third in the age group 20–29 years and was the only leading cause of death due to preventable illness in this group (4).

¹ Ministry of Health, Epidemiology Unit, Belmopan City, Belize. Send correspondence to: Ethan Gough, Epidemiology Unit, Ministry of Health, First Floor, East Block Building, Belmopan City, Belize, Central America; telephone: +501-822-2325; fax: +501-822-2942; email: egough@ghealth.gov.bz

² Central Health Region, Ministry of Health, Belize City, Belize.

In prisons, the prevalence of HIV varies worldwide (5–17), but HIV in prison populations has received much attention, and inmate populations are considered by many to be at greater risk of infection than the general population. Due to the high prevalence of behaviors conducive to transmission of HIV and other sexually-transmitted diseases (STDs), prisons may be viewed as reservoirs of HIV amplification and subsequent spreading in the community. These behaviors predominantly include unprotected sexual activity, tattooing, and in particular, injection drug use and its related needle/syringe sharing (6, 8, 17–21). Indeed, cases of HIV transmission within prison settings have been documented through epidemiologic and molecular investigation of prison outbreaks in Scotland (22–25) and Australia (26). Studies of HIV incidence in correctional facilities in the United States and Thailand provide further evidence of in-prison HIV transmission (17, 20, 27–30).

The Belize Central Prison is the country's only prison, and is currently under private management by the Kolbe Foundation, a private, Christian organization. Prior to this study, the Ministry of Health (MOH) worked very closely with the Central Prison Medical Center, particularly in the areas of tuberculosis and STDs, including HIV/AIDS, providing Voluntary Counseling and Testing (VCT), educational presentations, antiretroviral (ARV) therapy, case management, and training in clinical management. However, the seroprevalence of HIV among inmates of the Central Prison was unknown. From January–March 2005, the MOH, in collaboration with the Pan American Health Organization (PAHO), undertook a cross-sectional study of male inmates at the Belize Central Prison to determine the seroprevalence of HIV and to identify associated risk behaviors.

Approval for the study was obtained from the Ethics Committee of the Ministry of Health, Belize.

MATERIALS AND METHODS

Inmate sensitization

Prior to data collection, two visits were made to the Belize Central Prison to sensitize inmates to the project and to encourage participation. Sensitization included presentations on the benefits of knowing one's HIV status; the state of the epidemic in Belize; the National

AIDS Program (sponsored by the MOH); pre- and post-test counseling for both HIV-positive and negative individuals; clinical management and referral of HIV positive patients; the research protocol; and a testimony by a former inmate living with HIV. Sixty-nine percent (713 / 1 028) of the eligible inmate population participated in sensitization sessions. The remainder of the population was inaccessible due to either being engaged in labor-related activities or a religious service, or an unwillingness to participate. Although participation in the sensitization sessions was not a prerequisite for study participation, the coverage achieved in sensitization likely contributed to better HIV-testing rates.

Pretest counseling and data collection

Nine one-day weekend visits were made to the Belize Central Prison from 29 January–5 March 2005 to offer VCT to inmates. Eligible inmates were those who had been sentenced or remanded and were at least 16 years of age. Illegal immigrants awaiting deportation were excluded because this transient population has minimal interaction with other inmates and can present communication barriers due to language and cultural differences. Also excluded were inmates less than 16 years of age, the minimum age of legal consent in Belize.

After verbal informed-consent, socio-demographic and risk behavior data were collected using a pretested, interviewer-administered questionnaire. The questionnaire was in part derived from others used in inmate HIV seroprevalence studies in the United Kingdom and Ireland (6, 8).

After written informed-consent was obtained, HIV serostatus was determined by a 2-step HIV rapid test algorithm employed by the MOH VCT program. This rapid test algorithm was modeled on same day VCT services utilized in Rwanda and Zambia (31). Specimens were screened utilizing the Abbott Determine Assay for HIV-1/2 (Abbott Laboratories, Abbott Japan Co. LTD, Minao-Ku, Tokyo, Japan), and reactive samples were confirmed by the MedMira MiraWell HIV-1/2 test (MedMira Laboratories Inc, Halifax, Nova Scotia, Canada). Both tests were performed on each sample, and reactive specimens were retested on location. Remaining serum was transported to the Central Medical Laboratory in Belize City

for testing by Enzyme-Linked Immunosorbent Assay, Vironostika Uniform II PLUS 0 HIV-1/2 (Biomérieux, Biosiend, Boxtel, The Netherlands).

The algorithm was validated for use in the MOH VCT program prior to its use in this study. A total of 318 Abbott Determine Assays for HIV-1/2 and 30 confirmatory MedMira MiraWell HIV-1/2 tests were run against samples previously screened at the blood bank of the Central Medical Laboratory in Belize City. With the exception of one false-positive on the Abbott Determine Assay, all test results coincided with previously obtained ELISA test results.

Post-test counseling

On the Friday that followed each weekend visit, counselors from the VCT Center in Belize City returned to the Central Prison to provide the HIV test results and post-test counseling to those inmates who were interested. Results and post-test counseling were provided in a confidential manner.

Data analysis

Data on occupation before current incarceration were categorized using occupational groups and definitions developed in the 2002 *Living Standard Measurement Survey* (32). Major groups were identified; smaller groups and illegal occupations, such as drug dealing, were designated as "Other." Inmate age was grouped in 5-year intervals, and age at first sexual experience, by 3-year intervals.

Associations between HIV seropositivity and demographic or risk characteristics were determined using Odds Ratios (ORs). Large sample approximation was used to determine statistical significance. Multivariate logistic regression was performed to adjust for potential confounders. Predictors significantly ($P < 0.05$) associated with HIV by crude analysis were introduced into the multivariate model one at a time in order of magnitude. Those variables that produced a meaningful change in the magnitude of any association in the model, with statistical significance, were retained. Other variables known to be common confounders, or thought to be possible confounders based on a review of the literature were also introduced into the model and were retained or removed as described. Data entry and analysis were performed using Epi Info version 3.2.2.

TABLE 1. Demographic characteristics, incarceration information, HIV seroprevalence, and associated risk factors of 623 male inmates tested for anti-HIV-1/2 antibody at the Belize Central Prison, Belize, 2005

	Total		HIV positive		OR (95% CI)	P value
	No.	%	No.	%		
Country of birth						
Other ^a	80	12.8	2	2.5	Ref	—
Belize	543	87.2	23	4.2	1.73 (0.4, 7.5)	0.4624
Age in years						
< 25	214	34.5	4	1.9	Ref	—
25–29	137	22.1	9	6.6	3.69 (1.1, 12.2)	0.0326 ^b
30–34	82	13.2	6	7.3	4.20 (1.2, 15.3)	0.0295 ^b
35–39	63	10.1	3	4.8	2.67 (0.6, 12.3)	0.2068
≥ 40	125	20.1	3	2.4	1.29 (0.3, 5.9)	0.7408
Educational level completed						
< High school	486	78.3	21	4.3	Ref	—
≥ High school	135	21.7	4	3.0	0.67 (0.2, 2.0)	0.4753
Ethnicity						
Other ^c	309	49.7	6	1.9	Ref	—
Creole	313	50.3	19	6.1	3.29 (1.3, 8.3)	0.0123 ^b
Marital status before current incarceration						
Married	62	10.0	1	1.6	Ref	—
Living with a partner	202	32.5	12	5.9	3.85 (0.5, 30.2)	0.1993
Non-union ^d	358	57.5	12	3.4	2.13 (0.3, 16.6)	0.4719
District of residence before current incarceration						
Belize ^e	238	38.3	15	6.3	Ref	—
Other	384	61.7	10	2.6	0.40 (0.2, 0.9)	0.0266 ^b
Total time incarcerated in lifetime						
< 3 months	122	19.7	3	2.5	Ref	—
> 3 but < 12 months	132	21.3	2	1.5	0.61 (0.1, 3.7)	0.5919
1–3 years	186	30.0	10	5.4	2.25 (0.6, 8.4)	0.2244
> 3 years	180	29.0	10	5.6	2.36 (0.6, 8.8)	0.1991
Prison section where served most incarceration time						
Remands	130	21.0	5	3.8	Ref	—
Super max	11	1.8	1	9.1	2.50 (0.3, 23.5)	0.4230
Medium/maximum security	190	30.6	7	3.7	0.96 (0.3, 3.1)	0.9476
Tango 1–6	253	40.8	12	4.7	1.25 (0.4, 3.6)	0.6814
Wagner's youth facility	36	5.8	0	0.0	Undef ^f	—
Total inmates per cell						
1 or 2	69	11.1	7	10.1	Ref	—
3 or 4	226	36.5	5	2.2	0.20 (0.1, 0.7)	0.0078 ^b
> 4	324	52.3	13	4.0	0.37 (0.1, 1.0)	0.0428 ^b
Offense						
Burglary/theft/robbery/stolen goods	245	39.6	8	3.3	Ref	—
Drug offenses	92	14.9	4	4.3	1.34 (0.4, 4.6)	0.6388
Murder/manslaughter	69	11.1	3	4.3	1.34 (0.3, 5.2)	0.6713
Disorder/assault/harm/damage to property	53	8.6	1	1.9	0.57 (0.1, 4.6)	0.5968
Other ^g	102	16.5	4	3.9	1.20 (0.4, 4.1)	0.7660
More than one offense	58	9.4	5	8.6	2.84 (0.9, 9.0)	0.0778

^a El Salvador, England, Germany, Guatemala, Honduras, Mexico, Nicaragua, Romania, United States.

^b Statistically significant at $\alpha = 0.05$.

^c East Indian, Garifuna, Hispanic/latin, Maya, Mestizo.

^d Divorced, separated, single/never married, widowed.

^e Belize district.

^f Undefined odds ratio.

^g Attempted murder, fraud, indecent assault and other sexual offenses, owe the court, rape, unlicensed or unlawful possession.

RESULTS

During the study period, the estimated mid-period male inmate population was 1 144. Of the total, 114 did not meet eligibility criteria for participation. The majority of these were illegal immigrants awaiting deportation (75%). The remainder were either less than 16 years of age (3.5%), were recently arrested and were simply being held for processing (14.5%), or were in isolation (6.1%). One inmate was hospitalized for the duration

of the study. A convenience sample of 623 eligible inmates was obtained, representing 54.5% of the eligible male population. An estimated 50% or more eligible inmates were sampled from each prison section.

The median age of inmates in the sample was 28 years, with a range of 16–64 years. Inmates were predominantly born in Belize (87.2%), of Creole ethnicity (50.3%), not involved in a monogamous relationship (57.5%) or had been living with a partner prior to incarceration (32.5%),

and had less than a complete high school education (78.3%). Prior to incarceration, the majority of the inmates (61.7%) were residing outside of the Belize district, the largest administrative district of the country's six total districts. Most inmates had spent no more than three years incarcerated in their lifetime (71.0%), and were currently incarcerated for crimes having to do with attainment or possession of another person's property (39.6%), such as burglary, robbery, theft, or handling stolen goods (Table 1).

TABLE 2. Risk behaviors while incarcerated, HIV seroprevalence, and associated risk factors among 623 male inmates tested for anti-HIV-1/2 antibody at the Belize Central Prison, Belize, 2005

	Total		HIV positive		OR (95% CI)	P value
	No.	%	No.	%		
Shared tattoo equipment						
No	534	86.5	19	3.6	Ref	—
Yes	83	13.5	5	6.0	1.76 (0.6, 4.8)	0.2761
Ever sexually active in prison						
No	596	95.7	21	3.5	Ref	—
Yes	27	4.3	4	14.8	4.72 (1.3, 14.2)	0.0192 ^a
Penetrative sex with condom in last 12 months ^b						
No	607	99.2	22	3.6	Ref	—
Yes	5	0.8	1	20.0	6.57 (0.3, 54.9)	0.1754
Penetrative sex without condom in last 12 months ^b						
No	608	97.6	22	3.6	Ref	—
Yes	15	2.4	3	20.0	6.59 (1.4, 23.8)	0.0191 ^a
Penetrative sex partners in last 12 months ^b						
≤ 1	616	98.9	23	3.7	Ref	—
> 1	7	1.1	2	28.6	10.17 (1.3, 54.5)	0.0289 ^a
Ever paid item(s) for sex in prison						
No	614	98.9	24	3.9	Ref	—
Yes	7	1.1	1	14.3	4.07 (0.2, 29.0)	0.2518
Ever accepted item(s) for sex in prison						
No	615	99.0	24	3.9	Ref	—
Yes	6	1.0	1	16.7	4.88 (0.2, 37.0)	0.2199
Used alcohol in last 12 months						
No	557	90.1	23	4.1	Ref	—
Yes	61	9.9	2	3.3	0.80 (0.2, 3.5)	0.7649
Used marijuana in last 12 months						
No	287	46.3	9	3.1	Ref	—
Yes	333	53.7	16	4.8	1.57 (0.7, 3.6)	0.2888
Used cocaine in last 12 months						
No	608	98.2	25	4.1	Ref	—
Yes	11	1.8	0	0.0	Undef ^c	—
Used crack in last 12 months						
No	603	97.7	25	4.1	Ref	—
Yes	14	2.3	0	0.0	Undef ^c	—
Ever shared needles/syringes						
No	619	99.4	25	4.0	Ref	—
Yes	4	0.6	0	0.0	Undef ^c	—
Tattoos						
No tattoos	119	19.2	5	4.2	Ref	—
Tattoos but none in prison	285	46.0	11	3.9	0.91 (0.3, 2.7)	0.8598
Tattoos in prison	216	34.8	9	4.2	0.99 (0.3, 3.0)	0.9822

^a Statistically significant at $\alpha = 0.05$.

^b Penetrative sex with both sexes.

^c Undefined odds ratio.

Of the 623 inmates in the sample, 25 tested positive for HIV-1/2 antibody, for a seroprevalence of 4.0% (95% CI: 2.7, 6.0). Two inmates showed an indeterminate test result and were instructed to return to the Central Prison Medical Center in 3–6 months for a follow-up test.

Risk characteristics while incarcerated

Twenty-seven men (4.3%) reported ever being sexually active in prison. Fewer reported having penetrative sex without a condom in the last 12 months (2.4%), however these represented 88.2% of men who reported penetrative sex in that time. Only a few inmates (1.1%) reported penetrative sex with more than

one partner in the last 12 months, however this was almost half (41.2%) of those who had engaged in penetrative sex in that period. Additionally, only a handful of inmates reported ever paying (1.1%) or accepting (1.0%) money or other items in exchange for sexual favors while incarcerated (Table 2).

Thirty-five percent of inmates had been tattooed in prison, with 38.4% of these reporting ever sharing tattoo equipment. Substance use while incarcerated was also common, but marijuana was the most common illicit drug reportedly used in the last 12 months. Only four inmates reported ever sharing needles or syringes to inject drugs while incarcerated (Table 2).

Risk characteristics while not incarcerated

Most men reported having more than one partner of the opposite sex or exchanging items for sex during the two years prior to incarceration. However, only a few inmates reported always using condoms for any kind of heterosexual activity in that time (10.7%). Nineteen men (3.0%) reported ever engaging in male-to-male sex outside prison, with only eight reporting same sex activity in the last two years spent outside, and only one reporting always using condoms for same sex encounters in that period.

Alcohol and marijuana were the most common substances used outside prison, but a substantial number of inmates also

TABLE 3. Risk behaviours while not incarcerated, sexually transmitted disease (STD) history, HIV seroprevalence, and associated risk factors among 623 male inmates tested for anti-HIV-1/2 antibody at the Belize Central Prison, Belize, 2005

	Total		HIV positive		OR (95% CI)	P value
	No.	%	No.	%		
Number of partners of opposite sex in last two years outside prison						
≤ 1	227	38.2	10	4.4	Ref	—
> 1	367	61.8	15		4.1 (0.4, 2.1)	0.8619
Exchanged item(s) for sex in last two years outside prison						
No	442	71.6	20	4.5	Ref	—
Yes	175	28.4	5	2.9	0.62 (0.2, 1.7)	0.3512
Condom use in last two years outside prison ^a						
Not always	497	88.9	21	4.2	Ref	—
Always	62	11.1	2	3.2	0.75 (0.2, 3.3)	0.6973
Ever had sex with another man outside prison						
No	603	96.9	21	3.5	Ref	—
Yes	19	3.1	4	21.1	7.31 (1.9, 23.1)	0.0053 ^b
Same sex partners in last two years outside prison						
≤ 1	619	99.5	23	3.7	Ref	—
> 1	3	0.5	2	66.7	50.25 (3.7, 1524.0)	0.0046 ^b
Condom use with same sex partner(s) in last two years outside prison ^c						
Not always	7	87.5	2	28.6	Ref	—
Always	1	12.5	0	0.0	Undef ^d	—
Ever used alcohol						
No	78	12.5	5	6.4	Ref	—
Yes	544	87.5	20	3.7	0.56 (0.2, 1.5)	0.2597
Ever used marijuana						
No	134	21.6	2	1.5	Ref	—
Yes	487	78.4	23	4.7	3.29 (0.8, 14.1)	0.1095
Ever used cocaine						
No	483	78.8	20	4.1	Ref	—
Yes	130	21.2	5	3.8	0.94 (0.3, 2.6)	0.9052
Ever used crack						
No	431	69.6	17	3.9	Ref	—
Yes	188	30.4	8	4.3	1.09 (0.5, 2.6)	0.8366
Ever shared needles / syringes						
No	616	98.9	24	3.9	Ref	—
Yes	7	1.1	1	14.3	4.08 (0.2, 29.1)	0.2510
Ever diagnosed with an STD						
No	426	68.6	13	3.1	Ref	—
Yes	195	31.4	12	6.2	2.11 (0.9, 4.7)	0.0693
Pus or secretion from genitals in last three months						
No	581	93.3	23	4.0	Ref	—
Yes	42	6.7	2	4.8	1.24 (0.3, 5.5)	0.7743

^a Subset of sexually active inmates in the last two years outside prison ($n = 577$).

^b Statistically significant at $\alpha = 0.05$.

^c Subset of "Ever had sex with another man outside prison" ($n = 19$).

^d Undefined odds ratio.

reported crack and cocaine use. Only seven inmates reported ever sharing needles or syringes outside prison (Table 3).

STD history

Thirty-one percent of men also reported ever being diagnosed with an STD, but many fewer reported STD symptoms in the last 3–12 months. The most common symptom reported was pus or secretion from the genitals in the last three months (6.7%) (Table 3).

Logistic regression

Several factors showed a statistically significant bivariate association with HIV

seropositivity among inmates. However, after adjustment for confounding by multivariate logistic regression, only three factors remained significantly associated with HIV: (a) men reporting sex with another man outside prison were more likely to be HIV seropositive than men who reported no same sex partners (OR = 62.3); (b) inmates in the age groups 25–29 years (OR = 3.0) and 30–34 years (OR = 4.3) were more likely to have HIV compared to those less than 25 years of age; (c) inmates who had lived outside the Belize district before their current incarceration were less likely to be HIV seropositive than those who had lived within it (OR = 0.4) (Table 4). There were no statistically significant

associations between IVDU or any other type of substance use and HIV infection, or between tattooing in prison and HIV. Also, no incarceration-specific characteristics showed any association with HIV infection with the exception of total number of inmates per cell (Table 1), but this association did not remain statistically significant after adjustment for confounding.

DISCUSSION

The seroprevalence of HIV in the male inmate population at the Central Prison in Belize was 4.0%, almost twice that estimated in the adult population in 2004 (2.4%). The main findings showed HIV

TABLE 4. Multivariate analysis of demographic and risk factors associated with HIV seropositivity among 623 male inmates tested for anti-HIV-1/2 antibody at the Belize Central Prison, Belize, 2005

	OR (95% CI)	P value
Ever had sex with another man outside prison		
Yes	62.3 (5.9, 662.9)	0.0006 ^a
Ever sexually active in prison		
Yes	5.3 (0.7, 40.3)	0.1042
Age in years		
< 25	Ref	—
25–29	3.0 (1.0, 9.0)	0.0498 ^a
30–34	4.3 (1.2, 15.9)	0.0289 ^a
35–39	2.1 (0.5, 9.0)	0.3207
≥ 40	1.2 (0.4, 3.9)	0.7134
District of residence before current incarceration		
Belize ^b	Ref	—
Other	0.4 (0.2, 0.9)	0.0256 ^a
Marital status before current incarceration		
Married	Ref	—
Living with a partner	2.1 (0.5, 9.1)	0.3334
Non-union ^c	1.3 (0.3, 5.2)	0.739

^a Statistically significant at $\alpha = 0.05$.

^b Belize district.

^c Divorced, separated, single/never married, widowed.

seropositivity among inmates to be positively associated with male-to-male sex outside prison and being 25–29 or 30–34 years of age; and negatively associated with residing outside of the Belize district before current incarceration.

Although male-to-male sexual activity while incarcerated was found to be significantly associated with HIV infection by bivariate analysis (Table 2), only male-to-male sex outside prison showed a statistically significant association with HIV after adjustment for confounding (Table 4). This was the strongest association found in the study, but it is somewhat limited by poor precision as indicated by the width of the 95%CI: 5.9, 662.9. However, men who have sex with men (MSM) are a group known to be at particular risk of HIV infection and are also known to be a vulnerable subpopulation in some countries in Central America (2, 3). In prison populations, men who report having anal sex with other men have been found to be significantly more likely to be HIV-infected (8, 27), and being sexually active in prison has been identified as a significant contributing factor in syphilis (33) and hepatitis B (34) outbreaks in correctional facilities in the United States of America.

Although previous research shows the importance of male-to-male sex to HIV among inmate populations, there is only limited evidence for high rates of HIV transmission within prisons (17, 20, 27–30, 35). In addition, factors that increase the risk of contracting HIV in the

general population—e.g., poverty and low socioeconomic status—also increase the risk for incarceration. A study of intravenous drug users in Bangkok, Thailand, found both HIV and a history of incarceration to be associated with injection drug use inside and outside prison, while a history of incarceration was associated with ever having a same-sex partner, and ever being tattooed, both of which are important routes of transmission within prisons (36). Thus the population at risk of HIV infection may often be the same population likely to be incarcerated, raising questions about whether incarceration or infection came first.

Regardless, the potential for intra-prison transmission of HIV does exist; these findings are not an indication that transmission does not or cannot occur in the Belize Central Prison. Outbreaks are also of concern to correctional facilities. HIV outbreaks and outbreaks of other STDs have been documented in other countries (22–26, 33, 34).

Other risk factors of possible importance to HIV in prison populations (tattooing and IVDU) were not found to be associated with HIV infection in this group. With the exception of being tattooed in prison and sharing tattoo equipment, other risk behaviors that involve the sharing or use of unsterile needles and equipment were reportedly infrequent. Although cases of HIV transmission by contaminated tattoo needles have not been documented, the risk is believed

to exist (19, 37), and although the evidence appears conflicting, tattooing has been implicated as a possible route of Hepatitis C transmission (6, 38, 39).

Demographic characteristics found to be associated with HIV were the age groups 25–29 years of age and 30–34 years, and having resided in the Belize district. The reproductive and productive age group (15–49 years of age) is the group most affected by HIV/AIDS in Belize, with 81.4% of the new infections reported to the MOH in 2004. AIDS-related deaths ranked first among those 25–29, 30–34, and 35–39 years of age in 2004 (4). Data from the MOH also indicate that the Belize district is the area most impacted by the epidemic (4). Since inmates 25–39 years of age were more likely to be HIV seropositive and inmates who had lived outside the Belize district were less likely to be seropositive, the demographic associations among inmates appear to reflect the epidemic in the general population.

A substantial number of inmates reported some form of transactional sex, more than one partner, inconsistent condom use, or alcohol or marijuana use with sex outside prison (*data not shown*). Crack and cocaine use outside prison were also reported by several inmates. These behaviors can place inmates or their partners at continued risk of infection if resumed after their release.

Study limitations

Although sexual activity while incarcerated was reported by only a few inmates, reports by prison staff and inmates themselves indicated that sexual activity is common, specifically in the Medium Security section. Also, if the counselor was female, some inmates indicated an unwillingness to report their sexual behavior. Those who did report were more likely to be HIV seropositive by crude analysis, and sexual risk behavior in the last 12 months in prison was reported by up to three inmates with HIV (Table 2). Underreporting of sexual risk behaviors could therefore have influenced the findings of this study, and the possibility of sexual transmission within the Central Prison can not be disregarded.

Due to the voluntary nature of this study, there was a potential for selection bias. It is possible that inmates who believed themselves to be at-risk for HIV refused to participate. Thus the characteristics of an unknown number of HIV

seropositive inmates were not identified, limiting the degree to which the results can be generalized. However, 72.4% of the sample either believed they were at risk for HIV or were not sure (*data not shown*), indicating that many inmates who believed they could be HIV seropositive did participate.

Conclusions

Cross-sectional studies should be interpreted with caution since they cannot directly identify risk factors for contracting HIV. However, risk factors of importance to this population were identified that provide a more complete picture of HIV among inmates in Belize. Overall, the major findings seem to reflect the epidemic in Belize's general population, with the exception that male-to-male sex outside prison may be of particular importance among Belize's inmate population. The findings suggest that HIV is likely contracted by most male inmates before their incarceration and is largely due to same-sex activity. To clarify the

level of transmission within the Central Prison, a detuned ELISA assay could be used to further test specimens seropositive for HIV-1/2 antibody. This would identify infections that occurred, on average, within the last 129 days (40), providing an estimate of incidence that would help clarify the risk of contracting HIV within the correctional facility.

VCT should be continued and more actively promoted among inmates at the Central Prison to further identify HIV-infected individuals. Experience in the United States has shown substantial uptake of VCT services offered at correctional facilities, increasing by 194% over a six-year period (41). The Central Prison should be viewed as a public health opportunity for education, prevention, diagnosis, and treatment within a marginalized population that may be less effectively reached otherwise. In addition, the needs of inmates should be taken into account by those planning the National AIDS program. This should be done in collaboration with the prison authority. Since most inmates will eventually be re-

leased and many were serving sentences of three years or less, the public health impact of such efforts will extend beyond the prison and into the community.

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RESUMEN

Seroprevalencia al VIH y factores de riesgo asociados en hombres internados en la Prisión Central de Belice

Objetivos. Determinar la seroprevalencia al VIH e identificar los factores de riesgo asociados en hombres internados en la Prisión Central de Belice, administrada por la Fundación Kolbe.

Métodos. La muestra estuvo compuesta por 623 voluntarios hombres que se encontraban encarcelados entre el 15 de enero y el 5 de marzo de 2005. El estatus serológico con respecto al VIH se determinó en la prisión mediante la prueba de tamizaje Abbot Determine Assay y se confirmó con la prueba MedMira MiraWell Rapid, ambas para anticuerpos contra el VIH 1 y 2. El suero restante se analizó por ELISA en el Laboratorio Médico Central de Belice. Se recabaron los datos demográficos y sobre las conductas de riesgo mediante una encuesta preevaluada aplicada por un entrevistador. Se identificaron las asociaciones independientes con la seropositividad al VIH mediante análisis de regresión logística multifactorial ajustado por posibles factores de confusión.

Resultados. De los 623 prisioneros de la muestra, 25 resultaron positivos a anticuerpos contra el VIH-1/2, para una seroprevalencia de 4,0% (IC95%: 2,7% a 6,0%). Después de ajustar por los factores de confusión, la seropositividad se asoció con la actividad sexual con otros hombres fuera de la prisión, la edad y el distrito de residencia antes de su encarcelamiento actual.

Conclusiones. La seroprevalencia en la Prisión Central casi duplicó el estimado para la población adulta de Belice en 2004 (2,4%). Sin embargo, las variables sociales de importancia en los prisioneros parecieron reflejar la epidemia en la población general, aunque la relación sexual con hombres fuera de la prisión pareció tener mayor importancia en la población masculina encarcelada en Belice. Estos resultados indican que la mayoría de los prisioneros habría contraído la infección por el VIH antes de su encarcelamiento, en gran parte debido a prácticas homosexuales.

Palabras clave

Síndrome de inmunodeficiencia adquirida, seroprevalencia de VIH, prisiones, Belice.