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Understanding the Longitudinal Association of Depression with Unprotected Anal Intercourse in a Cohort of White and Black Non-Hispanic Men Who Have Sex With Men. A Case-Crossover Approach.

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By

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Bachelor of Science

Oklahoma State University

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Thesis Committee Chair: Eli Rosenberg, B.S. Ph.D.

An abstract of

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Abstract

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Depression is a common mental disorder, impacting 6% of the population each year. Men who have sex with men (MSM) experience a higher prevalence of depression than others, due to minority stress. This stress may lead to risky sex such as unprotected anal intercourse (UAI). Black MSM report higher levels of depression yet lower levels of UAI than their white counterparts. Using 554 subjects from the InvolveMENt study in Atlanta, white and black, non-hispanic MSM were administered 1.5 hour questionnaires every six months for two years, evaluating depression, unprotected anal intercourse, and other behaviors. A case-control design was used to estimate the effect of depression on UAI. Potential covariates were analyzed in aggregate and at each study period for bivariate associations between exposure and outcome. A full model with 3 total variables, including depression, was generated. Other variables were dropped individually then collectively to assess for possible increases in model precision. None of the 3 reduced models significantly increased precision over the full model. While the unadjusted odds ratio between depression and UAI was significant, the adjusted odds ratio was slightly, non-significantly positive. This may be due to a more distal effect of depression on sexual behavior, sample size limitations due to the study design, or a non-linear trend between depression and UAI. Future studies should incorporate a larger sample size or test for non-linear associations between depression and UAI.

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Understanding the Longitudinal Association of Depression with Unprotected Anal Intercourse in a Cohort of White and Black Non-Hispanic Men Who Have Sex With Men. A Case-Crossover Approach.

Background

Depression is one of the most common mental disorders in the world, affecting roughly 6% of adults each year [1]. It is characterized by a loss of interest or enjoyment in everyday activities, low mood, and other various symptoms [1]. While depression may be one of the most familiar mental health issues to the general population, its diagnosis in clinical settings have been problematic. It is estimated that at most half of depressed people are accurately diagnosed by general practitioners [2]. In general, depression should be viewed as a continuum of intensity rather than being broken down into distinct levels [1], but suggested types include major depression, persistent depressive disorder, seasonal affective disorder, and others [3].

Men who have sex with men (MSM) have higher rates of depression than the general population. In a systematic review using four studies of depression, the 12-month prevalence of depression in MSM was found to be 2.41 times that of heterosexual men [4-8], and other studies have found similar results [9]. In a population of heterosexual, homosexual, and bisexual identifying men, there was a statistically significant difference in anxiety symptoms, depression symptoms, suicidality, and alcohol misuse across the three groups [10].

There is also evidence of a difference in depression prevalence between white and black non-Hispanics, both among MSM and the general population. In the general population, whites tend to have lower rates of depression than blacks [11, 12]. In MSM, this association is the reverse. The mean score on the Centers for Epidemiologic Studies Depression (CES-D) was compared between that in a black MSM population and a previously reported score in a

predominantly (over 90%) white population, HIV negative black MSM had a higher mean score (12.8) than the predominantly white comparison group (9.9) [13].

It is hypothesized that MSM experience more stress, and consequently more mental health issues, as a result of a social structure that discriminates against MSM. This type of excess stress in minority groups has been termed minority stress [14]. The three major assumptions of minority stress is that it is chronic, socially based, and in addition to stress common among all people [15]. A major component of minority stress occurs through what is known as vigilance. If an individual has a high level of perceived social stigma, he or she may engage in behaviors to cope with this additional stress [16]. These coping strategies require a considerable amount of energy and resources, which places an excess of mental burden among minority groups such as MSM. This excess burden leads to poorer mental health outcomes overall, but can be overcome. A positive self-identity and access to social support may counteract the stresses caused by being in a minority group [15, 17, 18].

Male-to-male sexual contact currently explains 78% of new HIV infections among men, while only 3.9% of all men report male-to-male sexual contact in the past five years [19, 20]. Over the course of a lifetime, 6.9% of men report male-to-male sexual contact [20]. Unprotected anal sex is a main transmission route of HIV and sexually transmitted infections in general. When engaging in unprotected, receptive anal intercourse with an HIV positive partner, the probability of contracting HIV is roughly 1.4% per act [21]. Depression may be associated with risky sexual behaviors such as UAI. Koblin et al found HIV seroconversion to be associated with depression in a cohort study [22]. The main mechanism by which depression elevates the risk for HIV infection is believed to be an increase in risky sexual behaviors such as unprotected anal intercourse (UAI). A cohort study found unprotected anal intercourse (UAI) to be positively associated with depression [23]. A cross-sectional study did not find a link between depression

and high risk sexual behavior individually, but individuals who had multiple, simultaneous mental health problems (including depression) were more likely to have engaged in risky sexual behavior [24]. There was increasing strength of association as the number of coexisting health problems increased, though these estimates were not statistically different at a 99% significance level. There is also evidence of a dose-response relationship between depression and risky sex. In the previously mentioned cohort investigating seroconversion, each quartile of depression severity was associated with higher point estimates of seroconversion, although confidence intervals did overlap [22]. Risky sexual behavior does not have an equal effect on HIV incidence across racial groups, however.

Black MSM experience higher rates of HIV seroconversion overall [25]. Overall, blacks experience 7.9 times the rate of HIV infection than white MSM [19]. Over half (51%) of new HIV infections in blacks were among MSM [19]. However, a meta-analysis concluded black MSM do not have significantly different rates of UAI with male partners, number of sexual partners, or involvement in commercial sex work [26]. The meta-analysis did include some studies of entirely HIV positive samples. Of the HIV negative or mixed serostatus samples, two [27, 28] found an inverse association of black ethnicity with UAI, seven [29-35] reported a null association, and one [36] found race to be significantly directly associated with UAI. Interestingly, a positive attitude towards a black, gay identity corresponds to higher rates of safe sex among black MSM [17]. This raises an interesting issue. There is no evidence of black MSM engaging in more risky sexual behavior overall, yet depression is associated with the prevalence of risky sexual behavior and black ethnicity is associated with a higher rate of depression in MSM. It is plausible that, when compared to white MSM, black MSM have a meaningfully different relationship between depression and risky sexual behavior.

Herein, the link between depression and UAI is assessed among samples of black and white, non-Hispanic, HIV negative MSM in the greater Atlanta area using a case-crossover approach. Case-crossover designs are best used when both outcome and exposure vary within individuals [37]. Since depression comprises a wide range of mental health problems and is common in the general population [1], individual behavioral factors may mask the true effect of depression on sexual behavior. Since a case-control approach accounts for individual variation in the effect, it is an ideal framework to study behavioral effects of depression. The link between race and risky sexual behavior has been studied among MSM, as has the link between depression and race. However, the author is not aware of any published studies of a difference in association strength of depression and risky sexual behaviors between white and black non-Hispanic MSM. Finally, the InvolveMENt study uses multiple measures to enhance the sensitivity of self-reported UAI, and to offset desirability biases, which may help to reduce bias in the observed associations.

Methods

A case-crossover study design was used on a subset of participants in the InvolveMENt study at Emory to assess racial differences in depression and UAI. The case-crossover has been described before [37]. Briefly, a subject serves as both their own case and control, as UAI habits can change over time. Recruitment methods for the study were described previously [38]. Recruitment occurred between June 2010 and December 2012 in Atlanta, GA. Recruitment was done through convenience sampling on Facebook, as well as time-venue sampling at popular venues for Atlanta MSM. Those who were 18 or older, male at birth, who could complete the survey instrument in English, currently lived in the Atlanta metropolitan statistical area, had at least 1 male sex partner in the past 3 months, could provide two means of contact, and who self-reported their race as black or white were considered eligible initially. During the course of recruitment, new research suggested HIV seroprevalence was highly concentrated in young people [19]. Less than three months into the study, only men under 40 were considered, though previously recruited individuals over 40 years remained under observation. Those who reported Hispanic/Latino ethnicity, had plans to move away from Atlanta within the next two years, were in a monogamous relationship with a male, or were concurrently enrolled in another HIV study were excluded.

Overall, 605 sampling events were conducted at time-venue combinations, and 19,931 men were approached. A total of 8,983 men (45.1%) agreed to be screened, and 2,144 (23.9%) were determined to be eligible. On Facebook, 6,092 responded to the advertisements. Of all those recruited, 184 (13.5%) were deemed eligible out of the 1,360 (22%) who made it to the

screening stage. For the present study, any period in which a participant reported no sexual partners was excluded.

The majority of the data were collected via a 1.5 hour computer self-interview, with an almost identical follow-up interview at 3, 6, 12, 18, and 24 months. Depression scores were ascertained via a shortened, 10-item version of the Center for Epidemiological Studies Depression scale (CESD-10) at each time period. This version tends to agree well with the full version [39]. Race, age, education, employment status, non-injection drug use in the past 6 months, a lifetime problem with alcohol, physical abuse, sexual abuse, and sex in exchange for drugs or services (exchange sex) were collected via the self-interview instrument. A problem at any time with alcohol is assessed using a dichotomized CAGE questionnaire, where a score of 2 or greater is considered at risk for alcoholism [40]. Employment status, non-injection drug use, potential problems with alcohol, and exchange sex were collected at each time period. Race, education, history of physical abuse, and a history of sexual abuse were only collected at baseline. UAI (in the past 6 months) was self-reported. UAI was self-reported at each collection period. In addition to self-reported UAI, tests for gonorrhea and chlamydia were also conducted. Positive tests for these infections were judged to be evidence of UAI. Subjects who did not report UAI but had a positive test for STI's were considered to have engaged in UAI during the sampling period.

Data were analyzed using SAS 9.4 (Cary, North Carolina). UAI and depression were compared to each other and then compared to select characteristics using chi-squared tests, followed by an evaluation for racial differences in these associations. Next, the prevalence of depression and UAI according to categories of risk factors and race were assessed at each follow-up period to detect changes over the course of the study. Statistical significance was

assessed using Mantel-Hanzel chi square (Fisher's Exact Tests if any category had an expected cell count below 5).

A conditional logistic model was then fit to assess the exposure (depression as indicated by a CESD-10 depression questionnaire) and outcome (UAI in the past 6 months). This "full model" included any time-varying variables as confounders if they were associated with depression or UAI in at a significance level of 0.05. Only time dependent variables could be included as variables in the model, as time independent variables will be controlled for by the within-subject conditioning of the model. Next, covariates were dropped from the model to compare the change in effect size and confidence interval. Any reduced model containing a point estimate of the odds ratio within 10% of the full model was considered a candidate model. If the author judged a candidate model to significantly increase the precision of point estimates, it was considered the best final model.

Results

Table 1 shows selected characteristic at baseline. The cohort consisted of roughly equal numbers of black (46%) and white (54%) MSM. At baseline, 41.0% of participants were under 25 years of age, 79.4% were employed, and 13.2% scored 2 or higher on the CAGE alcohol questionnaire. White MSM were less likely to report sexual abuse and more likely to report non-injection drug use in the past six months or a history of alcohol abuse compared to black MSM. In addition, white MSM were more educated and older overall. At baseline, only non-injection drug use (OR=1.69 95% CI 1.08-2.64) was statistically significantly associated with UAI. A history of trouble with alcohol (OR=2.51 95% CI 1.51-4.18), being the victim of sexual abuse (OR=1.99 95% CI 1.33-2.99) or physical abuse (OR=1.62 95% CI 1.10-2.40), and exchange sex (OR=2.94 95% CI 1.25-6.94) were statistically significantly associated with depression overall. No statistically significant difference in UAI or depression was observed between the two groups.

Figure 1 shows the trend in the prevalence of depression over time. In black MSM, depression steadily fell from 26.8% at baseline to just above 19.7% at the final sample period. For white MSM, depression ranged from 24.5% (at month 24) to 32.0% (at month 12) with no apparent pattern. White MSM reported higher levels of depression than did black MSM at each study period, except for baseline. **Figure 2** shows the trend in the prevalence of UAI over time. Both groups reported a lower prevalence in during months 6, 12, and 18 than at the beginning and end of the study. At each time period and overall, black MSM reported lower overall prevalence of UAI. For white MSM, the highest and lowest periods of UAI were at baseline (81.6%) and month 6 (68.3%), respectively. For black MSM, the highest and lowest periods of UAI were at baseline (78.0%) and at month 18 (56.4%).

Bivariate associations between depression and indicators for UAI, age, education, employment status, non-injection drug use, alcohol abuse, history of physical or sexual abuse, and a recent history of exchange are presented in **Table 2**. Alcohol issues (OR=2.76 95% CI 1.91-3.99), physical abuse (OR 1.89 95% CI 1.46-2.44), sexual abuse (OR=1.58, 95% CI 1.19-2.11), and non-injection drug use in the previous six months (OR=2.46 95% CI 1.90-3.17) were statistically significantly associated with depression among white MSM. For black MSM, exchange sex in the past 6 months (OR=2.78 95% CI 1.27-6.09), history of issues with alcohol (OR=1.97 95% CI 1.06-3.67), physical abuse (OR=1.63 95% CI 1.21-2.20) and sexual abuse (OR=1.71 95% CI 1.26-2.31) were associated with depression. Across both races, UAI, age at recruitment, non-injection drug use, history of a problem with alcohol, history of physical abuse, history of sexual abuse, and exchange sex were associated with depression.

As shown in **Appendix A**, depression was also evaluated for significant bivariate associations at each time period individually (stratified on race). For white MSM, statistically significant associations were observed for UAI (at baseline), non-injection drug use (at baseline and all follow-up periods), alcohol abuse (baseline, 6, 12, and 24 month follow-ups), a history of physical abuse (at baseline, 6, 12, and 18 month follow-ups), sexual abuse (at baseline), and exchange sex (at baseline). For black MSM, statistically significant associations were observed for alcohol abuse (at baseline), physical abuse (at 6 months), sexual abuse (at baseline and 6 month follow-up), and exchange sex (at baseline, 6, 12, and 18 month follow-ups). Neither race showed a statistically significant association of depression with age or employment status. No statistically significant interactions were observed between races at any follow-up period for depression.

Bivariate associations between UAI and the above factors are presented in **Table 3**. For black MSM, depression (OR=1.33 95% CI 0.97-1.81), non-injection drug use (OR=2.09 95% CI

1.47-2.98), and a history of sexual abuse (OR=1.49 95% CI 1.11-1.99) were associated with UAI. Compared to high school education or less, those with some college or a vocational certification reported more UAI overall (OR 1.47 95% CI 1.04-2.07). For white MSM, a history of a problem with alcohol (OR=1.78 95% CI 1.10-2.87) and non-injection drug use (OR=1.64 95% CI 1.25-2.15) were statistically significantly associated with UAI. Overall, depression, non-injection drug use, a history of a problem with alcohol, sexual abuse, and exchange sex were all significantly associated with UAI. Versus high school or less education, all groups with higher levels of education reported higher levels of UAI.

As shown in **Appendix B**, UAI was also evaluated for significant bivariate associations at each time period individually (stratified on race). For white MSM grouped by observation period, a statistically significant association was observed for depression (at baseline), employment status (at 18 month follow-up), non-injection drug use (at baseline and 6 month follow-up), and sexual abuse (at 18-month follow-up). For black MSM grouped by observation period, statistically significant associations appear for non-injection drug use (at 6 month follow-up) and exchange sex (at 6 month follow-up). Alcohol abuse (at 6 month follow-up) and education (at 12, 18 and 24 month follow-up) had statistically significant difference in effect between races. Across all time periods for white MSM, a statistically significant association was observed for non-injection drug use and alcohol abuse. For black MSM across all time periods, a statistically significant association between UAI and education, non-injection drug use, and sexual abuse was observed. Across all time periods, the association of UAI and education was statistically significantly different between races. For all participants across all time periods, UAI was statistically significantly associated with depression, education, non-injection drug use, alcohol abuse, or history of sexual abuse.

Conditional logistic regression of the longitudinal relationship of depression on UAI, controlling for within-person factors and time-dependent covariates, are presented in **Table 4**. The association between depression and UAI was not significant in any fit model. The estimated odds ratio for depression varied from 1.07 (full model) to 1.05 (fully reduced model). There was no evidence of confounding from either non-injection drug use or lifetime problems with alcohol. Lower 95% confidence estimates of the odds ratio varied from 0.70 to 0.71, while upper 95% confidence limits of the odds ratio varied from 1.58 to 1.61. No models were judged to increase precision meaningfully, relative to the full model. Thus, the full model was determined to be the best model.

Discussion

Overall, models found a marginally positive, non-significant association between depression and UAI. The full model was judged to be the best model, though none of the models provide a clinically significant effect. In this sample, white MSM experienced more depression than blacks on average, contrary to previously reported bivariate associations [13]. Overall, MSM in our sample reported a higher prevalence of depression than would be expected in the general population [1]. White MSM did report UAI more frequently than their black counterparts, as with previous studies. Sexual education was a component of the study, so UAI was expected to fall during the study period. However, UAI reporting increased in both races at the final follow-up period.

Strengths of the study include the sensitive indicator for UAI, the use of a case-crossover design, and the study population (white and black, non-hispanic MSM). One weakness of the case-crossover study design is its reliance on subjects to change outcome and exposure status. That is, subjects must change depression status, sexual behaviors, or both over the course of the study to inform the model. Overall, only 47.1% of subjects were informative to the study model. This could explain the inability of a significant effect to be found for depression. Furthermore, a main assumption for this study was an immediate effect of depression on UAI. Perhaps this effect took a period longer than six months to manifest, or depression must be present over an extended period of time before it effects sexual behavior. Lagging depression scores by one time period may be a more appropriate way to estimate the relationship. It is also possible a curvilinear model may best explain the relationship between depression and UAI. Major depression can be associated with lower energy and decreased libido. Therefore, severely depressed individuals may be at lower risk for UAI compared to moderately depressed individuals. A curvilinear model would place the strongest association of UAI at a moderate

CESD-10 score, with lower risks toward either extreme. Thus, a curvilinear model or a model using a categorization of CESD-10 scores other than “low” vs. “high” may be considered in future studies. Finally, part of the study protocol was to teach participants about safe sex practices. If these sessions changed the association of UAI and depression, the results could be skewed.

This study fails to provide longitudinal evidence of depression as a predictor for UAI among MSM. It is possible a larger sample size could have detected a significant effect, though the odds ratio estimate was quite small (1.05). As a case-crossover approach better controls for confounding than previously used approaches, the association between depression and UAI may be less than previously reported. Given the marginal association of depression and the inability to reliably diagnose depression by general practitioners [2], CESD-10 scores are likely not effective as a predictor of UAI, nor should treating depression be considered an HIV prevention strategy. Numerous other effective HIV prevention strategies have been identified, and may be more appropriate as an HIV prevention strategy [41]. While this study finds an insignificant association, numerous other studies have linked depression and risky sexual behavior. Further studies using larger samples, a curvilinear model, or a more distal effect of depression on UAI may be alternative approaches to detect a meaningful effect. This study provides further evidence of the large disparity in mental health between MSM and the general population.

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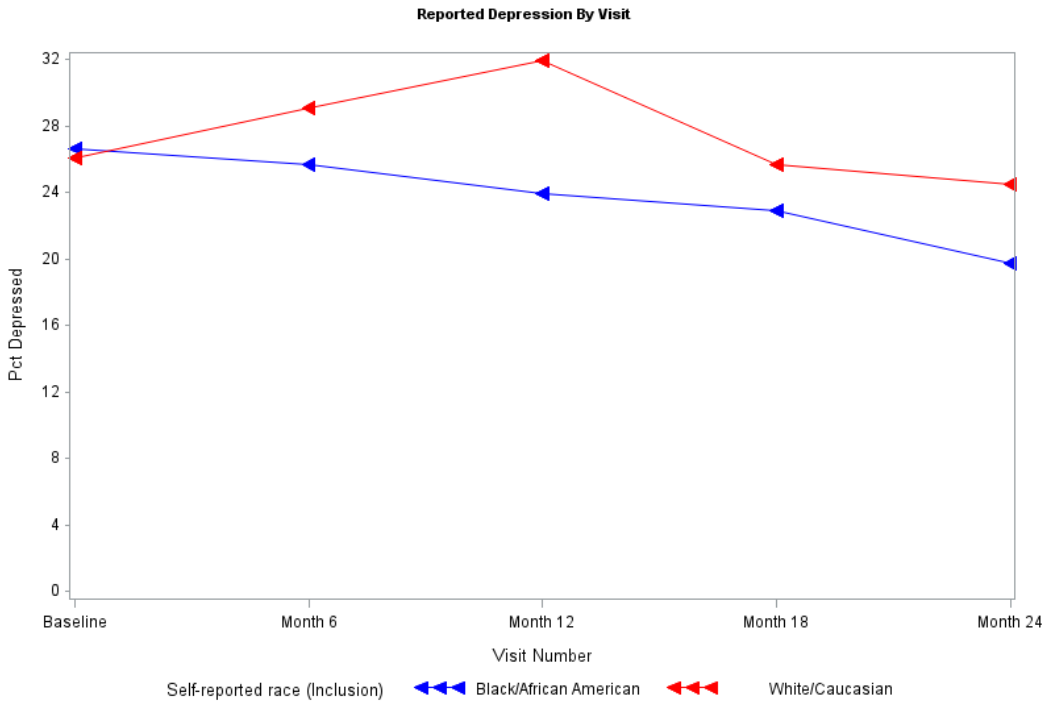

Figure 1. Reported Depression By Visit in Cohort of White and Black, non-hispanic Atlanta MSM.

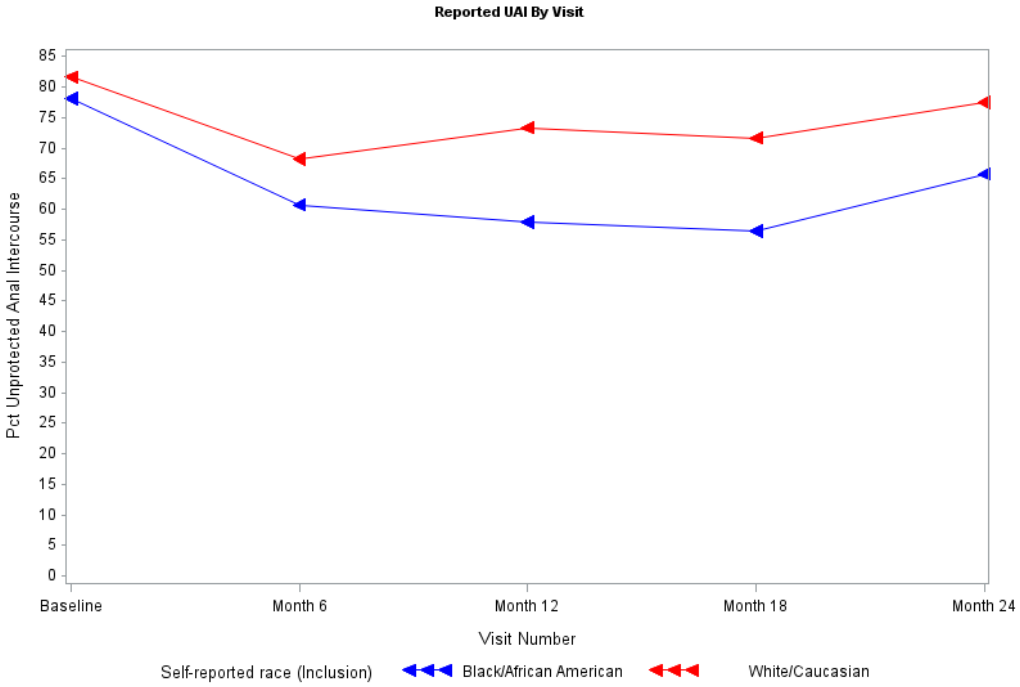

Figure 2. Reported UAI By Visit in Cohort of White and Black, non-Hispanic Atlanta MSM

Table 1. Characteristics at baseline among a cohort of black and white, non-hispanic MSM[a] in the Atlanta metropolitan area categorized depression[b] status and reported UAI[c] in the past six months (Total n=554).

	Reporting UAI[c] / Total		**Reporting Depression[b] / Total**	
	(443 / 554 Overall)	p < 0.05	(146 / 554 Overall)	p < 0.05
Age at Recruitment†				
Under 25	181 / 227	Ref	54 / 227	Ref
25 and Older	262 / 327	No	92 / 327	No
Education†				
H.S. or Less	73 / 93	Ref	23 / 93	Ref
Technical School[d]	172 / 203	No	61 / 203	No
College Degree[e]	196 / 256	No	62 / 256	No
Currently Employed				
No	91 / 113	Ref	36 / 113	Ref
Yes	351 / 440	No	109 / 440	No
NIDU[f,g]†				
No	252 / 329	Ref	76 / 329	Ref
Yes	188 / 222	Yes	68 / 222	No
Alcohol Problem[h]†				
No	381 / 481	Ref	114 / 481	Ref
Yes	62 / 73	No	32 / 73	Yes
Victim: Physical Abuse				
No	286 / 368	Ref	85 / 368	Ref
Yes	157 / 186	No	61 / 186	Yes
Victim: Sexual Abuse†				
No	318 / 404	Ref	91 / 404	Ref
Yes	125 / 150	No	55 / 150	Yes
Exchange Sex[g]				
No	424 / 532	Ref	135 / 532	Ref
Yes	19 / 22	No	11 / 22	Yes

†Statistically Significant (p<0.05) difference between races in behavior

[a]Men who have sex with Men

[b]Depressed defined as score over 9 on 10-item Center for Epidemiologic Studies- Depression (CESD-10) assessment

[c]Unprotected Anal Intercourse; determined by questionnaire and tests for anal infection

[d]Some College, Associate's degree, and/or technical school

[e]College, post-graduate, or professional school

[f]Non-injection Drug Use

[g]Past 6 months

[h]CAGE score of 2 or greater

Table 2. Bivariate associations between depression[a] and selected characteristics stratified on race in a cohort of white and black, non-hispanic Men who have Sex with Men. Multiple observations per subject (Total subjects = 554). Responses collected over five periods each spaced six months apart.

	Reporting Depression[a] / Total			Odds Ratio (All races)
	Black	White	Overall	OR (95% CL)
Depressed[a]	**239 / 988**	**340 / 1,233**	**581 / 2,225**	**N/A**
Time Independent				
Age at Recruitment				
Under 25	108 / 468	96 / 388	204 / 856	Ref
25 and Older	131 / 520	244 / 845	375 / 1,365	1.22 (1.00, 1.49)
Education				
H.S. or Less	57 / 223	28 / 109	85 / 332	Ref
Technical School[b]	109 / 402	115 / 406	224 / 808	1.12 (0.84, 1.50)
College Degree	73 / 361	197 / 713	270 / 1,074	0.98 (0.74, 1.30)
Victim: Physical Abuse				
No	134 / 640	192 / 826	326 / 1,466	Ref
Yes	*105 / 348	*148 / 407	*253 / 755	1.77 (1.46, 2.16)
Victim: Sexual Abuse				
No	142 / 677	242 / 953	384 / 1,630	Ref
Yes	*97 / 311	*98 / 280	*195 / 591	1.62 (1.32, 1.99)
Time Dependent (Past 6 Months)				
Alcohol Problem[c]				
No	222 / 943	277 / 1,102	499 / 2,045	Ref
Yes	*17 / 45	*63 / 131	*80 / 176	2.57 (1.88, 3.52)
Non-injection drug use				
No	184 / 775	146 / 727	330 / 1,502	Ref
Yes	53 / 208	*192 / 503	*245 / 711	1.86 (1.53, 2.26)
Exchange Sex				
No	227 / 962	327 / 1,199	554 / 2,161	Ref
Yes	*12 / 26	13 / 34	*25 / 60	2.07 (1.23, 3.48)
Currently Employed				
No	56 / 200	53 / 157	109 / 357	Ref
Yes	182 / 787	287 / 1,076	*469 / 1,863	0.76 (0.60, 0.98)
Unprotected Anal Intercourse				
No	73 / 349	73 / 313	146 / 662	Ref
Yes	166 / 639	267 / 920	*433 / 1,559	1.36 (1.10, 1.68)

*Statistically Significant (a<0.05) difference in association to reference

[a]Score greater than 9 on 10-item Center for Epidemiologic Studies-Depression (CESD-10) scale

[b]Tech school or some college, no degree

[c]CAGE questionnaire score of 2 or greater

Table 3. Bivariate associations between unprotected anal intercourse (UAI) and selected characteristics stratified on race in a cohort of white and black, non-hispanic Men who have Sex with Men. UAI as reported by individual and by presence of anal infections. Multiple observations per subject (Total subjects = 554). Responses collected over five periods each spaced six months apart.

	Reporting UAI / Total			**Odds Ratio (Overall)**
	Black	White	Overall	OR (95% CL)
UAI	**639 / 988**	**920 / 1,233**	**1,559 / 2,221**	**N/A**
Time Independent				
Age at Recruitment				
Under 25	311 / 468	303 / 388	614 / 856	Ref
25 and Older	328 / 520	617 / 845	945 / 1,365	0.89 (0.73, 1.07)
Education				
High School or Less	136 / 223	77 / 109	213 / 332	Ref
Technical School[a]	*280 / 402	307 / 406	*587 / 808	1.48 (1.13, 1.95)
College Degree	221 / 361	531 / 713	*752 / 1,074	1.30 (1.01, 1.69)
Victim: Physical Abuse				
No	403 / 640	612 / 826	1,015 / 1,466	Ref
Yes	236 / 348	308 / 407	544 / 755	1.15 (0.94, 1.39)
Victim: Sexual Abuse				
No	419 / 677	705 / 953	1,124 / 1630	Ref
Yes	*220 / 311	215 / 280	*435 / 591	1.26 (1.02, 1.55)
Time Dependent (Past 6 Months)				
Alcohol Problem[b]				
No	611 / 943	811 / 1,102	1,422 / 2,045	Ref
Yes	28 / 45	*109 / 131	*137 / 176	1.54 (1.07, 2.22)
Non-injection drug use				
No	476 / 775	515 / 727	991 / 1,502	Ref
Yes	*160 / 208	*402 / 503	562 / 711	1.94 (1.58, 2.40)
Exchange Sex				
No	618 / 962	1,199	1,509 / 2,161	Ref
Yes	21 / 26	*29 / 34	50 / 60	2.16 (1.09, 4.29)
Currently Employed				
No	127 / 200	110 / 157	237 / 357	Ref
Yes	511 / 787	810 / 1,076	1,321 / 1,863	1.23 (0.97, 1.57)
Depression[c]				
No	276 /473	653 / 893	1,126 / 1,642	Ref
Yes	166 / 239	267 / 340	*433 / 579	1.36 (1.10, 1.68)

*Statistically Significant (a<0.05) difference in association within group

[a]Technical school or some college, no degree

[b]CAGE questionnaire score of 2 or greater
[c]Score greater than 9 on 10-item Center for Epidemiologic Studies-Depression (CESD-10) scale

Table 4. Effect estimates of depression[a] for Unprotected Anal Intercourse[b] in a population of white and black, non-hispanic men who gave sex with men in the Atlanta area using a case-crossover approach (total subjects=554).

	Depression Effect Estimate	
Covariates in Model	**Odds Ratio**	**(Lower, Upper 95% OR)**
NIDU[c] and Alcohol Problem[d]	1.05	(0.70, 1.58)
NIDU[c]	1.06	(0.70, 1.58)
Alcohol[d]	1.06	(0.71, 1.59)
None	1.07	(0.71, 1.61)

[a]Score greater than 9 on 10-item Center for Epidemiologic Studies depression scale
[b]Indicated by self-report or presence of anal infections
[c]Non-injection drug use reported in last 6 months
[d]Score of two or higher on CAGE questionnaire

Appendix A: Bivariate Associations Between Variables of Interest and Depression

Bivariate Associations to Depression At Baseline

	Black (overall n=258)			White (overall n=301)			
	n	%Depressed	p	n	% Depressed	p	BD[a]
UAI?							
No	56	20	0.18	55	15	0.03[b]	0.51
Yes	199	29		244	29		
Age							
Under 25	128	26	0.70	101	21	0.13	0.41
25 and Older	129	28		200	29		
Education							
High School	62	29	0.14	32	16	0.34	0.44
Tech School	103	32		102	28		
College diploma	91	20		166	27		
Currently employed							
No	60	28	0.72	55	36	0.06[c]	0.3
Yes	196	26		246	24		
Noninjection Drug Use							
No	185	27	0.83	148	19	0.01	0.05
Yes	70	26		152	33		
Alcohol Problem							
No	236	25	0.03	249	23	<0.01	0.86
Yes	21	48		52	42		
Any Physical Abuse							
No	169	24	0.11	200	23	0.04	0.81
Yes	88	33		101	34		
Any Sexual Abuse							
No	176	22	<0.01	230	23	0.02	0.71
Yes	81	38		71	37		
Exchange Sex							
No	242	25	0.02	287	25	0.04	0.87
Yes	15	53		14	50		

[a]BD=Breslow-Day test for interaction, assessing for difference of association by race

[b]Red Shading Indicates p<0.05

[c]Yellow shading indicates $0.05 \leq p < 0.10$

Bivariate Associations to Depression At 6 Months

	Black (overall n=214)			White (overall n=268)			
	n	%Depressed	p	n	% Depressed	p	BD[a]
UAI?							
No	84	19	0.07[c]	85	27	0.62	0.31
Yes	130	30		183	30		
Age							
Under 25	99	23	0.44	85	29	0.94	0.54
25 and Older	115	28		183	29		
Education							
High School or Less	50	24	0.91	24	29	0.92	0.56
Tech School	88	27		91	31		
College diploma	75	25		152	28		
Currently employed							
No	46	28	0.65	34	32	0.66	0.99
Yes	168	25		234	29		
Noninjection Drug Use							
No	169	25	0.74	162	23	0.01[b]	0.22
Yes	44	27		105	38		
Alcohol Problem							
No	204	25	0.75	246	26	<0.01	0.1
Yes	10	30		22	64		
Any Physical Abuse							
No	138	20	0.01	180	24	0.01	0.95
Yes	76	34		88	40		
Any Sexual Abuse							
No	147	21	0.02	205	27	0.14	0.52
Yes	67	36		63	37		
Exchange Sex							
No	202	24	0.05	257	29	0.89	0.17
Yes	12	50		11	27		

[a]BD=Breslow-Day test for interaction, assessing for difference of association by race
[b]Red Shading Indicates p<0.05
[c]Yellow shading indicates 0.05 ≤ p <0.10

Bivariate Associations to Depression At 12 Months

	Black (overall n=188)			White (overall n=244)			
	n	%Depressed	p	n	% Depressed	p	BD[a]
UAI?							
No	79	27	0.47	65	26	0.24	0.18
Yes	109	22		179	34		
Age							
Under 25	88	23	0.72	75	29	0.56	0.91
25 and Older	100	25		169	33		
Education							
High School	41	22	0.62	19	26	0.85	0.07[c]
Tech School	76	28		81	32		
College diploma	71	21		143	33		
Currently employed							
No	43	30	0.27	28	25	0.4	0.18
Yes	145	22		216	33		
Noninjection Drug Use							
No	151	25	0.77	150	26	0.02[b]	0.12
Yes	36	22		93	41		
Alcohol Problem							
No	181	24	0.77	224	30	0.02	0.41
Yes	7	29		20	55		
Any Physical Abuse							
No	122	21	0.25	165	27	0.02	0.58
Yes	66	29		79	42		
Any Sexual Abuse							
No	129	24	0.96	190	30	0.22	0.4
Yes	59	24		54	39		
Exchange Sex							
No	176	22	0.03	235	32	0.52	0.07
Yes	12	50		9	22		

[a]BD=Breslow-Day test for interaction, assessing for difference of association by race

[b]Red Shading Indicates p<0.05

[c]Yellow shading indicates 0.05 ≤ p <0.10

Bivariate Associations to Depression At 18 Months

	Black (overall n=179)			White (overall n=226)			
	n	%Depressed	p	n	% Depressed	p	BD[a]
UAI?							
No	78	21	0.5033	64	20	0.247	0.7403
Yes	101	25		162	28		
Age							
Under 25	84	20	0.4246	69	26	0.9231	0.5135
25 & Older	95	25		157	25		
Education							
High School	39	23	0.5699	21	29	0.8005	0.4306
Tech School	73	26		74	26		
College diploma	67	19		130	25		
Currently employed							
No	32	28	0.4381	21	33	0.3982	0.9142
Yes	147	22		205	25		
Noninjection Drug Use							
No	147	22	0.3827	142	15	<0.01[b]	0.0593
Yes	31	29		84	43		
Alcohol Problem							
No	175	23	0.9199	207	24	0.09[c]	0.5721
Yes	4	25		19	42		
Any Physical Abuse							
No	113	19	0.1523	150	21	0.04	0.7746
Yes	66	29		76	34		
Any Sexual Abuse							
No	124	19	0.09	176	24	0.2451	0.6713
Yes	55	31		50	32		
Exchange Sex							
No	167	21	0.02	217	27	0.07	<0.01
Yes	12	50		9	0		

[a]BD=Breslow-Day test for interaction, assessing for difference of association by race

[b]Red Shading Indicates p<0.05

[c]Yellow shading indicates 0.05 ≤ p <0.10

Bivariate Associations to Depression At 24 Months

	Black (overall n=152)			White (overall n=196)			
	n	%Depressed	p	n	% Depressed	p	BD[a]
UAI?							
No	52	17	0.59	44	27	0.63	0.47
Yes	100	21		152	24		
Age							
Under 25	70	21	0.63	59	17	0.11	0.14
25 and Older	82	18		137	28		
Education							
High School	32	28	0.35	13	38	0.49	0.14
Tech School	62	19		60	23		
College diploma	58	16		122	24		
Currently employed							
No	19	21	0.88	21	43	0.04[b]	0.26
Yes	133	20		175	22		
Noninjection Drug Use							
No	125	19	0.72	127	16	<0.01	0.07[c]
Yes	27	22		69	41		
Alcohol Problem							
No	149	19	0.55	178	22	0.04	0.83
Yes	3	33		18	44		
Any Physical Abuse							
No	98	18	0.57	132	20	0.06	0.46
Yes	54	22		64	33		
Any Sexual Abuse							
No	102	18	0.36	153	23	0.32	0.99
Yes	50	24		43	30		
Exchange Sex							
No	146	18	0.06	186	25	0.28	0.03
Yes	6	50		10	10		

[a]BD=Breslow-Day test for interaction, assessing for difference of association by race

[b]Red Shading Indicates p<0.05

[c]Yellow shading indicates $0.05 \leq p < 0.10$

Appendix B: Bivariate Associations Between Variables of Interest and Depression

Bivariate Associations to UAI At Baseline

	Black (n=255)			White (n=299)			Total	
	N	%Depressed	p	N	% Depressed	p		Bd
Depressed?								
No	187	76	0.2	221	79	0		0.5
Yes	68	84		78	90			
Age								
Under 25	127	80	0.6	100	80	0.6		0.4
25 and Older	128	77		199	82			
Education								
High School	61	79	0.1	32	78	0.5		0.1
Tech School	103	84		100	85			
College diploma	90	70		166	80			
Currently employed								
No	60	83	0.3	53	77	0.4		0.1
Yes	194	76		246	83			
Noninjection Drug Use								
No	183	77	0.4	146	77	0		0.5
Yes	70	81		152	86			
Alcohol Problem								
No	234	78	0.8	247	80	0.2		0.3
Yes	21	76		52	88			
Any Physical Abuse								
No	169	76	0.2	199	79	0.2		0.9
Yes	86	83		100	86			
Any Sexual Abuse								
No	175	76	0.2	229	81	0.5		0.8
Yes	80	83		70	84			
Exchange Sex								
No	241	77	0.2	285	82	0.8		0.2
Yes	14	78		14	79			

[a]BD=Breslow-Day test for interaction, assessing for difference of association by race

[b]Red Shading Indicates p<0.05

[c]Yellow shading indicates 0.05 ≤ p <0.10

Bivariate Associations to UAI At 6 Months

	Black (n=214)			White (n=268)			
	n	%Depressed	p	n	% Depressed	p	BD
Depressed?							
No	159	57	0.07	190	67	0.62	0.31
Yes	55	71		78	71		
Age							
Under 25	99	60	0.75	85	73	0.26	0.31
25 and Older	115	62		183	66		
Education							
High School	50	54	0.09	24	63	0.75	0.08
Tech School	88	69		91	67		
College diploma	75	55		152	70		
Currently employed							
No	46	54	0.32	34	68	0.93	0.56
Yes	168	63		234	68		
Noninjection Drug Use							
No	169	55	0	162	64	0.05	0.08
Yes	44	84		105	75		
Alcohol Problem							
No	204	62	0.17	246	67	0.06	0.02
Yes	10	40		22	86		
Any Physical Abuse							
No	138	59	0.59	180	68	0.8	0.83
Yes	76	63		88	69		
Any Sexual Abuse							
No	147	58	0.19	205	68	0.76	0.49
Yes	67	67		63	70		
Exchange Sex							
No	202	59	0.02	257	68	0.75	0.12
Yes	12	92		11	73		

[a]BD=Breslow-Day test for interaction, assessing for difference of association by race

[b]Red Shading Indicates p<0.05

[c]Yellow shading indicates 0.05 ≤ p <0.10

Bivariate Associations to UAI At 12 Months

	Black (n=188)			White (n=244)			
	n	%Depressed	p	n	% Depressed	p	BD[a]
Depressed?							
No	143	59	0.47	166	71	0.24	0.18
Yes	45	53		78	78		
Age							
Under 25	88	60	0.56	75	79	0.21	0.59
25 and Older	100	56		169	71		
Education							
High School	41	49	0.24	19	63	0.56	0.01[b]
Tech School	76	64		81	75		
College diploma	71	56		143	73		
Currently employed							
No	43	53	0.50	28	75	0.83	0.56
Yes	145	59		216	73		
Noninjection Drug Use							
No	151	56	0.13	150	71	0.25	0.63
Yes	36	69		93	77		
Alcohol Problem							
No	181	57	0.46	224	74	0.72	0.42
Yes	7	71		20	70		
Any Physical Abuse							
No	122	57	0.82	165	74	0.77	0.71
Yes	66	59		79	72		
Any Sexual Abuse							
No	129	53	0.07[c]	190	74	0.57	0.09
Yes	59	68		54	70		
Exchange Sex							
No	176	57	0.53	173	74	0.64	0.44
Yes	12	67		6	67		

[a]BD=Breslow-Day test for interaction, assessing for difference of association by race

[b]Red Shading Indicates $p<0.05$

[c]Yellow shading indicates $0.05 \leq p < 0.10$

Bivariate Associations to UAI At 18 Months

	Black (n=179)			White (n=226)			
	n	%Depressed	p	n	% Depressed	p	BD[a]
Depressed?							
No	138	55	0.5	168	70	0.25	0.74
Yes	41	61		58	78		
Age							
Under 25	84	56	0.9	69	75	0.42	0.5
25 and Older	95	57		157	70		
Education							
High School	39	51	0.57	21	67	0.66	0.02[b]
Tech School	73	55		74	69		
College diploma	67	61		130	74		
Currently employed							
No	32	59	0.71	21	52	0.04	0.07[c]
Yes	147	56		205	74		
Noninjection Drug Use							
No	147	53	0.07	142	70	0.39	0.34
Yes	31	71		84	75		
Alcohol Problem							
No	175	57	0.2	207	71	0.21	0.07
Yes	4	25		19	84		
Any Physical Abuse							
No	113	54	0.39	150	71	0.63	0.79
Yes	66	61		76	74		
Any Sexual Abuse							
No	124	54	0.33	176	68	0.03	0.28
Yes	55	62		50	84		
Exchange Sex							
No	167	57	0.29	217	71	0.24	0.12
Yes	12	42		9	89		

[a]BD=Breslow-Day test for interaction, assessing for difference of association by race

[b]Red Shading Indicates p<0.05

[c]Yellow shading indicates 0.05 ≤ p <0.10

Bivariate Associations to UAI At 24 months

	Black (n=152)			White (n=196)			
	n	%Depressed	p	Total n	% Depressed	p	BD[a]
Depressed?							
No	122	65	0.59	148	78	0.63	0.47
Yes	30	70		48	75		
Age							
Under 25	70	73	0.09[c]	59	85	0.11	0.92
25 and Older	82	60		137	74		
Education							
High School	32	66	0.70	13	85	0.46	0.04[b]
Tech School	62	69		60	82		
College diploma	58	62		122	75		
Currently employed							
No	19	53	0.20	21	67	0.21	0.99
Yes	133	68		175	79		
Noninjection Drug Use							
No	125	65	0.58	127	75	0.21	0.72
Yes	27	70		69	83		
Alcohol Problem							
No	149	66	0.97	178	78	0.98	0.99
Yes	3	67		18	78		
Any Physical Abuse							
No	98	63	0.38	132	79	0.55	0.29
Yes	54	70		64	75		
Any Sexual Abuse							
No	102	70	0.44	153	78	0.58	0.35
Yes	50	64		43	74		
Exchange Sex							
No	146	66	0.96	186	77	0.85	0.92
Yes	6	67		10	80		

[a]BD=Breslow-Day test for interaction, assessing for difference of association by race

[b]Red Shading Indicates p<0.05

[c]Yellow shading indicates 0.05 ≤ p <0.10

Appendix C: SAS Code

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*****************************************************************;
* UAI and Depression in Black and White MSM
            *;
* Date: 9/2/2014
                  *;
* Programmer: Jon Downs
                  *;
*
                              *;
*****************************************************************;
options nofmterr;
*Call in formats and dataset location;
libname involve 'T:\EpiProjs\Rosenberg_Analysis_Team\2014_06 - Downs -
Depression and UAI - INV\Data\Baseline freeze - 02_18_2013';
libname long 'T:\EpiProjs\Rosenberg_Analysis_Team\2014_06 - Downs -
Depression and UAI - INV\Data\Longitudinal';
libname library 'T:\EpiProjs\Rosenberg_Analysis_Team\2014_06 - Downs -
Depression and UAI - INV\Data\Baseline freeze - 02_18_2013';


*Copy datasets in SASto local computer to remove write-password
protection and assign visit numbers to baseline;
data work.participants_survey_baseline;
      set involve.participants_survey_baseline;
      Visit=1;
run;
data work.status;
      set involve.status;
run;
data work.sti_baseline;
      set involve.sti_baseline;
run;

data time_dep_demo;
      set long.time_dep_demo;
run;
proc contents data=time_dep_demo;
run;
data key_vars_long;
      set long.key_vars_long;
      mcount=cmiss(employed_now,poverty,homeless,
            arrested,sexp6m,any_main);
      if mcount=6 then delete;
run;

*Sort datasets prior to merging;
proc sort data = work.status;
      by study_id;
run;
proc contents data=work.status;
run;
proc sort data = work.participants_survey_baseline;
      by study_id;
```

```
run;
proc sort data = work.sti_baseline;
      by study_id;
run;
proc sort data = work.time_dep_demo;
      by study_id;
run;
proc sort data = work.key_vars_long;
      by study_id;
run;

*******************
Data familiarization
*******************

*Print subset of HIV status dataset;
proc print data=status (obs=100);
run;
*Print subset of survey results at baseline;
proc print data=participants_survey_baseline (obs=100);
run;
*Print subset of all sti's at baseline;
proc print data=sti_baseline (obs=100);
run;
*Print subset of longitudinal variables;
proc print data=key_vars_long (obs=100);
run;
*Check for HIV status (both acute and detectable at baseline);
proc freq data=status;
      tables baseline_hiv*baseline_acute/list missing;
run;

*Get frequencies of creating missings count (key_vars_long);
proc freq data=key_vars_long;
      tables mcount;
run;

*Combine baseline and HIV status to narrow sample to HIV- people;
data work.step1;
      merge work.participants_survey_baseline work.status;
            if baseline_hiv ne 1 then delete;
run;
*Create format for visit variable;
proc format;
value monthf 0='Baseline'
             1='Month 6'
             2='Month 12'
             3='Month 18'
             4='Month 24';
run;


*Create the final dataset for analysis;
data longdata;
      merge time_dep_demo key_vars_long sti_baseline step1;
      by study_id;
*Recode scoring of positive CES-D items - reversed scoring;
```

```
      if cesd_hopeful=3 then cesd_hopefulp=0;
      if cesd_hopeful=2 then cesd_hopefulp=1;
      if cesd_hopeful=1 then cesd_hopefulp=2;
      if cesd_hopeful=0 then cesd_hopefulp=3;
      if cesd_happy=3 then cesd_happyp=0;
      if cesd_happy=2 then cesd_happyp=1;
      if cesd_happy=1 then cesd_happyp=2;
      if cesd_happy=0 then cesd_happyp=3;
*See if any CESD scores have multiple variables missing;
      cesd_missing=0;
      if cesd_bother=. then cesd_missing=cesd_missing+1;
      if cesd_concentrate=. then cesd_missing=cesd_missing+1;
      if cesd_depressed=. then cesd_missing=cesd_missing+1;
      if cesd_effort=. then cesd_missing=cesd_missing+1;
      if cesd_hopefulp=. then cesd_missing=cesd_missing+1;
      if cesd_fearful=. then cesd_missing=cesd_missing+1;
      if cesd_badsleep=. then cesd_missing=cesd_missing+1;
      if cesd_happyp=. then cesd_missing=cesd_missing+1;
      if cesd_lonely=. then cesd_missing=cesd_missing+1;
      if cesd_getgoing=. then cesd_missing=cesd_missing+1;

*delete any CESD with more than 1 missing;
      if cesd_missing gt 1 then delete;

*Create new variables to make missings equal to 0 (to correctly sum
scores);
      cesd_bother2=cesd_bother;
      cesd_concentrate2=cesd_concentrate;
      cesd_depressed2=cesd_depressed;
      cesd_effort2=cesd_effort;
      cesd_hopefulp2=cesd_hopefulp;
      cesd_fearful2=cesd_fearful;
      cesd_badsleep2=cesd_badsleep;
      cesd_happyp2=cesd_happyp;
      cesd_lonely2=cesd_lonely;
      cesd_getgoing2=cesd_getgoing;
      if cesd_bother=. then cesd_bother2=0;
      if cesd_concentrate=. then cesd_concentrate2=0;
      if cesd_depressed=. then cesd_depressed2=0;
      if cesd_effort=. then cesd_effort2=0;
      if cesd_hopefulp=. then cesd_hopefulp2=0;
      if cesd_fearful=. then cesd_fearful2=0;
      if cesd_badsleep=. then cesd_badsleep2=0;
      if cesd_happyp=. then cesd_happyp2=0;
      if cesd_lonely=. then cesd_lonely2=0;
      if cesd_getgoing=. then cesd_getgoing2=0;
*Create var for total response for CES-D scale;
      cesd_total=0;
            cesd_total=cesd_bother2+cesd_concentrate2+cesd_depressed2+
            cesd_effort2+cesd_hopefulp2+cesd_fearful2+cesd_badsleep2
            +cesd_happyp2+cesd_lonely2+cesd_getgoing2;
      cesd_average=cesd_total/(10-cesd_missing);
      cesd_adj=10*cesd_average;

*Create indicator for cutoff CESD score;
cesd_bin=.;
      if cesd_adj ge 10 then cesd_bin=1;
```

```
      if cesd_adj lt 10 then cesd_bin=0;
*Create var for total response for CAGE scale questions;
      cage=0;
      if drink_cut=1 then cage=cage+1;
      if drink_critic=1 then cage=cage+1;
      if drink_guilt=1 then cage=cage+1;
      if drink_morning=1 then cage=cage+1;
*Create binary var for CAGE outcome. Above 2 indicates
problematic alcohol use;
      if cage gt . and cage le 2 then drink=0;
      if cage gt 2 then drink=1;
*Create categorized variable for age;
      if age_baseline lt 25 then age_25=0;
      if age_baseline ge 25 then age_25=1;
*Create var for total number of exchange partners, p12m;
      exchangep6m=0;
      if male_exchangep6m=1 then exchangep6m=1;
      if female_exchangep6m=1 then exchangep6m=1;
      if mtf_exchangep6m=1 then exchangep6m=1;
      if ftm_exchangep6m=1 then exchangep6m=1;
*Combine var for sexual abuse;
      abuse_sexual=0;
      if abuse_child_sexabuse=1 then abuse_sexual=1;
      if abuse_adult_sexabuse=1 then abuse_sexual=1;
*Combine var for physical abuse;
      abuse_physical=0;
      if abuse_child_physabuse=1 then abuse_physical=1;
      if abuse_adult_physabuse=1 then abuse_physical=1;
*Collapse variable levels;
      educ2=.;
      if educ ge 3 then educ2=0;
      if educ=2 then educ2=1;
      if educ=1 then educ2=2;
      if living eq 3 then living=1;
*Label new variables;
      label cage="CAGE Questionnaire"
            drink="Alcohol Problem"
            age_25="Age Group";
*Make visits equally spaced, starting at zero;
      visit2=visit;
      if visit=1 then visit2=2;
      visit3=visit2-2;
*Remove study_id 808 (left before completing survey/HIV test);
      if study_id=808 then delete;
*Remove missing UAI status;
      if any_uai_sens=. then delete;
*Apply new format to visit variable;
format visit3 monthf.;
run;
proc print data=longdata;
      var study_id drink_cut drink_critic drink_guilt drink_morning;
      where visit ne 0;
run;
proc print data=longdata (obs=100);
      var educ educ2;
run;
proc contents data=longdata;
```

```
run;
proc freq data=longdata;
      tables drink*visit;
      where study_id lt 50;
run;

/*******************************
*     Data validation                    *
*******************************
*Check all obs gt 803 are out of the dataset;
proc print data=longdata;
      where study_id gt 803;
run;
*Check follow-up pattern;
proc freq data=longdata;
      tables visit3;
run;

*Check created variables against their components;
proc freq data=work.longdata;
      tables educ*educ2
abuse_sexual*abuse_child_sexabuse*abuse_adult_sexabuse

      abuse_physical*abuse_child_physabuse*abuse_adult_physabuse

      cesd_adj*cesd_total*cesd_average*cesd_missing*cesd_bin

      exchangep6m*male_exchangep6m*female_exchangep6m*mtf_exchangep6m*
                        ftm_exchangep6m

      drink*cage*drink_cut*drink_critic*drink_guilt*drink_morning
                  visit3*visit2*visit/list missing;
                  attrib visit format=;
run;
*Check range of cesd_total (total cesd score);
proc univariate data=work.longdata;
      var cesd_total;
run;

*/

/************************************************
*
      *
*     Figure 1
      *
*
      *
************************************************/
proc sort data=longdata;
      by visit3 race_inc;
run;
*Get summary stats for depression;
proc summary data = longdata;
by visit3 race_inc;
var cesd_bin;
output out = mean_cesd (drop = _:) mean = mean n = n stderr = stderr;
```

```
run;
proc print data=mean_cesd;
run;
*Set up graphics for printing;
*Symbol settings for graph;
symbol1 i = j value=A font =marker c = blue h = 1  line=1 width = 1;
symbol2 i = j value =A font = marker c = red h = 1  line=1 width = 1;
*Title: text and settings;
title height=1 'Reported Depression By Visit';
*Footnote: text and settings;
footnote font=arabic height=2 j=l wrap 'Figure 1. Reported Depression
By Visit in Cohort of White and Black,
 non-hispanic Atlanta MSM.';
 *Vertical Axis settings;
axis1 label=(a=90 j=c 'Pct Depressed')
            order=(0 to 0.32 by 0.04)
            minor=none;
*Horizontal Axis Settings;
axis2 order=(0 to 4 by 1)
            minor=none
            label=('Visit Number');
*Run plot;
proc gplot data = mean_cesd;
      plot mean * visit3 = race_inc/haxis=axis2 vaxis=axis1;
run; quit;
/*****************************************************
*
      *
*     Figure 2
      *
*
      *
*****************************************************/
*Get summary stats for depression;
proc summary data = longdata;
by visit3 race_inc;
var any_uai_sens;
output out = mean_uai (drop = _:) mean = mean n = n stderr = stderr;
run;
*Set up graphics for printing;
symbol1 i = j value=A font =marker c = blue h = 1  line=1 width = 1;
symbol2 i = j value =A font = marker c = red h = 1  line=1 width = 1;
*Title content and settings;
title height=1 'Reported UAI By Visit';
*Footnote content and settings;
footnote font=arabic height=2 j=l wrap 'Figure 2. Reported UAI By Visit
in Cohort of White and Black,
 non-Hispanic Atlanta MSM';
 *Vertical Axis settings;
axis1 label=(a=90 j=c 'Pct Unprotected Anal Intercourse')
            order=(0 to 0.85 by .05)
            minor=none;
*Horizontal Axis settings;
axis2 order=(0 to 4 by 1)
            minor=none
            label=('Visit Number');
*Print averages by time;
```

```
proc print data=mean_uai;
run;
*Run plot for graphic;
proc gplot data = mean_uai;
      plot mean * visit3 = race_inc/haxis=axis2 vaxis=axis1;
run; quit;

/*************************************************
*
      *
*     Table 1
      *
*
      *
*************************************************/
*Racial Diffs- Difference in race by covariates?;
Proc freq data=longdata;
tables (any_uai_sens cesd_bin age_25 educ2 employed_now noninjection
drink
            abuse_physical abuse_sexual exchangep6m)*race_inc/chisq;
            where visit3=0;
run;
/***********************************
* UAI (Racial)                                  *
***********************************/
*Age overall;
proc freq data=longdata;
      tables race_inc*age_25*any_uai_sens/chisq cmh;
      where visit3=0;
run;
*Education (Votech);
proc freq data=longdata;
      tables race_inc*educ2*any_uai_sens/chisq cmh;
      where visit3=0 and educ2 ne 2;
run;
*Education (College);
proc freq data=longdata;
      tables race_inc*educ2*any_uai_sens/chisq cmh;
      where visit3=0 and educ2 ne 1;
run;
*Employment overall;
proc freq data=longdata;
      tables race_inc*employed_now*any_uai_sens/chisq cmh;
      where visit3=0;
run;
*NIDU;
proc freq data=longdata;
      tables race_inc*noninjection*any_uai_sens/chisq cmh;
      where visit3=0;
run;
*Alcohol;
proc freq data=longdata;
      tables race_inc*drink*any_uai_sens/chisq cmh;
      where visit3=0;
run;
*Abuse (physical);
proc freq data=longdata;
```

```
      tables race_inc*abuse_physical*any_uai_sens/chisq cmh;
      where visit3=0;
run;
*Abuse (sexual);
proc freq data=longdata;
      tables race_inc*abuse_sexual*any_uai_sens/chisq cmh;
      where visit3=0;
run;
*Exchange sex;
proc freq data=longdata;
      tables race_inc*exchangep6m*any_uai_sens/chisq cmh;
      where visit3=0;
run;
/**********************************
* Depression      (Racial)                *
**********************************/
*Age overall;
proc freq data=longdata;
      tables age_25*cesd_bin/chisq cmh;
      where visit3=0;
      by race_inc;
run;
*Education (Votech);
proc freq data=longdata;
      tables educ2*cesd_bin/chisq cmh;
      where visit3=0 and educ2 ne 2;
run;
*Education (College);
proc freq data=longdata;
      tables educ2*cesd_bin/chisq cmh;
      where visit3=0 and educ2 ne 1;
run;
*Employment overall;
proc freq data=longdata;
      tables employed_now*cesd_bin/chisq cmh;
      where visit3=0;
run;
*NIDU;
proc freq data=longdata;
      tables noninjection*cesd_bin/chisq cmh;
      where visit3=0;
run;
*Alcohol;
proc freq data=longdata;
      tables drink*cesd_bin/chisq cmh;
      where visit3=0;
run;
*Abuse (physical);
proc freq data=longdata;
      tables abuse_physical*cesd_bin/chisq cmh;
      where visit3=0;
run;
*Abuse (sexual);
proc freq data=longdata;
      tables abuse_sexual*cesd_bin/chisq cmh;
      where visit3=0;
run;
```

```
*Exchange sex;
proc freq data=longdata;
      tables race_inc*exchangep6m*cesd_bin/chisq cmh;
      where visit3=0;
run;
/***********************************
* UAI (OVERALL)                                  *
***********************************/
*Age overall;
proc freq data=longdata;
      tables age_25*any_uai_sens/chisq cmh;
      where visit3=0;
run;
*Education (Votech);
proc freq data=longdata;
      tables educ2*any_uai_sens/chisq cmh;
      where visit3=0 and educ2 ne 2;
run;
*Education (College);
proc freq data=longdata;
      tables educ2*any_uai_sens/chisq cmh;
      where visit3=0 and educ2 ne 1;
run;
*Employment overall;
proc freq data=longdata;
      tables employed_now*any_uai_sens/chisq cmh;
      where visit3=0;
run;
*NIDU;
proc freq data=longdata;
      tables noninjection*any_uai_sens/chisq cmh;
      where visit3=0;
run;
*Alcohol;
proc freq data=longdata;
      tables drink*any_uai_sens/chisq cmh;
      where visit3=0;
run;
*Abuse (physical);
proc freq data=longdata;
      tables abuse_physical*any_uai_sens/chisq cmh;
      where visit3=0;
run;
*Abuse (sexual);
proc freq data=longdata;
      tables abuse_sexual*any_uai_sens/chisq cmh;
      where visit3=0;
run;
*Exchange sex;
proc freq data=longdata;
      tables exchangep6m*any_uai_sens/chisq cmh;
      where visit3=0;
run;
/***********************************
* Depression      (OVERALL)                *
***********************************/
*Age overall;
```

```
proc freq data=longdata;
      tables age_25*cesd_bin/chisq cmh;
      where visit3=0;
run;
*Education (Votech);
proc freq data=longdata;
      tables educ2*cesd_bin/chisq cmh;
      where visit3=0 and educ2 ne 2;
run;
*Education (College);
proc freq data=longdata;
      tables educ2*cesd_bin/chisq cmh;
      where visit3=0 and educ2 ne 1;
run;
*Employment overall;
proc freq data=longdata;
      tables employed_now*cesd_bin/chisq cmh;
      where visit3=0;
run;
*NIDU;
proc freq data=longdata;
      tables noninjection*cesd_bin/chisq cmh;
      where visit3=0;
run;
*Alcohol;
proc freq data=longdata;
      tables drink*cesd_bin/chisq cmh;
      where visit3=0;
run;
*Abuse (physical);
proc freq data=longdata;
      tables abuse_physical*cesd_bin/chisq cmh;
      where visit3=0;
run;
*Abuse (sexual);
proc freq data=longdata;
      tables abuse_sexual*cesd_bin/chisq cmh;
      where visit3=0;
run;
*Exchange sex;
proc freq data=longdata;
      tables exchangep6m*cesd_bin/chisq cmh;
      where visit3=0;
run;

/*****************************************************
*
      *
*     Table 2
      *
*
      *
*****************************************************/
*Sort data;
proc sort data=longdata;
      by visit3;
run;
```

```
/***********************************
*Stratified by race and time period *
*NOT in paper version of T2               *
***********************************/
*UAI;
proc freq data=longdata;
      tables race_inc*(any_uai_sens)*cesd_bin
            /nocol nocum cmh chisq;
      by visit3;
run;
*Categorical Age;
proc freq data=longdata;
      tables race_inc*(age_25)*cesd_bin
            /nocol nocum cmh chisq;
      by visit3;
run;
*Education;
proc freq data=longdata;
      tables race_inc*(educ2)*cesd_bin
            /nocol nocum cmh chisq;
      by visit3;
run;
*Employment status;
proc freq data=longdata;
      tables race_inc*(employed_now)*cesd_bin
            /nocol nocum cmh chisq;
      by visit3;
run;
*Noninjection drug use;
proc freq data=longdata;
      tables race_inc*(noninjection)*cesd_bin
            /nocol nocum cmh chisq;
      by visit3;
run;
*Drinkin';
proc freq data=longdata;
      tables race_inc*(drink)*cesd_bin
            /nocol nocum cmh chisq;
      by visit3;
run;
*Physical Abuse;
proc freq data=longdata;
      tables race_inc*(abuse_physical)*cesd_bin
            /nocol nocum cmh chisq;
      by visit3;
run;
*Sexual Abuse;
proc freq data=longdata;
      tables race_inc*(abuse_sexual)*cesd_bin
            /nocol nocum cmh chisq;
      by visit3;
run;
*Exchange Sex;
proc freq data=longdata;
      tables race_inc*(exchangep6m)*cesd_bin
            /nocol nocum cmh chisq;
```

```
      by visit3;
run;
/***********************************
Overall (no time period/race)
***********************************/
ods html close;
ods html;
*UAI;
proc freq data=longdata;
      tables (any_uai_sens)*cesd_bin
            /nocol nocum cmh chisq;
run;
ods html close;
ods html;
*Categorical Age;
proc freq data=longdata;
      tables (age_25)*cesd_bin
            /nocol nocum cmh chisq;
run;
ods html close;
ods html;
*Education (Votech to HS);
proc freq data=longdata;
      tables (educ2)*cesd_bin
            /nocol nocum cmh chisq;
      where educ2 ne 2;
run;
ods html close;
ods html;
*Education (College to HS);
proc freq data=longdata;
      tables (educ2)*cesd_bin
            /nocol nocum cmh chisq;
      where educ2 ne 1;
run;
ods html close;
ods html;
*Employment status;
proc freq data=longdata;
      tables (employed_now)*cesd_bin
            /nocol nocum cmh chisq;
run;
ods html close;
ods html;
*Noninjection drug use;
proc freq data=longdata;
      tables (noninjection)*cesd_bin
            /nocol nocum cmh chisq;
run;
ods html close;
ods html;
*Drinkin';
proc freq data=longdata;
      tables (drink)*cesd_bin
            /nocol nocum cmh chisq;
run;
ods html close;
```

```
ods html;
*Physical Abuse;
proc freq data=longdata;
      tables (abuse_physical)*cesd_bin
            /nocol nocum cmh chisq;
run;
ods html close;
ods html;
*Sexual Abuse;
proc freq data=longdata;
      tables (abuse_sexual)*cesd_bin
            /nocol nocum cmh chisq;
run;
ods html close;
ods html;
*Exchange Sex;
proc freq data=longdata;
      tables (exchangep6m)*cesd_bin
            /nocol nocum cmh chisq;
run;
/***********************************
Stratified by race (OR By Race)
***********************************/
proc sort data=longdata;
      by race_inc;
run;
ods html close;
ods html;
*UAI;
proc freq data=longdata;
      tables (any_uai_sens)*cesd_bin
            /nocol nocum cmh chisq;
            by race_inc;
run;
ods html close;
ods html;
*Categorical Age;
proc freq data=longdata;
      tables (age_25)*cesd_bin
            /nocol nocum cmh chisq;
            by race_inc;
run;
ods html close;
ods html;
*Education (Votech to HS);
proc freq data=longdata;
      tables (educ2)*cesd_bin
            /nocol nocum cmh chisq;
      where educ2 ne 2;
      by race_inc;
run;
ods html close;
ods html;
*Education (College to HS);
proc freq data=longdata;
      tables (educ2)*cesd_bin
            /nocol nocum cmh chisq;
```

```
      where educ2 ne 1;
      by race_inc;
run;
ods html close;
ods html;
*Employment status;
proc freq data=longdata;
      tables (employed_now)*cesd_bin
            /nocol nocum cmh chisq;
      by race_inc;
run;
ods html close;
ods html;
*Noninjection drug use;
proc freq data=longdata;
      tables (noninjection)*cesd_bin
            /nocol nocum cmh chisq;
      by race_inc;
run;
ods html close;
ods html;
*Drinkin';
proc freq data=longdata;
      tables (drink)*cesd_bin
            /nocol nocum cmh chisq;
      by race_inc;
run;
ods html close;
ods html;
*Physical Abuse;
proc freq data=longdata;
      tables (abuse_physical)*cesd_bin
            /nocol nocum cmh chisq;
      by race_inc;
run;
ods html close;
ods html;
*Sexual Abuse;
proc freq data=longdata;
      tables (abuse_sexual)*cesd_bin
            /nocol nocum cmh chisq;
      by race_inc;
run;
ods html close;
ods html;
*Exchange Sex;
proc freq data=longdata;
      tables (exchangep6m)*cesd_bin
            /nocol nocum cmh chisq;
      by race_inc;
run;
/*************************************************
*
      *
*     Table 3
      *
```

```
*
      *
*************************************************/
/***********************************
*Stratified time period;
***********************************/
ods html close;
ods html;
proc sort data=longdata;
      by visit3;
run;
*depression;
proc freq data=longdata;
      tables race_inc*(cesd_bin)*any_uai_sens
            /nocol nocum cmh chisq;
      by visit3;
run;
*Categorical Age;
proc freq data=longdata;
      tables race_inc*(age_25)*any_uai_sens
            /nocol nocum cmh chisq;
      by visit3;
run;
*Education;
proc freq data=longdata;
      tables race_inc*(educ2)*any_uai_sens
            /nocol nocum cmh chisq;
      by visit3;
run;
*Employment status;
proc freq data=longdata;
      tables race_inc*(employed_now)*any_uai_sens
            /nocol nocum cmh chisq;
      by visit3;
run;
*Noninjection drug use;
proc freq data=longdata;
      tables race_inc*(noninjection)*any_uai_sens
            /nocol nocum cmh chisq;
      by visit3;
run;
*Drinkin';
proc freq data=longdata;
      tables race_inc*(drink)*any_uai_sens
            /nocol nocum cmh chisq;
      by visit3;
run;
*Physical Abuse;
proc freq data=longdata;
      tables race_inc*(abuse_physical)*any_uai_sens
            /nocol nocum cmh chisq;
      by visit3;
run;
*Sexual Abuse;
proc freq data=longdata;
      tables race_inc*(abuse_sexual)*any_uai_sens
            /nocol nocum cmh chisq;
```

```
      by visit3;
run;
*Exchange Sex;
proc freq data=longdata;
      tables race_inc*(exchangep6m)*any_uai_sens
            /nocol nocum cmh chisq;
      by visit3;
run;
/***********************************
Overall (Overall OR)
***********************************/
ods html close;
ods html;
*Depression;
proc freq data=longdata;
      tables (cesd_bin)*any_uai_sens
            /nocol nocum cmh chisq;
run;
ods html close;
ods html;
*Categorical Age;
proc freq data=longdata;
      tables (age_25)*any_uai_sens
            /nocol nocum cmh chisq;
run;
ods html close;
ods html;
*Education (hs vs votech);
proc freq data=longdata;
      tables (educ2)*any_uai_sens
            /nocol nocum cmh chisq;
      where educ2 ne 2;
run;
ods html close;
ods html;
*Education (hs vs college);
proc freq data=longdata;
      tables (educ2)*any_uai_sens
            /nocol nocum cmh chisq;
      where educ2 ne 1;
run;
ods html close;
ods html;
*Employment status;
proc freq data=longdata;
      tables (employed_now)*any_uai_sens
            /nocol nocum cmh chisq;
run;
ods html close;
ods html;
*Noninjection drug use;
proc freq data=longdata;
      tables (noninjection)*any_uai_sens
            /nocol nocum cmh chisq;
run;
ods html close;
ods html;
```

```
*Drinkin';
proc freq data=longdata;
      tables (drink)*any_uai_sens
            /nocol nocum cmh chisq;
run;
ods html close;
ods html;
*Physical Abuse;
proc freq data=longdata;
      tables (abuse_physical)*any_uai_sens
            /nocol nocum cmh chisq;
run;
ods html close;
ods html;
*Sexual Abuse;
proc freq data=longdata;
      tables (abuse_sexual)*any_uai_sens
            /nocol nocum cmh chisq;
run;
ods html close;
ods html;
*Exchange Sex;
proc freq data=longdata;
      tables (exchangep6m)*any_uai_sens
            /nocol nocum cmh chisq;
run;
/***********************************
OR by Race (Bivariate Association stratified on Race)
***********************************/
*Sort by race;
proc sort data=longdata;
      by race_inc;
run;
ods html close;
ods html;
*Depression;
proc freq data=longdata;
      tables (cesd_bin)*any_uai_sens
            /nocum cmh chisq;
            by race_inc;
run;
ods html close;
ods html;
*Categorical Age;
proc freq data=longdata;
      tables (age_25)*any_uai_sens
            /nocol nocum cmh chisq;
            by race_inc;
run;
ods html close;
ods html;
*Education (hs vs votech);
proc freq data=longdata;
      tables (educ2)*any_uai_sens
            /nocol nocum cmh chisq;
      where educ2 ne 2;
      by race_inc;
```

```
run;
ods html close;
ods html;
*Education (hs vs college);
proc freq data=longdata;
      tables (educ2)*any_uai_sens
            /nocol nocum cmh chisq;
      where educ2 ne 1;
      by race_inc;
run;
ods html close;
ods html;
*Employment status;
proc freq data=longdata;
      tables (employed_now)*any_uai_sens
            /nocol nocum cmh chisq;
            by race_inc;
run;
ods html close;
ods html;
*Noninjection drug use;
proc freq data=longdata;
      tables (noninjection)*any_uai_sens
            /nocol nocum cmh chisq;
      by race_inc;
run;
ods html close;
ods html;
*Drinkin';
proc freq data=longdata;
      tables (drink)*any_uai_sens
            /nocol nocum cmh chisq;
            by race_inc;
run;
ods html close;
ods html;
*Physical Abuse;
proc freq data=longdata;
      tables (abuse_physical)*any_uai_sens
            /nocol nocum cmh chisq;
            by race_inc;
run;
ods html close;
ods html;
*Sexual Abuse;
proc freq data=longdata;
      tables (abuse_sexual)*any_uai_sens
            /nocol nocum cmh chisq;
            by race_inc;
run;
ods html close;
ods html;
*Exchange Sex;
proc freq data=longdata;
      tables (exchangep6m)*any_uai_sens
            /nocol nocum cmh chisq;
            by race_inc;
```

```
run;
/***********
Modeling
***********/
ods html close;
ods html;
*Full model;
proc logistic data=longdata;
      model any_uai_sens(event='1')=cesd_bin drink noninjection;
      strata study_id;
run;
ods html close;
ods html;
*No alcohol misuse;
proc logistic data=longdata;
      model any_uai_sens(event='1')=cesd_bin noninjection;
      strata study_id;
run;
ods html close;
ods html;
*No non-injection drug use;
proc logistic data=longdata;
      model any_uai_sens(event='1')=cesd_bin drink;
      strata study_id;
run;
ods html close;
ods html;
*Depression Alone;
proc logistic data=longdata;
      model any_uai_sens(event='1')=cesd_bin;
      strata study_id;
run;data key_vars_long;
      set long.key_vars_long;
      mcount=cmiss(employed_now,poverty,homeless,
            arrested,sexp6m,any_main);
      if mcount=6 then delete;
run;

*Sort datasets prior to merging;
proc sort data = work.status;
      by study_id;
run;
proc contents data=work.status;
run;
proc sort data = work.participants_survey_baseline;
      by study_id;
run;
proc sort data = work.sti_baseline;
      by study_id;
run;
proc sort data = work.time_dep_demo;
      by study_id;
run;
proc sort data = work.key_vars_long;
      by study_id;
run;
```

```
******************
Data familiarization
******************

*Print subset of HIV status dataset;
proc print data=status (obs=100);
run;
*Print subset of survey results at baseline;
proc print data=participants_survey_baseline (obs=100);
run;
*Print subset of all sti's at baseline;
proc print data=sti_baseline (obs=100);
run;
*Print subset of longitudinal variables;
proc print data=key_vars_long (obs=100);
run;
*Check for HIV status (both acute and detectable at baseline);
proc freq data=status;
      tables baseline_hiv*baseline_acute/list missing;
run;

*Get frequencies of creating missings count (key_vars_long);
proc freq data=key_vars_long;
      tables mcount;
run;

*Combine baseline and HIV status to narrow sample to HIV- people;
data work.step1;
      merge work.participants_survey_baseline work.status;
            if baseline_hiv ne 1 then delete;
run;
*Create format for visit variable;
proc format;
value monthf 0='Baseline'
             1='Month 6'
             2='Month 12'
             3='Month 18'
             4='Month 24';
run;


*Create the final dataset for analysis;
data longdata;
      merge time_dep_demo key_vars_long sti_baseline step1;
      by study_id;
*Recode scoring of positive CES-D items - reversed scoring;
      if cesd_hopeful=3 then cesd_hopefulp=0;
      if cesd_hopeful=2 then cesd_hopefulp=1;
      if cesd_hopeful=1 then cesd_hopefulp=2;
      if cesd_hopeful=0 then cesd_hopefulp=3;
      if cesd_happy=3 then cesd_happyp=0;
      if cesd_happy=2 then cesd_happyp=1;
      if cesd_happy=1 then cesd_happyp=2;
      if cesd_happy=0 then cesd_happyp=3;
*See if any CESD scores have multiple variables missing;
      cesd_missing=0;
      if cesd_bother=. then cesd_missing=cesd_missing+1;
```

```
      if cesd_concentrate=. then cesd_missing=cesd_missing+1;
      if cesd_depressed=. then cesd_missing=cesd_missing+1;
      if cesd_effort=. then cesd_missing=cesd_missing+1;
      if cesd_hopefulp=. then cesd_missing=cesd_missing+1;
      if cesd_fearful=. then cesd_missing=cesd_missing+1;
      if cesd_badsleep=. then cesd_missing=cesd_missing+1;
      if cesd_happyp=. then cesd_missing=cesd_missing+1;
      if cesd_lonely=. then cesd_missing=cesd_missing+1;
      if cesd_getgoing=. then cesd_missing=cesd_missing+1;

*delete any CESD with more than 1 missing;
      if cesd_missing gt 1 then delete;

*Create new variables to make missings equal to 0 (to correctly sum
scores);
      cesd_bother2=cesd_bother;
      cesd_concentrate2=cesd_concentrate;
      cesd_depressed2=cesd_depressed;
      cesd_effort2=cesd_effort;
      cesd_hopefulp2=cesd_hopefulp;
      cesd_fearful2=cesd_fearful;
      cesd_badsleep2=cesd_badsleep;
      cesd_happyp2=cesd_happyp;
      cesd_lonely2=cesd_lonely;
      cesd_getgoing2=cesd_getgoing;
      if cesd_bother=. then cesd_bother2=0;
      if cesd_concentrate=. then cesd_concentrate2=0;
      if cesd_depressed=. then cesd_depressed2=0;
      if cesd_effort=. then cesd_effort2=0;
      if cesd_hopefulp=. then cesd_hopefulp2=0;
      if cesd_fearful=. then cesd_fearful2=0;
      if cesd_badsleep=. then cesd_badsleep2=0;
      if cesd_happyp=. then cesd_happyp2=0;
      if cesd_lonely=. then cesd_lonely2=0;
      if cesd_getgoing=. then cesd_getgoing2=0;
*Create var for total response for CES-D scale;
      cesd_total=0;
            cesd_total=cesd_bother2+cesd_concentrate2+cesd_depressed2+
            cesd_effort2+cesd_hopefulp2+cesd_fearful2+cesd_badsleep2
            +cesd_happyp2+cesd_lonely2+cesd_getgoing2;
      cesd_average=cesd_total/(10-cesd_missing);
      cesd_adj=10*cesd_average;

*Create indicator for cutoff CESD score;
cesd_bin=.;
      if cesd_adj ge 10 then cesd_bin=1;
      if cesd_adj lt 10 then cesd_bin=0;
*Create var for total response for CAGE scale questions;
      cage=0;
      if drink_cut=1 then cage=cage+1;
      if drink_critic=1 then cage=cage+1;
      if drink_guilt=1 then cage=cage+1;
      if drink_morning=1 then cage=cage+1;
*Create binary var for CAGE outcome. Above 2 indicates
problematic alcohol use;
      if cage gt . and cage le 2 then drink=0;
      if cage gt 2 then drink=1;
```

```
*Create categorized variable for age;
      if age_baseline lt 25 then age_25=0;
      if age_baseline ge 25 then age_25=1;
*Create var for total number of exchange partners, p12m;
      exchangep6m=0;
      if male_exchangep6m=1 then exchangep6m=1;
      if female_exchangep6m=1 then exchangep6m=1;
      if mtf_exchangep6m=1 then exchangep6m=1;
      if ftm_exchangep6m=1 then exchangep6m=1;
*Combine var for sexual abuse;
      abuse_sexual=0;
      if abuse_child_sexabuse=1 then abuse_sexual=1;
      if abuse_adult_sexabuse=1 then abuse_sexual=1;
*Combine var for physical abuse;
      abuse_physical=0;
      if abuse_child_physabuse=1 then abuse_physical=1;
      if abuse_adult_physabuse=1 then abuse_physical=1;
*Collapse variable levels;
      educ2=.;
      if educ ge 3 then educ2=0;
      if educ=2 then educ2=1;
      if educ=1 then educ2=2;
      if living eq 3 then living=1;
*Label new variables;
      label cage="CAGE Questionnaire"
            drink="Alcohol Problem"
            age_25="Age Group";
*Make visits equally spaced, starting at zero;
      visit2=visit;
      if visit=1 then visit2=2;
      visit3=visit2-2;
*Remove study_id 808 (left before completing survey/HIV test);
      if study_id=808 then delete;
*Remove missing UAI status;
      if any_uai_sens=. then delete;
*Apply new format to visit variable;
format visit3 monthf.;
run;
proc print data=longdata;
      var study_id drink_cut drink_critic drink_guilt drink_morning;
      where visit ne 0;
run;
proc print data=longdata (obs=100);
      var educ educ2;
run;
proc contents data=longdata;
run;
proc freq data=longdata;
      tables drink*visit;
      where study_id lt 50;
run;

/*******************************
*     Data validation                    *
*******************************
*Check all obs gt 803 are out of the dataset;
proc print data=longdata;
```

```
      where study_id gt 803;
run;
*Check follow-up pattern;
proc freq data=longdata;
      tables visit3;
run;

*Check created variables against their components;
proc freq data=work.longdata;
      tables educ*educ2
abuse_sexual*abuse_child_sexabuse*abuse_adult_sexabuse

      abuse_physical*abuse_child_physabuse*abuse_adult_physabuse

      cesd_adj*cesd_total*cesd_average*cesd_missing*cesd_bin

      exchangep6m*male_exchangep6m*female_exchangep6m*mtf_exchangep6m*
                        ftm_exchangep6m

      drink*cage*drink_cut*drink_critic*drink_guilt*drink_morning
                  visit3*visit2*visit/list missing;
                  attrib visit format=;
run;
*Check range of cesd_total (total cesd score);
proc univariate data=work.longdata;
      var cesd_total;
run;

*/

/***************************************************
*
      *
*     Figure 1
      *
*
      *
***************************************************/
proc sort data=longdata;
      by visit3 race_inc;
run;
*Get summary stats for depression;
proc summary data = longdata;
by visit3 race_inc;
var cesd_bin;
output out = mean_cesd (drop = _:) mean = mean n = n stderr = stderr;
run;
proc print data=mean_cesd;
run;
*Set up graphics for printing;
*Symbol settings for graph;
symbol1 i = j value=A font =marker c = blue h = 1  line=1 width = 1;
symbol2 i = j value =A font = marker c = red h = 1  line=1 width = 1;
*Title: text and settings;
title height=1 'Reported Depression By Visit';
*Footnote: text and settings;
```

```
footnote font=arabic height=2 j=l wrap 'Figure 1. Reported Depression
By Visit in Cohort of White and Black,
 non-hispanic Atlanta MSM.';
 *Vertical Axis settings;
axis1 label=(a=90 j=c 'Pct Depressed')
            order=(0 to 0.32 by 0.04)
            minor=none;
*Horizontal Axis Settings;
axis2 order=(0 to 4 by 1)
            minor=none
            label=('Visit Number');
*Run plot;
proc gplot data = mean_cesd;
      plot mean * visit3 = race_inc/haxis=axis2 vaxis=axis1;
run; quit;
/************************************************
*
      *
*     Figure 2
      *
*
      *
************************************************/
*Get summary stats for depression;
proc summary data = longdata;
by visit3 race_inc;
var any_uai_sens;
output out = mean_uai (drop = _:) mean = mean n = n stderr = stderr;
run;
*Set up graphics for printing;
symbol1 i = j value=A font =marker c = blue h = 1  line=1 width = 1;
symbol2 i = j value =A font = marker c = red h = 1  line=1 width = 1;
*Title content and settings;
title height=1 'Reported UAI By Visit';
*Footnote content and settings;
footnote font=arabic height=2 j=l wrap 'Figure 2. Reported UAI By Visit
in Cohort of White and Black,
 non-Hispanic Atlanta MSM';
 *Vertical Axis settings;
axis1 label=(a=90 j=c 'Pct Unprotected Anal Intercourse')
            order=(0 to 0.85 by .05)
            minor=none;
*Horizontal Axis settings;
axis2 order=(0 to 4 by 1)
            minor=none
            label=('Visit Number');
*Print averages by time;
proc print data=mean_uai;
run;
*Run plot for graphic;
proc gplot data = mean_uai;
      plot mean * visit3 = race_inc/haxis=axis2 vaxis=axis1;
run; quit;

/************************************************
*
      *
```

```
*     Table 1
      *
*
      *
*****************************************************/
*Racial Diffs- Difference in race by covariates?;
Proc freq data=longdata;
tables (any_uai_sens cesd_bin age_25 educ2 employed_now noninjection
drink
            abuse_physical abuse_sexual exchangep6m)*race_inc/chisq;
            where visit3=0;
run;
/***********************************
* UAI (Racial)                                    *
***********************************/
*Age overall;
proc freq data=longdata;
      tables race_inc*age_25*any_uai_sens/chisq cmh;
      where visit3=0;
run;
*Education (Votech);
proc freq data=longdata;
      tables race_inc*educ2*any_uai_sens/chisq cmh;
      where visit3=0 and educ2 ne 2;
run;
*Education (College);
proc freq data=longdata;
      tables race_inc*educ2*any_uai_sens/chisq cmh;
      where visit3=0 and educ2 ne 1;
run;
*Employment overall;
proc freq data=longdata;
      tables race_inc*employed_now*any_uai_sens/chisq cmh;
      where visit3=0;
run;
*NIDU;
proc freq data=longdata;
      tables race_inc*noninjection*any_uai_sens/chisq cmh;
      where visit3=0;
run;
*Alcohol;
proc freq data=longdata;
      tables race_inc*drink*any_uai_sens/chisq cmh;
      where visit3=0;
run;
*Abuse (physical);
proc freq data=longdata;
      tables race_inc*abuse_physical*any_uai_sens/chisq cmh;
      where visit3=0;
run;
*Abuse (sexual);
proc freq data=longdata;
      tables race_inc*abuse_sexual*any_uai_sens/chisq cmh;
      where visit3=0;
run;
*Exchange sex;
proc freq data=longdata;
```

```
      tables race_inc*exchangep6m*any_uai_sens/chisq cmh;
      where visit3=0;
run;
/***********************************
* Depression      (Racial)                *
***********************************/
*Age overall;
proc freq data=longdata;
      tables race_inc*age_25*cesd_bin/chisq cmh;
      where visit3=0;
run;
*Education (Votech);
proc freq data=longdata;
      tables race_inc*educ2*cesd_bin/chisq cmh;
      where visit3=0 and educ2 ne 2;
run;
*Education (College);
proc freq data=longdata;
      tables race_inc*educ2*cesd_bin/chisq cmh;
      where visit3=0 and educ2 ne 1;
run;
*Employment overall;
proc freq data=longdata;
      tables race_inc*employed_now*cesd_bin/chisq cmh;
      where visit3=0;
run;
*NIDU;
proc freq data=longdata;
      tables race_inc*noninjection*cesd_bin/chisq cmh;
      where visit3=0;
run;
*Alcohol;
proc freq data=longdata;
      tables race_inc*drink*cesd_bin/chisq cmh;
      where visit3=0;
run;
*Abuse (physical);
proc freq data=longdata;
      tables race_inc*abuse_physical*cesd_bin/chisq cmh;
      where visit3=0;
run;
*Abuse (sexual);
proc freq data=longdata;
      tables race_inc*abuse_sexual*cesd_bin/chisq cmh;
      where visit3=0;
run;
*Exchange sex;
proc freq data=longdata;
      tables race_inc*exchangep6m*cesd_bin/chisq cmh;
      where visit3=0;
run;
/***********************************
* UAI (OVERALL)                              *
***********************************/
*Age overall;
proc freq data=longdata;
      tables age_25*any_uai_sens/chisq cmh;
```

```
      where visit3=0;
run;
*Education (Votech);
proc freq data=longdata;
      tables educ2*any_uai_sens/chisq cmh;
      where visit3=0 and educ2 ne 2;
run;
*Education (College);
proc freq data=longdata;
      tables educ2*any_uai_sens/chisq cmh;
      where visit3=0 and educ2 ne 1;
run;
*Employment overall;
proc freq data=longdata;
      tables employed_now*any_uai_sens/chisq cmh;
      where visit3=0;
run;
*NIDU;
proc freq data=longdata;
      tables noninjection*any_uai_sens/chisq cmh;
      where visit3=0;
run;
*Alcohol;
proc freq data=longdata;
      tables drink*any_uai_sens/chisq cmh;
      where visit3=0;
run;
*Abuse (physical);
proc freq data=longdata;
      tables abuse_physical*any_uai_sens/chisq cmh;
      where visit3=0;
run;
*Abuse (sexual);
proc freq data=longdata;
      tables abuse_sexual*any_uai_sens/chisq cmh;
      where visit3=0;
run;
*Exchange sex;
proc freq data=longdata;
      tables exchangep6m*any_uai_sens/chisq cmh;
      where visit3=0;
run;
/**********************************
* Depression      (OVERALL)               *
**********************************/
*Age overall;
proc freq data=longdata;
      tables age_25*cesd_bin/chisq cmh;
      where visit3=0;
run;
*Education (Votech);
proc freq data=longdata;
      tables educ2*cesd_bin/chisq cmh;
      where visit3=0 and educ2 ne 2;
run;
*Education (College);
proc freq data=longdata;
```

```
      tables educ2*cesd_bin/chisq cmh;
      where visit3=0 and educ2 ne 1;
run;
*Employment overall;
proc freq data=longdata;
      tables employed_now*cesd_bin/chisq cmh;
      where visit3=0;
run;
*NIDU;
proc freq data=longdata;
      tables noninjection*cesd_bin/chisq cmh;
      where visit3=0;
run;
*Alcohol;
proc freq data=longdata;
      tables drink*cesd_bin/chisq cmh;
      where visit3=0;
run;
*Abuse (physical);
proc freq data=longdata;
      tables abuse_physical*cesd_bin/chisq cmh;
      where visit3=0;
run;
*Abuse (sexual);
proc freq data=longdata;
      tables abuse_sexual*cesd_bin/chisq cmh;
      where visit3=0;
run;
*Exchange sex;
proc freq data=longdata;
      tables exchangep6m*cesd_bin/chisq cmh;
      where visit3=0;
run;

/*************************************************
*
      *
*     Table 2
      *
*
      *
*************************************************/
*Sort data;
proc sort data=longdata;
      by visit3;
run;

/***********************************
*Stratified by race and time period *
*NOT in paper version of T2         *
***********************************/
*UAI;
proc freq data=longdata;
      tables race_inc*(any_uai_sens)*cesd_bin
            /nocol nocum cmh chisq;
      by visit3;
run;
```

```
*Categorical Age;
proc freq data=longdata;
      tables race_inc*(age_25)*cesd_bin
            /nocol nocum cmh chisq;
      by visit3;
run;
*Education;
proc freq data=longdata;
      tables race_inc*(educ2)*cesd_bin
            /nocol nocum cmh chisq;
      by visit3;
run;
*Employment status;
proc freq data=longdata;
      tables race_inc*(employed_now)*cesd_bin
            /nocol nocum cmh chisq;
      by visit3;
run;
*Noninjection drug use;
proc freq data=longdata;
      tables race_inc*(noninjection)*cesd_bin
            /nocol nocum cmh chisq;
      by visit3;
run;
*Drinkin';
proc freq data=longdata;
      tables race_inc*(drink)*cesd_bin
            /nocol nocum cmh chisq;
      by visit3;
run;
*Physical Abuse;
proc freq data=longdata;
      tables race_inc*(abuse_physical)*cesd_bin
            /nocol nocum cmh chisq;
      by visit3;
run;
*Sexual Abuse;
proc freq data=longdata;
      tables race_inc*(abuse_sexual)*cesd_bin
            /nocol nocum cmh chisq;
      by visit3;
run;
*Exchange Sex;
proc freq data=longdata;
      tables race_inc*(exchangep6m)*cesd_bin
            /nocol nocum cmh chisq;
      by visit3;
run;
/***********************************
Overall (no time period/race)
***********************************/
ods html close;
ods html;
*UAI;
proc freq data=longdata;
      tables (any_uai_sens)*cesd_bin
            /nocol nocum cmh chisq;
```

```
run;
ods html close;
ods html;
*Categorical Age;
proc freq data=longdata;
      tables (age_25)*cesd_bin
            /nocol nocum cmh chisq;
run;
ods html close;
ods html;
*Education (Votech to HS);
proc freq data=longdata;
      tables (educ2)*cesd_bin
            /nocol nocum cmh chisq;
      where educ2 ne 2;
run;
ods html close;
ods html;
*Education (College to HS);
proc freq data=longdata;
      tables (educ2)*cesd_bin
            /nocol nocum cmh chisq;
      where educ2 ne 1;
run;
ods html close;
ods html;
*Employment status;
proc freq data=longdata;
      tables (employed_now)*cesd_bin
            /nocol nocum cmh chisq;
run;
ods html close;
ods html;
*Noninjection drug use;
proc freq data=longdata;
      tables (noninjection)*cesd_bin
            /nocol nocum cmh chisq;
run;
ods html close;
ods html;
*Drinkin';
proc freq data=longdata;
      tables (drink)*cesd_bin
            /nocol nocum cmh chisq;
run;
ods html close;
ods html;
*Physical Abuse;
proc freq data=longdata;
      tables (abuse_physical)*cesd_bin
            /nocol nocum cmh chisq;
run;
ods html close;
ods html;
*Sexual Abuse;
proc freq data=longdata;
      tables (abuse_sexual)*cesd_bin
```

```
            /nocol nocum cmh chisq;
run;
ods html close;
ods html;
*Exchange Sex;
proc freq data=longdata;
      tables (exchangep6m)*cesd_bin
            /nocol nocum cmh chisq;
run;
/************************************
Stratified by race (Racial OR)
************************************/
proc sort data=longdata;
      by race_inc;
run;
ods html close;
ods html;
*UAI;
proc freq data=longdata;
      tables (any_uai_sens)*cesd_bin
            /nocol nocum cmh chisq;
            by race_inc;
run;
ods html close;
ods html;
*Categorical Age;
proc freq data=longdata;
      tables race_inc*(age_25)*cesd_bin
            /nocol nocum cmh chisq;
            by race_inc;
run;
ods html close;
ods html;
*Education (Votech to HS);
proc freq data=longdata;
      tables (educ2)*cesd_bin
            /nocol nocum cmh chisq;
      where educ2 ne 2;
      by race_inc;
run;
ods html close;
ods html;
*Education (College to HS);
proc freq data=longdata;
      tables (educ2)*cesd_bin
            /nocol nocum cmh chisq;
      where educ2 ne 1;
      by race_inc;
run;
ods html close;
ods html;
*Employment status;
proc freq data=longdata;
      tables race_inc*(employed_now)*cesd_bin
            /nocol nocum cmh chisq;
      by race_inc;
run;
```

```
ods html close;
ods html;
*Noninjection drug use;
proc freq data=longdata;
      tables race_inc*(noninjection)*cesd_bin
            /nocol nocum cmh chisq;
      by race_inc;
run;
ods html close;
ods html;
*Drinkin';
proc freq data=longdata;
      tables race_inc*(drink)*cesd_bin
            /nocol nocum cmh chisq;
      by race_inc;
run;
ods html close;
ods html;
*Physical Abuse;
proc freq data=longdata;
      tables race_inc*(abuse_physical)*cesd_bin
            /nocol nocum cmh chisq;
      by race_inc;
run;
ods html close;
ods html;
*Sexual Abuse;
proc freq data=longdata;
      tables race_inc*(abuse_sexual)*cesd_bin
            /nocol nocum cmh chisq;
      by race_inc;
run;
ods html close;
ods html;
*Exchange Sex;
proc freq data=longdata;
      tables race_inc*(exchangep6m)*cesd_bin
            /nocol nocum cmh chisq;
      by race_inc;
run;
/*************************************************
*
      *
*     Table 3
      *
*
      *
*************************************************/
/***********************************
*Stratified time period;
***********************************/
ods html close;
ods html;
proc sort data=longdata;
      by visit3;
run;
*depression;
```

```
proc freq data=longdata;
      tables race_inc*(cesd_bin)*any_uai_sens
            /nocol nocum cmh chisq;
      by visit3;
run;
*Categorical Age;
proc freq data=longdata;
      tables race_inc*(age_25)*any_uai_sens
            /nocol nocum cmh chisq;
      by visit3;
run;
*Education;
proc freq data=longdata;
      tables race_inc*(educ2)*any_uai_sens
            /nocol nocum cmh chisq;
      by visit3;
run;
*Employment status;
proc freq data=longdata;
      tables race_inc*(employed_now)*any_uai_sens
            /nocol nocum cmh chisq;
      by visit3;
run;
*Noninjection drug use;
proc freq data=longdata;
      tables race_inc*(noninjection)*any_uai_sens
            /nocol nocum cmh chisq;
      by visit3;
run;
*Drinkin';
proc freq data=longdata;
      tables race_inc*(drink)*any_uai_sens
            /nocol nocum cmh chisq;
      by visit3;
run;
*Physical Abuse;
proc freq data=longdata;
      tables race_inc*(abuse_physical)*any_uai_sens
            /nocol nocum cmh chisq;
      by visit3;
run;
*Sexual Abuse;
proc freq data=longdata;
      tables race_inc*(abuse_sexual)*any_uai_sens
            /nocol nocum cmh chisq;
      by visit3;
run;
*Exchange Sex;
proc freq data=longdata;
      tables race_inc*(exchangep6m)*any_uai_sens
            /nocol nocum cmh chisq;
      by visit3;
run;
/***********************************
Overall (Overall OR)
***********************************/
ods html close;
```

```
ods html;
*Depression;
proc freq data=longdata;
      tables (cesd_bin)*any_uai_sens
            /nocol nocum cmh chisq;
run;
ods html close;
ods html;
*Categorical Age;
proc freq data=longdata;
      tables (age_25)*any_uai_sens
            /nocol nocum cmh chisq;
run;
ods html close;
ods html;
*Education (hs vs votech);
proc freq data=longdata;
      tables (educ2)*any_uai_sens
            /nocol nocum cmh chisq;
      where educ2 ne 2;
run;
ods html close;
ods html;
*Education (hs vs college);
proc freq data=longdata;
      tables (educ2)*any_uai_sens
            /nocol nocum cmh chisq;
      where educ2 ne 1;
run;
ods html close;
ods html;
*Employment status;
proc freq data=longdata;
      tables (employed_now)*any_uai_sens
            /nocol nocum cmh chisq;
run;
ods html close;
ods html;
*Noninjection drug use;
proc freq data=longdata;
      tables (noninjection)*any_uai_sens
            /nocol nocum cmh chisq;
run;
ods html close;
ods html;
*Drinkin';
proc freq data=longdata;
      tables (drink)*any_uai_sens
            /nocol nocum cmh chisq;
run;
ods html close;
ods html;
*Physical Abuse;
proc freq data=longdata;
      tables (abuse_physical)*any_uai_sens
            /nocol nocum cmh chisq;
run;
```

```
ods html close;
ods html;
*Sexual Abuse;
proc freq data=longdata;
      tables (abuse_sexual)*any_uai_sens
            /nocol nocum cmh chisq;
run;
ods html close;
ods html;
*Exchange Sex;
proc freq data=longdata;
      tables (exchangep6m)*any_uai_sens
            /nocol nocum cmh chisq;
run;
/***********************************
OR by Race
***********************************/
*Sort by race;
proc sort data=longdata;
      by race_inc;
run;
ods html close;
ods html;
*Depression;
proc freq data=longdata;
      tables (cesd_bin)*any_uai_sens
            /nocum cmh chisq;
            by race_inc;
run;
ods html close;
ods html;
*Categorical Age;
proc freq data=longdata;
      tables (age_25)*any_uai_sens
            /nocol nocum cmh chisq;
            by race_inc;
run;
ods html close;
ods html;
*Education (hs vs votech);
proc freq data=longdata;
      tables (educ2)*any_uai_sens
            /nocol nocum cmh chisq;
      where educ2 ne 2;
      by race_inc;
run;
ods html close;
ods html;
*Education (hs vs college);
proc freq data=longdata;
      tables (educ2)*any_uai_sens
            /nocol nocum cmh chisq;
      where educ2 ne 1;
      by race_inc;
run;
ods html close;
ods html;
```

```
*Employment status;
proc freq data=longdata;
      tables (employed_now)*any_uai_sens
            /nocol nocum cmh chisq;
            by race_inc;
run;
ods html close;
ods html;
*Noninjection drug use;
proc freq data=longdata;
      tables (noninjection)*any_uai_sens
            /nocol nocum cmh chisq;
      by race_inc;
run;
ods html close;
ods html;
*Drinkin';
proc freq data=longdata;
      tables (drink)*any_uai_sens
            /nocol nocum cmh chisq;
            by race_inc;
run;
ods html close;
ods html;
*Physical Abuse;
proc freq data=longdata;
      tables (abuse_physical)*any_uai_sens
            /nocol nocum cmh chisq;
            by race_inc;
run;
ods html close;
ods html;
*Sexual Abuse;
proc freq data=longdata;
      tables (abuse_sexual)*any_uai_sens
            /nocol nocum cmh chisq;
            by race_inc;
run;
ods html close;
ods html;
*Exchange Sex;
proc freq data=longdata;
      tables (exchangep6m)*any_uai_sens
            /nocol nocum cmh chisq;
            by race_inc;
run;
/***********
Modeling
***********/
ods html close;
ods html;
*Full model;
proc logistic data=longdata;
      model any_uai_sens(event='1')=cesd_bin drink noninjection;
      strata study_id;
run;
ods html close;
```

```
ods html;
*No alcohol misuse;
proc logistic data=longdata;
      model any_uai_sens(event='1')=cesd_bin noninjection;
      strata study_id;
run;
ods html close;
ods html;
*No non-injection drug use;
proc logistic data=longdata;
      model any_uai_sens(event='1')=cesd_bin drink;
      strata study_id;
run;
ods html close;
ods html;
*Depression Alone;
proc logistic data=longdata;
      model any_uai_sens(event='1')=cesd_bin;
      strata study_id;
run;
```