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Alcohol consumption trajectory patterns in adult women with HIV infection

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Abstract

HIV-infected women with excessive alcohol consumption are at risk for adverse health outcomes, but little is known about their long-term drinking trajectories. This analysis included longitudinal data, obtained from 1996–2006, from 2791 women with HIV from the Women's Interagency HIV Study. Among these women, the proportion in each of five distinct drinking trajectories was: continued heavy drinking (3%), reduction from heavy to non-heavy drinking (4%), increase from non-heavy to heavy drinking (8%), continued non-heavy drinking (36%), and continued non-drinking (49%). Depressive symptoms, other substance use (crack/cocaine, marijuana, and tobacco), co-infection with HCV, and heavy drinking prior to enrollment were associated with trajectories involving future heavy drinking. In conclusion, many women with HIV change their drinking patterns over time. Clinicians and those providing alcohol-related interventions might target those with depression, current use of tobacco or illicit drugs, HCV infection, or a previous history of drinking problems.

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Keywords

Alcohol consumption; women; HIV-infection; trajectories

BACKGROUND

Approximately half of US women with HIV infection report any alcohol consumption in the past month, and at specific time points, approximately 12% – 22% exceed recommended limits as established by the National Institute of Alcohol Abuse and Alcoholism (1–4). Exceeding recommended consumption amounts, defined for women as drinking >7 drinks per week or >3 drinks per occasion, is associated with poorer medication adherence, increased risky sexual behavior, increased HIV viral load, and more rapid disease progression (5–11). Most previous assessments of alcohol consumption and related outcomes in HIV-infected women have focused on assessments at single time points. However, because individuals often change their drinking patterns over time, assessments at single time points likely do not accurately reflect their long-term drinking exposure, or their risk of drinking in the future. Alcohol trajectory analysis can identify long-term drinking patterns that may be associated with greater long-term consequences. Identification of factors that are associated with the most severe long-term trajectories might identify current drinkers at highest risk for continued long-term drinking, or those who are current non-drinkers (or low-level drinkers) who are at greatest risk for increasing their drinking over time, and therefore might be the target of concentrated preventive interventions.

Because alcohol consumption can have such significant health impacts in persons with HIV infection, it is important to determine their drinking patterns over time and to infer whether there are any differences in long-term drinking trajectories that are unique to women with HIV. However, few if any assessments of long-term alcohol drinking trajectories have been reported in HIV-infected women. Here, our objectives were to identify long-term drinking trajectories during longitudinal follow-up in women with HIV infection, to identify baseline characteristics of these women associated with the most serious long-term drinking trajectories, and to compare long-term drinking trajectories in HIV-positive and HIV-negative women.

METHODS

Data were obtained from 3766 women participating in the Women's Interagency HIV Study (WIHS), a prospective observational cohort study of HIV-positive and HIV-negative women in the United States. The WIHS enrolled participants in 1994–1995 (n=2623) and again in 2000–2001 (N=1143). Participating sites are based in the Bronx and Brooklyn, New York City; Washington DC, Los Angeles, the San Francisco Bay area, and Chicago. Institutional Review Boards at each of the participating centers approved the WIHS study protocols, and informed written consent was obtained from all participants. The study design has been described previously (12, 13) and study information is available at https://statepiaps.jhsph.edu/wihs/.

Data Collection

The baseline questionnaire, completed at study enrollment, included items to assess age, race, educational attainment, marital status, and employment status. On the baseline questionnaire, participants also indicated the quantity and frequency of use of the following substances in the previous six months: tobacco, marijuana, cocaine, crack or freebase cocaine, heroin, and methadone. Current drug use was defined as taking the drug at least once a month. Participants also reported whether they had ever injected any drugs and

whether they were currently injecting drugs. HIV serostatus was determined by ELISA antibody testing and an approved confirmatory test and CD4 cell count was categorized as <=200/mm3, 201–500/mm3, and >500/mm3. Information on the time since seroconversion was not available. Depression was assessed using the 20-item CES-D scale; women were classified as having clinically significant symptoms of depression if they had a CES-D score of >=16 (14). Baseline blood specimens for the 1994/1995 recruits were tested in 2000 for hepatitis C virus (HCV) infection, and the 2001/2002 recruits were tested in real time. Thus, all women in active follow-up eventually learned their HCV status, although women enrolled in 1994–95 were not given their HCV test results until later.

Alcohol assessment

WIHS has assessed alcohol quantity and frequency at enrollment and at each successive 6-month visit. WIHS uses several strategies to maximize the validity of the alcohol assessment information, including showing pictures of various drink types to participants and creating a non-judgmental atmosphere. At the enrollment and each six-month follow-up visit, WIHS participants were asked about the average number of days per week that they had a drink of alcohol, defined as “one can, bottle or glass of beer, a glass of wine, a shot of liquor, a mixed drink with that amount of liquor, or any other kind of alcoholic beverage.” Response options were every day, 5–6 days a week, 3–4 days a week, 1–2 days a week, less than once a week, and none. Next, they were asked about the usual number of drinks they consumed per day, with open-ended responses elicited during 1996 – 2004 and categorized choices for 2005 onward (0, 1–2, 3–4, 5–6, or 7 or more drinks per day). Open-ended responses such as “a pint of vodka” were converted to numbers of standard drinks. The number of drinks per week was determined by multiplying the reported quantity by the reported frequency per week. For these analyses, “heavy” drinking refers to consumption of >7 drinks per week, an amount defined as exceeding recommended limits by the National Institute on Alcohol Abuse and Alcoholism (4).

Past drinking behavior and treatment for drinking was assessed at study enrollment. Specifically, women provided information about the highest amounts of alcohol they ever regularly consumed in the past (categorized as past heavy, moderate, or non-drinking based on National Institute of Alcohol Abuse and Alcoholism criteria), and on whether they ever had received any type of treatment for alcohol problems (such as Alcoholics Anonymous, inpatient or outpatient detoxification, medication prescriptions).

Statistical analyses

The WIHS data from 23 semiannual study visits (1996 – 2006) were included in these analyses. The primary analyses included the women with HIV infection at enrollment, although we also conducted a separate analysis among women without HIV and among the entire sample combined (HIV-positive and HIV-negative). A semi-parametric group-based logistic model was used to identify groups of homogenous drinking trajectories. Specifically, the SAS macro PROC TRAJ was used to fit a linear mixture model that quantified alcohol intake patterns over study follow up and classified them into groups of homogenous drinking trajectories (15). This procedure sorts individual drinking curves into clusters of similar shape by taking each person’s response of number of drinks/week over all 23 visits and estimates a single model. Models with four to nine categories were considered and we chose the five-category model because it had the best fit to the data by the Baysean Information Criterion (BIC). The results for these trajectory analyses were similar when we excluded participants who had fewer than 3 follow-up visits, and thus we included data from all enrolled women. We also ran PROC TRAJ separately in women with and without HIV infection. The general trajectory patterns were similar.

Multivariable logistic regression models were used to predict specific long-term drinking trajectories using risk factors assessed at baseline. Two separate analyses were run, based on women's drinking status at study enrollment. First, among women with heavy drinking at baseline, we compared those who continued to drink at heavy levels over time, to those who decreased their drinking (or stopped completely). Second, among women with lower levels of drinking (or no drinking) at baseline, we compared women who increased to heavy drinking over time to those who remained non-drinkers or low-level drinkers. Stepwise modeling was used to identify factors most strongly associated with specific drinking trajectories. Potential variables considered included the enrollment values for participant age, race, marital status, education, employment, study recruitment site, period of enrollment, depressive symptoms, HCV status, other illicit and licit substance use, past drinking amount, and past alcohol treatment. We examined the potential impact of HIV serostatus and HIV disease stage on long-term drinking trajectories using data from the entire sample (HIV-positive and HIV-negative). In this analysis, HIV disease stage at study enrollment was included in the multivariable model as a 4- category variable (HIV-negative, HIV+/CD4 <200 cells/mm3, HIV+/CD4 200–500 cells/mm3, and HIV+/CD4 >500 cells/mm3), with other variables found to be significant in the HIV-stratified analysis also included in the multivariable model.

RESULTS

Of the 3766 study participants, most (74%) were HIV-positive. Among the 2791 HIV-positive women, mean age at enrollment was 35 years; 58% were African American, 24% were Hispanic, and the remainder were primarily white (Table 1). Fewer than half were married (37%), employed at enrollment (24%), or had greater than a high school education (32%). About 1 in 5 (21%) had HCV antibodies. Other substance use at enrollment was relatively common, and included tobacco (51%), marijuana (21%), crack/freebase (16%), cocaine (12%), and heroin (10%). About a third of the women (35%) had a previous history of regular heavy drinking (>7 drinks per week); and 20% reported a history of participation in an alcohol treatment program. The HIV-negative women in WIHS had fairly similar characteristics, although the HIV-negative women were more likely to be employed, to be enrolled in the 2001/2002 cohort (vs. the 1994/1995 cohort), to have HCV antibodies, and to use marijuana (see Table 1).

The analyses revealed five distinct long-term drinking trajectories (Figure 1). The proportion of HIV-positive women in each group was: Group 1) continued heavy drinking (3%); Group 2) reduction from heavy to non-heavy drinking (4%); Group 3) increase from non-heavy to heavy drinking (8%); Group 4) continued non-heavy drinking (36%), and Group 5) continued non-drinking (49%). Thus, while many women changed their drinking patterns over time, the majority of women with HIV infection either continued to drink but kept their alcohol consumption below heavy levels (Group 4) or remained non-drinkers throughout follow-up (Group 5).

Factors associate with distinct drinking trajectories in HIV-positive women

Among HIV-positive women with heavier drinking at baseline (Groups 1 and 2), those with continued heavy drinking over time (Group 1) were significantly more likely to report depressive symptoms (OR 1.6, 95% CI 1.0 – 2.8), crack/cocaine use at baseline (OR 3.6, 95% CI 2.1 – 6.0), or positive HCV antibody status (OR 1.8, 95% CI 1.1 – 3.0), compared to women who reduced their heavy drinking over time (Group 2) (Table 2). The findings were similar in HIV-uninfected women, other than depressive symptoms (Table 2).

Among HIV-positive women with non-heavy or no drinking at baseline (Groups 3, 4 and 5), women were significantly more likely to increase to heavy drinking (Group 3) if they

engaged in other illicit or licit substance use at baseline (cocaine, marijuana or tobacco), had a history of heavy drinking prior to enrollment, or had ever participated in alcohol treatment prior to enrollment (Table 3). Hepatitis C antibody status was not associated with drinking trajectories in these women without heavy drinking at baseline. The results were similar in women who were HIV-uninfected (Table 3).

In multivariable analyses that included the entire sample (HIV-positive and HIV-uninfected), HIV infection status was not itself significantly associated with any of the distinct trajectory patterns (data not shown).

DISCUSSION

Examination of long-term drinking trajectories in women with HIV infection is important, as heavy alcohol consumption is associated with a wide range of behavioral and biologic health outcomes including more rapid disease progression (5–11). Our investigation identified five distinct long-term drinking trajectories in U.S. women with HIV infection. About a fifth of these women had substantial changes in their drinking behavior over time, whereas the remaining 80% continued either to not drink or to drink moderately. Drinking trajectory patterns were similar among HIV-positive and HIV-uninfected women. Previous research, including some from the same cohort,(3) has demonstrated that 12– 22% of HIV-infected women meet criteria for heavy drinking at single time points (1–3, 7). However, many women change their drinking behavior over time, and this longitudinal analysis suggest that fewer than 5% will continue to drink at heavy levels over a longer period of time, whereas another 10% will initiate (or re-initiate) drinking at a heavy level. Thus, clinicians caring for adult women with HIV infection need to include repeated assessments of alcohol consumption over time.

Most previous studies that examined drinking trajectories have presented results for trends among adolescents as they emerge into adulthood (16–21), or reported studies that combined men and women (22, 23), although some newer reports describe drinking trajectories in adult U.S. women over age 50 (24, 25). It is difficult to compare trajectory patterns across studies because the age groups, gender, or the number of trajectory categories were different. However, the results from our study, showing changing drinking patterns over time, are generally consistent with the findings from other cohorts of U.S. women.

In our study, women with depressive symptoms, who used other drugs such as crack/cocaine, marijuana, and tobacco, or who had a past history of heavy drinking, were most likely to be on trajectories associated with long-term heavy drinking. The few other studies that examined specific risk factors associated with long-term trajectories also found that previous drinking history, tobacco and drug use, and depression are associated with heavy drinking over time (22, 23, 25). The finding that women who used tobacco and other drugs were the most resistant to long-term moderation in drinking, suggests that intervention strategies that address multiple substances concurrently may be needed (rather than targeting single behaviors). The overlapping of several types of substance use mirror what we previously found in different analyses of this cohort, in which both chronic problem drinking and chronic crack use were associated with high viral load among women with HIV infection (26), and polysubstance use was associated with decreased success in smoking cessation in HIV-infected women (27).

This study has several strengths, including the repeated alcohol measures over time, use of strategies to improve accuracy of alcohol consumption reporting, and an HIV-negative control group. However, several study limitations should be noted. Although the WIHS study used several strategies to enhance self-reporting of alcohol, alcohol consumption is

subject to measurement error and most likely is under-reported. Thus, the actual proportion of women with heavy drinking is likely to be somewhat higher. Some women were missing data at some time points or may have dropped out of the cohort. We found similar results in trajectories after excluding subjects with fewer than 3 outcome assessments, which suggests that the data are robust to these issues.

We focused our analysis on whether baseline characteristics are associated with long-term trajectories, although we recognize that several of the measures we assessed can change over time and might influence future alcohol trajectory patterns. A focus on baseline characteristics is most consistent with information a clinician might have when considering the likelihood of future drinking trajectories (initial risk). Thus, the findings have relevance for clinical screening and intervention programs. However, because many variables do change over time, future analyses of this topic might consider an analytic approach that incorporates behavior change over time in order to better understand the possible causal associations between these factors and changes in drinking.

Health care providers caring for women with HIV infection should assess for current alcohol consumption as well as identify women at increased risk for long-term drinking problems. The findings from this study may help clinicians and public health providers to identify women in need of more aggressive monitoring and possible intervention, regardless of their current drinking behavior. For example, women with a previous history of heavy drinking are at greater risk for long-term heavy drinking, even if they are not drinking heavily at the current visit. At the same time, health care providers can provide positive reinforcement towards the great majority of women who are not drinking at harmful levels, with more emphasis on those factors associated with resiliency.

In summary, these findings suggest that over time, the majority of HIV-infected and at-risk women will have long-term trajectories involving lower levels of drinking (or non-drinking). However, approximately 1 in 10 adult women will either continue to drink at heavy levels or increase their drinking to levels that exceed recommended guidelines. Past alcohol consumption behavior, current use of tobacco and/or other drugs, and depressive symptoms were the characteristics most strongly associated with long-term heavy drinking trajectories in this analysis.

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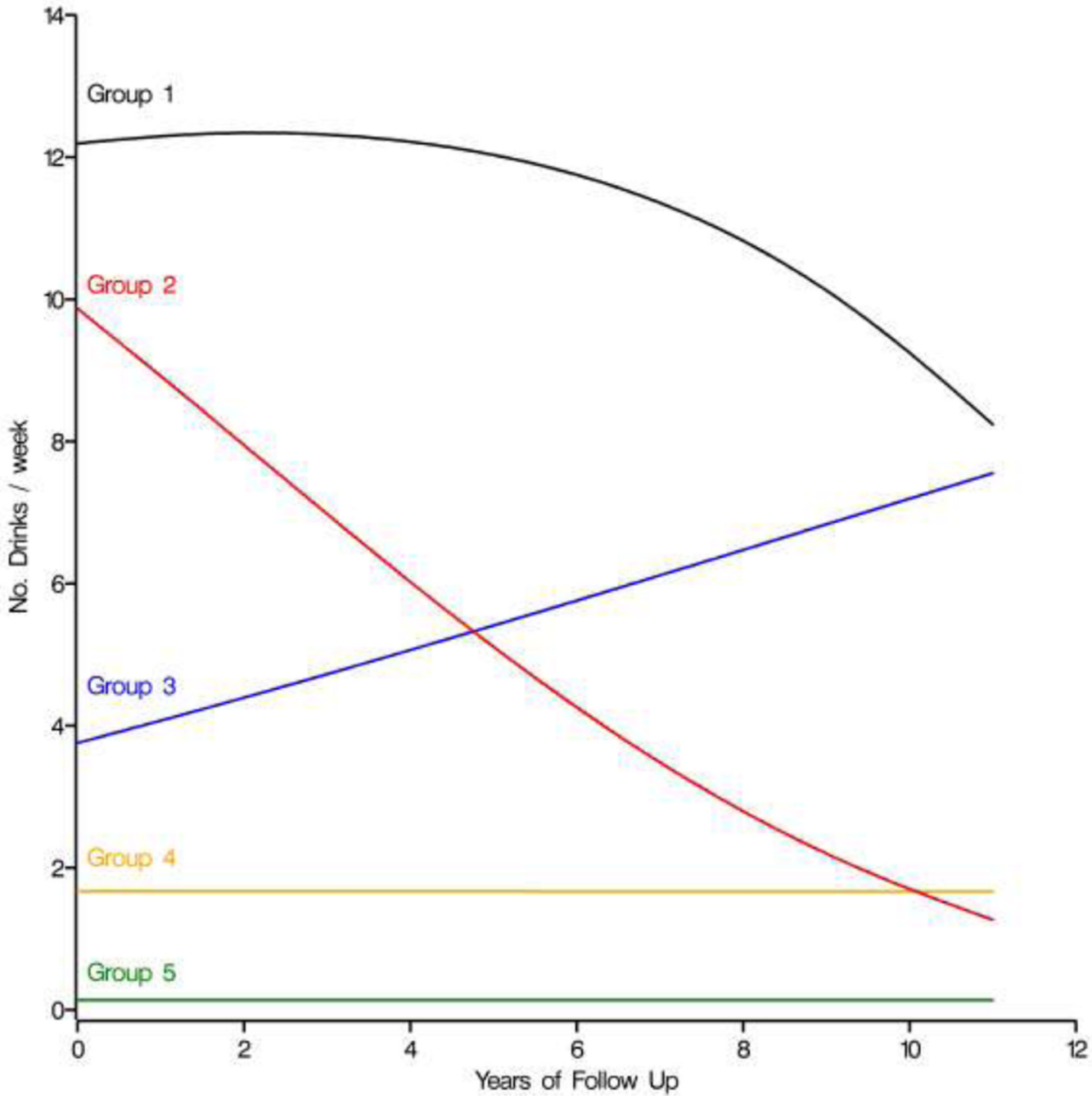

Figure 1.
Drinking trajectory patterns for 3768 women: Women's Interagency HIV Study, 1994 – 2006. The five groups include (1) women who were persistent heavy drinkers (3%); (2) women who cut back from heavy drinking to non-heavy drinking (4%); (3) women who increased to heavy drinking over time (8%); (4) women who remained non-heavy drinkers during the entire follow-up (36%); and (5) women who were non-drinkers (49%).

Table 1

Baseline characteristics of 3766 women included in alcohol trajectories analysis, overall and according to HIV serostatus.

Socio-Demographic Factors	**All (N=3766) N (%)**	**HIV+ (N=2791) N (%)**	**HIV− (N=975) N (%)**	**p-value***
Age Group (years)				
<30	1039 (28)	652 (23)	387 (40)	<.0001
30–40	1720 (46)	1343 (48)	377 (39)	
>40	1007 (27)	796 (28)	211 (22)	
Race				
White	566 (15)	426 (15)	140 (14)	0.72
African American	2174 (58)	1617 (58)	557 (57)	
Hispanic	901 24)	658 (24)	243 (25)	
Other	125 (3.3)	90 (3.2)	35 (3.6)	
Marital Status				
Single	1315 (36)	915 (33)	400 (42)	<.0001
Married	1381 (37)	1020 (37)	361 (38)	
Sep/Div/Widowed	998 (27)	810 (30)	188 (20)	
Employed	999 (27)	677 (24)	322 (33)	<.0001
Education > High School	1204 (32)	887 (32)	317 (33)	0.60
Site				
Bronx	772 (20)	547 (20)	225 (23)	0.06
Brooklyn	611 (16)	455 (16)	156 (16)	
Washington DC	568 (15)	417 (15)	151 (16)	
Los Angeles	762 (20)	572 (20)	190 (20)	
San Francisco	580 (15)	427 (15)	153 (16)	
Chicago	473 (12)	373 (13)	100 (10)	
Year of Enrollment				
1994/1995	2623 (70)	2054 (74)	569 (58)	<.0001
2001/2002	1143 (30)	737 (26)	406 (42)	
Clinical Characteristics				
CD4 Group				
<200/mm3	665 (25)	665 (25)	---	---
200–500/mm3	1171 (43)	1171 (43)	---	
>500/mm3	868 (32)	868 (32)	---	
HCV Antibody Positive	1152 (31)	197(21)	955 (35)	<.0001
Depressive Symptoms (CESD>=16)	1953 (53)	1476 (54)	477 (50)	0.02
Drug Use at Baseline (at least monthly)				
cocaine	460 (12)	324 (12)	136 (14)	0.06
heroin	395 (10)	284 (10)	111 (11)	0.29

Socio-Demographic Factors	**All (N=3766) N (%)**	**HIV+ (N=2791) N (%)**	**HIV− (N=975) N (%)**	**p-value***
crack/freebase cocaine	626 (17)	442 (16)	184 (19)	0.03
(illicit) methadone	66 (1.8)	38 (1.4)	28 (2.9)	0.002
marijuana/hash	912 (24)	594 (21)	318 (33)	<.0001
injected drug	307 (8)	225 (8.1)	82 (8.4)	0.74
tobacco	1986 (53)	1424 (51)	562 (58)	0.0004
Peak Drinking History (prior to baseline)				
Non drinker	1985 (54)	1499 (55)	486 (51)	0.07
Moderate drinker	377 (10)	274 (10)	103 (11)	
Heavy drinker	1329 (36)	957 (35)	372 (39)	
Ever Had Alcohol Treatment (prior to baseline)	782 (21)	554 (20)	228 (24)	0.02

* P-values for comparisons between HIV + and HIV − women.

Table 2

In women with heavy drinking at baseline, factors associated with a persistent heavy drinking trajectory, compared to women who reduced drinking over time: multivariable analysis.

	HIV-positive				**HIV-uninfected**			
Baseline Variable	**(n = 329)**				**(n = 148)**			
	Odds Ratio	**95% CI**	**Wald χ^2**	**P**	**Odds Ratio**	**95% CI**	**Wald χ^2**	**p**
Depression								
Yes (vs. no)	1.6	1.0–2.8	3.5	0.06				
Crack/Cocaine Use								
Yes (vs. no)	3.6	2.1–6.0	23.7	<.001	5.8	2.6–12.9	18.3	<.001
HCV Seropositive								
Yes (vs. no)	1.8	1. 1–3.0	4.7	0.03	2.4	1.0–5.8	4.8	0.03

Table 3

Among women without heavy drinking at baseline, factors associated with a trajectory increasing to heavy drinking over time (compared to trajectories that remained non-heavy drinking or non-drinking): multivariable analysis.

Baseline Variable	HIV-positive (n = 2303)				HIV-uninfected (n = 779)			
	Odds Ratio	95% CI	Wald χ^2	p	Odds Ratio	95% CI	Wald χ^2	p
Education								
> High School (vs. <= high school)	0.65	0.41–1.04	3.3	0.07	-	-		
Crack/Cocaine Use								
Yes (vs. no)	3.48	2.33 –5.19	37.3	<.001	3.17	1.88–5.37	21.0	<.001
Marijuana Use								
Yes (vs. no)	2.79	1.89–4.10	27.0	<.001	3.06	1.86–5.05	24.8	<.001
Tobacco Use								
Yes (vs. no)	2.91	1.74–4.87	16.5	<.001	2.27	1.25–4.12	6.6	0.01
Peak Drinking History (prior to baseline)								
Non-drinker (reference)	1				1			
Moderate drinker	0.36	0.13–1.03	5.4	0.02	0.44	0.15–1.33	5.4	0.02
Heavy drinker	1.51	1.00–2.28	22.0	<.001	2.40	1.45–3.97	14.4	<.001
Ever Had Alcohol Treatment (prior to baseline)								
Yes (vs. no)	2.66	1.77–3.99	22.0	<.001	-	-		
HCV Seropositive								
Yes (vs. no)	0.97	0.65–1.43	0.0	0.86	0.97	0.56–1.65	0.0	0.90