Addiction

RESEARCH REPORT

doi:10.1111/j.1360-0443.2008.02436.x

Factors associated with incarceration and incident human immunodeficiency virus (HIV) infection among injection drug users participating in an HIV vaccine trial in Bangkok, Thailand, 1999–2003

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ABSTRACT

Aims To determine if incarceration was associated with human immunodeficiency virus (HIV) infection and identify risk factors for incarceration among injection drug users (IDUs) participating in an HIV vaccine trial in Bangkok. **Design** The AIDSVAX B/E HIV vaccine trial was a randomized, double-blind, placebo-controlled study. A proportional hazards model was used to evaluate demographic characteristics, risk behavior and incarceration as predictors of HIV infection and generalized estimation equation logistic regression analysis to investigate demographic characteristics and risk behaviors for predictors of incarceration. **Setting** The trial was conducted in Bangkok Metropolitan Administration drug-treatment clinics, 1999–2003. **Participants** A total of 2546 HIV-uninfected IDUs enrolled in the trial. **Measurements** HIV testing was performed and an interviewer-administered questionnaire was used to assess risk behavior and incarceration at baseline and every 6 months for a total of 36 months. **Findings** HIV incidence was 3.4 per 100 person-years [95% confidence interval (CI), 3.0–3.9] and did not differ among vaccine and placebo recipients. In multivariable analysis, being in jail ($P < 0.04$), injecting ($P < 0.0001$), injecting daily ($P < 0.0001$) and sharing needles ($P = 0.02$) were associated with HIV infection and methadone maintenance was protective ($P = 0.0006$). Predictors of incarceration in multivariable analysis included: male sex ($P = 0.04$), younger age ($P < 0.0001$), less education ($P = 0.001$) and being in jail ($P < 0.0001$) or prison ($P < 0.0001$) before enrollment. **Conclusions** Among IDUs in the AIDSVAX B/E trial, incarceration in jail was associated with incident HIV infection. IDUs in Thailand remain at high risk of HIV infection and additional prevention tools are needed urgently. HIV prevention services, including methadone, should be made available to IDUs.

Keywords HIV infection, HIV vaccine trial, injection drug users, incarceration, jail, prison, Thailand.

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Submitted 9 June 2008; initial review completed 12 September 2008; final version accepted 15 October 2008

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INTRODUCTION

As of the end of 2006, approximately 307 000 people in Thailand have been diagnosed with acquired immune deficiency syndrome (AIDS). The estimated prevalence of human immunodeficiency virus (HIV) infection among injection drug users (IDUs) is 42%, the highest among risk populations surveyed [1,2]. HIV spread rapidly among IDUs in Bangkok in the late 1980s, with estimated incidence rates as high as 57 per 100 person-years [3–6]. While HIV prevalence among blood donors, pregnant women, military conscripts and female sex workers fell in the 1990s, the prevalence among IDUs remained high at 30–50% [1,7]. Incarceration probably contributed to the high sustained HIV prevalence among IDUs [6–15].

In Thailand, people detained by police are confined initially in jail. In most cases, detainees remain in jail for 1–3 days, and are then released or moved to a prison holding area to await adjudication. If convicted, detainees are moved to a prison to serve their sentence. Authorities do not provide drug treatment or sterile injection equipment in jails or prisons; thus, if drug injection occurs it occurs with needles that are likely to be shared. Indeed, previous studies suggest that injection drug use during incarceration is an important risk factor for HIV infection among IDUs in Thailand [7,11,12].

The Bangkok Metropolitan Administration (BMA), the city government of Bangkok, operates 17 drug-treatment clinics that offer a range of services to IDUs, including HIV voluntary counseling and testing, risk-reduction counseling, social and welfare services, health education, primary medical care and referrals, methadone treatment, male condoms and bleach to clean injection equipment with demonstrations and instructions on appropriate use. IDUs requesting methadone treatment start a 45-day detoxification program with oral methadone. The dose is titrated based on symptoms with a goal of stopping methadone by day 45. If the client has not been able to stop methadone by day 45, detoxification may be repeated. After three failed attempts at detoxification, the client may start methadone maintenance therapy. BMA clinics provide these services free of charge. Thailand's narcotics law prohibits the distribution of needles and syringes to IDUs and needles are not provided in the drug-treatment clinics; however, sterile needles and syringes are available to the public over the counter at low cost (5–10 baht/0.12–0.25 US$) in pharmacies in Bangkok.

Longitudinal follow-up of 1209 IDUs in the BMA clinics during 1995–98 found that drug injection while incarcerated, recent incarceration without injection and previous incarceration were independent risk factors for HIV infection [7,11]. These results suggest that incarceration is related to HIV transmission through multiple pathways. A case–control study in the BMA clinics during 2000–01 found that HIV-infected IDUs were more likely to have injected drugs or shared needles in jail [12].

During 1999–2003, a phase III efficacy trial of the AIDSVAX B/E HIV vaccine was conducted among IDUs attending BMA drug-treatment clinics [16–18]. The vaccine trial provided an opportunity to evaluate the relationship between incarceration and incident HIV infection. This substudy was not planned in advance of the trial. In this paper, we describe the injection practices, sexual activity and incarceration experience of vaccine trial participants, determine if incarceration in jail or prison was associated with incident HIV infection, and identify demographic and behavioral factors associated with incarceration.

METHODS

The AIDSVAX B/E HIV vaccine trial was a randomized, double-blind, placebo-controlled trial conducted among IDUs at BMA drug-treatment clinics during 1999–2003. Detailed descriptions of the study have been published previously [16–19]. Briefly, media announcements, a telephone hotline, posters and flyers were used to recruit IDUs. IDUs attending the BMA drug-treatment clinics were informed of the trial and staff were available to provide information about the trial and answer questions. A total of 2546 HIV-uninfected IDUs enrolled and were assigned randomly (1 : 1) to receive either AIDSVAX B/E or placebo at months 0, 1, 6, 12, 18, 24 and 30. HIV testing was performed with Genetic Systems-Biorak enzyme-linked immunosorbent assay (ELISA) and Western blot kits [18] to determine HIV status at baseline and at every 6-month study visit for a total of 36 months. An interviewer-administered questionnaire was used at baseline to assess demographic characteristics (age, sex, education level attained) and to determine if the participant had ever been incarcerated in jail or prison. An additional interviewer-administered questionnaire was used at baseline and at every 6-month study visit to assess injection drug use, sharing of needles and/or syringes, sexual activity, condom use, participation in a methadone treatment program and incarceration in jail or prison during the previous 6 months. Risk-reduction counseling and health education were provided at every study visit. Enrollment visits were conducted in study clinics. Follow-up visits were conducted in clinics or, if the participant was incarcerated, prison.

Before the trial, investigators met with Department of Correction Officials to describe the study and request permission and assistance maintaining follow-up of incarcerated participants. During the consent process, research staff discussed follow-up strategies with potential participants. When research staff learned that a participant was incarcerated, staff contacted correctional

authorities and requested permission to conduct a study visit. Once study staff and correctional authorities agreed on a date and staff to enter the prison, a standard study visit was conducted. Study visits were not conducted in jails because of the unpredictability and relatively short duration of incarceration.

We used SAS (version 9; SAS Institute, Cary, NC, USA) for analysis. HIV incidence rates were calculated per 100 person-years of HIV-negative observation. Person-time calculations were based on status reported at 6-month visits. Exact 95% Poisson confidence intervals (CI) were calculated for the estimated HIV incidence rates. A discrete time proportional hazards model was used to evaluate demographic characteristics at baseline and incarceration, injection practices, sexual behavior and participation in methadone treatment during the 6 months preceding follow-up study visits as predictors of HIV infection [20]. We assumed that HIV infection status was associated with behaviors or events that occurred during the preceding 6 months. Variables that were associated with incident HIV infection in bivariate analysis ($P \leq 0.1$) were evaluated in a multivariable model. We used generalized estimation equation (GEE) logistic regression to evaluate baseline demographic characteristics, incarceration history and participation in methadone treatment for predictors of incarceration during the course of the study [21]. The correlation structure for repeated measures in the GEE estimation was assumed to be unstructured and odds ratios (OR) and 95% CI were estimated from the logistic models. Variables that were associated with incarceration in bivariate analysis ($P \leq 0.1$) were evaluated in a separate multivariable model.

The trial protocol was approved by ethical review committees of the Thailand Ministry of Public Health, BMA and Mahidol University and by an institutional review board of the US Centers for Disease Control and Prevention. Participants with incident HIV infection received HIV care according to Thailand national guidelines [22,23].

RESULTS

A total of 2546 HIV-uninfected IDUs enrolled in the trial and 2295 (90.1%) were followed to month 36 or until HIV infection. Participants were predominantly male (93.4%), with a median age of 26 years (range 20–59 years). Most (67.3%) had completed 9 years of school or more. Among enrolled participants, immunoblot and nucleic acid-based amplification testing found that 19 (0.8%) participants had undetected HIV infection at their enrollment visit and these 19 were excluded from analyses; 211 (8.3%) individuals became HIV-infected during follow-up, yielding an HIV incidence rate of 3.4 (95% CI: 3.0–3.9) per 100 person-years. HIV incidence rates were similar among vaccine and placebo recipients and the trial demonstrated that the AIDSVAX B/E vaccine did not prevent HIV infection [18]. One participant tested HIV-seropositive at an unscheduled visit before the first follow-up visit. Data from this participant were excluded from additional analyses. All 210 participants with incident HIV infection completed the study visit preceding the first HIV positive study visit. Thus, the interval prior to seroconversion when risk behavior data was collected was the same (6 months) for all participants.

At enrollment, 1997 (78.4%) participants reported that they had been incarcerated in the past; 1943 (76.3%) in jail, 1278 (50.2%) in prison and 1224 (48.1%) in jail and prison (data not shown). At follow-up visits (months 6, 12, 18, 24, 30 and 36), 1322 (53.9%) participants reported incarceration since the previous study visit; 1267 (51.7%) in jail, 982 (40.0%) in prison and 927 (37.8) in both (Table 1). A total of 3480 (9.7%) study visits were conducted in prisons.

The proportion of participants reporting incarceration during the preceding 6 months increased from enrollment to month 12 (17.6–26.4%; $P < 0.0001$), and then remained steady from month 12 to month 36 (26.4–27.6%; $P = 0.67$).

Among the 210 participants with incident HIV infection, 73 (34.8%) reported incarceration during the 6 months before the first HIV-positive study visit; of these 14 (19.2%) reported injecting during these incarceration periods. Participants reported injecting while incarcerated during 1.9% of the follow-up time-periods, while 6.7% (14 of 210) of incident HIV infections occurred during these (1.9%) time-periods. The HIV incidence rate for participants who reported injecting while incarcerated (jail or prison) was 11.0 (95% CI: 6.0–18.5) per 100 person-years; 9.2 (95% CI: 4.2–17.4) per 100 person-years in jail and 14.7 (95% CI: 4.8–34.3) per 100 person-years in prison.

The proportion of participants injecting, injecting daily and injecting with needles or syringes used by others during the past 6 months declined during follow-up (all $P < 0.0001$). A total of 2106 (85.9%) participants reported injecting drugs and 777 (31.7%) reported sharing needles and/or syringes during follow-up (Table 1). Reports of injecting among those who reported being in prison during the 6 months before the study visit decreased from 11.2% at baseline to 1.6% at 6 months ($P = 0.002$) and remained between 1.6% and 3.4% months 12–36 (data not shown).

The proportion of men reporting 100% condom use with male partners declined from 34.8% at baseline to 7.7% at month 12 then increased to 36.8% at month 36 ($P = 0.44$). Among incarcerated male participants, 30 of 1253 (2.4%) reported sexual intercourse with a male

Table 1 Reports of incarceration, drug use and sexual activity during the 6 months before the study visit by injection drug users participating in the AIDSVAX B/E vaccine trial, Bangkok, Thailand, 1999–2003.

	Visit month								*Reported risk variable at least once months 6–36*
	Baseline *n = 2546* *No. (%)*	*Month 6* *n = 2438* *No. (%)*	*Month 12* *n = 2362* *No. (%)*	*Month 18* *n = 2296* *No. (%)*	*Month 24* *n = 2227* *No. (%)*	*Month 30* *n = 2171* *No. (%)*	*Month 36* *n = 2099* *No. (%)*	*P-value*	*n = 2452* *No. (%)*
Incarceration during the 6 months before the visit									
In jail	360 (14.1)	458 (18.8)	442 (18.7)	365 (15.9)	331 (14.9)	306 (14.1)	293 (14.0)	<0.0001*	1267 (51.7)
In prison	188 (7.4)	320 (13.1)	466 (19.7)	499 (21.7)	494 (22.2)	468 (21.6)	467 (22.2)	<0.0001*	982 (40.0)
In jail or prison	447 (17.6)	497 (20.4)	623 (26.4)	621 (27.0)	605 (27.2)	584 (26.9)	580 (27.6)	<0.0001*	1322 (53.9)
Injection drug use during the 6 months before the visit									
Injected drugs	2389 (93.8)	1915 (78.6)	1614 (68.3)	1413 (61.5)	1289 (57.9)	1133 (52.2)	1015 (48.4)	<0.0001	2106 (85.9)
Shared injection equipment	790 (31.0)	311 (12.8)	283 (12.0)	249 (10.8)	248 (11.1)	189 (8.7)	164 (7.8)	<0.0001	777 (31.7)
Injected daily	936 (36.8)	527 (21.6)	452 (19.1)	441 (19.2)	393 (17.6)	353 (16.3)	316 (15.0)	<0.0001	1177 (48.0)
Sexual activity during the 6 months before the visit									
Reported sexual intercourse with more than one partner of the opposite sex	306 (12.0)	208 (8.5)	194 (8.2)	210 (9.2)	194 (8.7)	220 (10.1)	171 (8.2)	<0.0001	662 (25.4)
Reported sexual intercourse with live-in partner	854 (33.5)	790 (32.4)	734 (31.1)	716 (31.2)	704 (31.6)	691 (31.8)	668 (31.8)	0.02	1300 (53.0)
Always used condom when having sexual intercourse with live-in partner[a]	62 (7.3)	83 (10.5)	74 (10.1)	76 (10.6)	89 (12.6)	76 (11.0)	70 (10.5)	<0.0001	
Reported sexual intercourse with one or more non-live-in (i.e. casual) partners	348 (13.7)	289 (11.8)	259 (11.0)	280 (12.2)	264 (11.8)	287 (13.2)	223 (10.6)	0.0007	865 (35.3)
Always used condom when having sexual intercourse non-live-in (i.e. casual) partners[a]	160 (46.0)	153 (52.9)	142 (54.8)	154 (55.0)	138 (52.3)	165 (57.5)	111 (49.8)	0.21	
Men reporting sexual intercourse with a man[b]	23 (1.0)	12 (0.5)	13 (0.6)	6 (0.3)	14 (0.7)	14 (0.7)	19 (1.0)	0.01	52/2328 (2.2)
Men reporting they always used condom when having sexual intercourse with a man[a,b]	8 (34.8)	3 (25.0)	1 (7.7)	1 (16.7)	5 (35.7)	4 (28.6)	7 (36.8)	0.44	
Incarcerated men reporting sexual intercourse with a man[c]	5 (1.2)	6 (1.3)	4 (0.7)	4 (0.7)	9 (1.6)	9 (1.6)	11 (2.0)	0.53	30/1253 (2.4)

*P-value calculated for month 6 to month 36 because baseline visits were conducted in clinics while follow-up visits were conducted in clinics or prisons. [a]Denominator limited to those reporting sexual intercourse. [b]Denominator limited to men. [c]Denominator limited to incarcerated men.

partner (Table 1). None of the male participants reporting sex with male partners ($n = 52$), including incarcerated participants, became HIV-infected during follow-up. The proportion of participants reporting sexual intercourse with more than one person of the opposite sex declined from 12.0% at baseline to 8.2% at month 36 ($P < 0.0001$). The proportion reporting sexual intercourse with non-live-in (i.e. casual) partners declined from 13.7% at baseline to 10.6% at month 36 ($P = 0.0007$) and the proportion reporting 100% condom use with these casual partners ranged from 46.0% to 57.5% between baseline and 36 months ($P = 0.21$) (Table 1).

In bivariate analysis, being in jail, injecting drugs, injecting daily, sharing injecting equipment and participation in the methadone detoxification program were all associated with HIV infection ($P < 0.0001$). In multivariable analysis, being in jail ($P < 0.04$), injecting ($P < 0.0001$), injecting daily ($P < 0.0001$) and sharing ($P = 0.02$) were associated independently with incident HIV infection. Participating in the methadone maintenance program was protective ($P = 0.0006$) (Table 2). Being in prison during the trial was not associated with HIV infection. In multivariable analysis of predictors for incarceration, male sex ($P = 0.04$), age ≤ 26 years ($P < 0.0001$), < 9 years of school ($P = 0.001$) and a history of being in jail ($P < 0.0001$) or prison ($P < 0.0001$) before enrollment were associated independently with incarceration during the trial. Participating in a methadone maintenance program lowered the risk of incarceration ($P < 0.0001$) (Table 3).

DISCUSSION

Among IDUs in the AIDSVAX B/E vaccine trial, incarceration in jail was an independent risk factor for incident HIV infection; incarceration in prison was not. Jailed IDUs with acute withdrawal symptoms do not have access to sterile injection equipment or methadone in a setting where potential sharing partners are likely to be HIV-infected. These jail and inmate characteristics increase the likelihood of HIV transmission. The number of participants testing positive for HIV and reporting they had injected drugs in jail ($n = 9$) or prison ($n = 5$) during the preceding 6 months was small and 59 (80.8%) of those testing positive after incarceration reported no injection drug use in jail or prison. This suggests under-reporting of HIV risk behavior in jail or prison or that incarceration is a surrogate marker for HIV risk behavior before, during or after incarceration.

The increase in the proportion of participants reporting incarceration during the preceding 6 months from enrollment to month 12 is due probably to the fact that enrollment visits were conducted in clinics, while follow-up visits were conducted in clinics or prisons. Reports of incarceration in jail declined from month 6 to month 36 and reports of incarceration in prison were stable from month 12 to month 36.

Consistent with a previous study among IDUs in Bangkok [7], IDUs in this trial reported relatively low levels of sexual activity and sexual behaviors, including condom use, were not associated with HIV infection. The decrease in reported injection drug use and sharing of injection equipment during follow-up has been described [17,19] and is due probably to repeat HIV testing, risk-reduction counseling and health education during the trial.

Not surprisingly, injecting drugs, injecting daily and sharing injection equipment were associated with HIV infection. IDUs in the maintenance program were at lower risk for incarceration and HIV infection than those not in methadone maintenance. Assignment to methadone maintenance, however, was not random. IDUs received maintenance therapy only after failing detoxification. None the less, the protective effect was consistent with findings of previous studies in Thailand, Australia and the United States [11,24–26]. In Thailand the public health importance of methadone treatment for opiate addiction is recognized and maintenance programs are available. Therefore, targeting IDUs most likely to be incarcerated (i.e. young, poorly educated, males with a history of incarceration) to offer them HIV prevention services including methadone maintenance and working to extend these services to incarcerated IDUs would be a reasonable next step.

This study has a number of limitations, including the use of self-reports for injection drug use, needle sharing, sexual activity and incarceration. Self-reporting of stigmatized or illegal behavior is problematic, and under-reporting of these activities is possible [27]. The illegality and stigma attached to these activities, however, did not change during the trial. Thus, rates of under-reporting are likely to have remained constant allowing meaningful comparisons over time. Also, we did not collect data on the exact dates of incarceration or release. Therefore, participants reporting incarceration during the 6 months before incident HIV infection may have become HIV-infected before, during or after incarceration.

IDUs participating in the AIDSVAX B/E HIV vaccine trial were incarcerated frequently during study follow-up. Pre-trial discussions with Corrections Department Officials and with potential trial participants during the consent process established a framework to maintain participant follow-up during incarceration. It is important to note that the association of incarceration with HIV infection has been reported in many countries and is not unique to Thailand [8–10,14,28–30].

In February 2003, the Thai Government began a 'war on drugs' to reduce the supply of and demand for illicit drugs, particularly methamphetamines, in Thailand

Table 2 Results of bivariate and multivariable analysis using a proportional hazards model to evaluate baseline demographic characteristics, and incarceration, injection practices and sexual activity during the 6 months before study visits as predictors of human immunodeficiency virus (HIV) infection among 2546 injection drug users participating in the AIDSVAX B/E vaccine trial, Bangkok, Thailand, 1999–2003.

				Risk of HIV infection			
				Bivariate analysis		*Multivariable analysis*	
	Seroconverters	*Person-years*	*HIV incidence (95% CI)*	*Hazard ratio (95% CI)*	*P-value*	*Hazard ratio (95% CI)*	*P-value*
Sex							
Female	10	442	2.3 (1.1–4.2)	1.0			
Male	200	6354	3.2 (2.7–3.6)	1.4 (0.7–2.7)	0.30	Not included	
Age at enrollment							
>26 years	90	3176	2.8 (2.3–3.5)	1.0			
≤26 years	120	3620	3.3 (2.8–4.0)	1.2 (0.9–1.5)	0.26	Not included	
Education							
≥Grade 9	134	4549	2.9 (2.5–3.5)	1.0			
<Grade 9	76	2248	3.4 (2.7–4.2)	1.2 (0.9–1.5)	0.33	Not included	
In jail during the 6 months before visit							
No	153	5699	2.7 (2.3–3.2)	1.0		1.0	
Yes	57	1098	5.2 (3.9–6.7)	2.0 (1.4–2.7)	<0.0001	1.4 (1.0–1.9)	0.04
In prison during the 6 months before visit							
No	161	5440	3.0 (2.5–3.4)	1.0			
Yes	49	1357	3.6 (2.7–4.8)	1.2 (0.9–1.7)	0.22	Not included	
Injection frequency during the 6 months before visit							
No injection	24	2607	0.9 (0.6–1.4)	1.0		1.0	
Injected less than daily	99	2947	3.4 (2.7–4.1)	3.9 (2.5–6.2)	<0.0001	4.3 (2.7–6.9)	<0.0001
Injected daily	87	1239	7.0 (5.6–8.7)	8.3 (5.2–13.1)	<0.0001	7.8 (4.9–12.6)	<0.0001
Sharing during the 6 months before visit							
No	160	6066	2.6 (2.2–3.1)	1.0		1.0	
Yes	50	722	6.9 (5.1–9.1)	2.7 (2.0–3.8)	<0.0001	1.5 (1.1–2.1)	0.02
Sexual intercourse with live-in partner during the 6 months before visit							
No	153	4624	3.3 (2.8–3.9)	1.0			
Yes	57	2151	2.6 (2.0–3.4)	0.8 (0.6–1.1)	0.12	Not included	
Always used condom when having sexual intercourse with live-in partner[a]							
No	51	1917	2.7 (2.0–3.5)	1.0			
Yes	5	234	2.1 (0.7–5.0)	0.8 (0.3–2.0)	0.64	Not included	
Sexual intercourse with one or more non-live-in (i.e. casual) partners during the 6 months before visit							
No	187	5988	3.1 (2.7–3.6)	1.0			
Yes	23	800	2.9 (1.8–4.3)	0.9 (0.6–1.4)	0.70	Not included	
Always used condom when having sexual intercourse non-live-in (i.e. casual) partners[a]							
No	9	382	2.4 (1.1–4.5)	1.0			
Yes	13	436	3.0 (1.6–5.1)	1.2 (0.5–2.8)	0.68	Not included	
Men reporting sexual intercourse with a man during the 6 months before visit[b]							
No	200	6315	3.2 (2.7–3.6)	1.0			
Yes	0	39	0.0 (undefined)	0.0 (undefined)	0.97	Not included	
Participated in methadone detoxification during the 6 months before visit							
No	121	5130	2.4 (2.0–2.8)	1.0			
Yes	89	1666	5.3 (4.3–6.6)	2.4 (1.8–3.3)	<0.0001	NS	
Participated in methadone maintenance during the 6 months before visit							
No	145	4320	3.4 (2.8–4.0)	1.0		1.0	
Yes	65	2476	2.6 (2.0–3.4)	0.8 (0.6–1.0)	0.10	0.6 (0.4–0.8)	0.0006

CI = confidence interval; NS = not significant. [a]Denominator limited to those reporting sexual intercourse. [b]Denominator limited to men.

Table 3 Results of generalized estimating equation logistic regression analysis of demographic characteristics, previous incarceration, and methadone treatment as predictors of incarceration among injection drug users participating in the AIDSVAX B/E vaccine trial, Bangkok, Thailand, 1999–2003.

		Bivariate analysis		*Multivariable analysis*	
Variable	*Number incarcerated during trial (%)*	*OR (95% CI)*	*P-value*	*OR (95% CI)*	*P-value*
Sex					
Female ($n = 159$)	69 (43.4)	1.0		1.0	
Male ($n = 2293$)	1253 (54.6)	1.6 (1.2–2.1)	0.0008	1.3 (1.0–1.8)	0.04
Age at enrollment					
>26 years ($n = 1147$)	556 (48.5)	1.0		1.0	
≤26 years ($n = 1305$)	766 (58.7)	1.4 (1.2–1.6)	<0.0001	1.5 (1.3–1.7)	<0.0001
Education					
≥Grade 9 ($n = 1639$)	849 (51.8)	1.0		1.0	
<Grade 9 ($n = 813$)	473 (58.2)	1.3 (1.2–1.5)	<0.0001	1.3 (1.1–1.4)	0.001
History of being in jail before enrollment					
No ($n = 582$)	226 (38.8)	1.0		1.0	
Yes ($n = 1870$)	1096 (58.6)	2.2 (1.9–2.7)	<0.0001	1.7 (1.4–2.0)	<0.0001
History of being in prison before enrollment					
No ($n = 1219$)	560 (45.9)	1.0		1.0	
Yes ($n = 1233$)	762 (61.8)	2.0 (1.8–2.3)	<0.0001	1.7 (1.5–2.0)	<0.0001
Participated in methadone detoxification during trial					
No ($n = 911$)	422 (46.3)	1.0			
Yes ($n = 1541$)	900 (58.4)	1.0 (0.9–1.1)	0.44	Not included	
Participated in methadone maintenance during trial					
No ($n = 1020$)	581 (57.0)	1.0		1.0	
Yes ($n = 1432$)	741 (51.8)	0.6 (0.6–0.7)	<0.0001	0.6 (0.6–0.7)	<0.0001

OR = odds ratio; CI = confidence interval.

[31]. Heroin users in drug treatment programs, the population from which trial participants were recruited, were not the target of the campaign. Several human-rights organizations expressed concern about increases in drug-related homicides [32]; however, homicide was not reported as cause of death in the trial.

The results of this study add to a large body of evidence demonstrating an association between incarceration, particularly in a jail, and HIV infection [7–15,28,29]. Despite this evidence and recommendations that drug treatment and HIV prevention tools be made available to incarcerated IDUs, these services remain rare in prison [15,30,33–35]. There is an urgent need for additional HIV prevention tools. The public health community should target existing HIV prevention services, including methadone maintenance, to IDUs and work to make these services available to incarcerated IDUs.

Clinical trial registration

The AIDSVAX B/E HIV vaccine trial was registered at ClinicalTrials.gov http://clinicaltrials.gov/ct2/show/NCT00006327?term=AIDSVAX&rank=6

ClinicalTrials.gov Identifier: NCT00006327.

Declaration of interest

Marc Gurwith was employed by VaxGen during the AIDSVAX B/E HIV vaccine trial.

Acknowledgements

We thank the 2546 volunteers who participated in this trial, the staff of the Bangkok Metropolitan Administration Drug-Treatment Clinics, the Vaccine Trial Centre of Mahidol University and VaxGen, Inc., the sponsor of the trial. The findings and conclusions in this paper are those of the authors and do not necessarily represent the views of the Centers for Disease Control and Prevention.

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