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REPEATED MEASURES ANALYSIS OF ALCOHOL PATTERNS AMONG GAY AND BISEXUAL MEN IN THE MOMENTUM HEALTH STUDY

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Abstract

Declaration of interest

The authors report no conflicts of interest. The authors alone are responsible for the content and writing of the article.

Background: This study analyzed repeated study visits (n=2,624) of 693 gay and bisexual men (GBM) in the Momentum Health Study from July, 2012 - June, 2015. Based on recent cross-sectional analyses, we hypothesized that over the study period: 1) hazardous drinking levels would remain high, 2) GBM classified as Hazardous Drinkers will be consistently associated with high risk sex, and 3) GBM classified as Always Hazardous Drinkers differ significantly from Sometimes Hazardous Drinkers.

Methods: AUDIT classified participants as Non-Hazardous Drinkers or Hazardous Drinkers, the Cochran-Mantel-Haenszel Test assessed hazardous drinking trends, and Generalized Estimating Equations (GEE) analysis identified Hazardous Drinking covariates. Logistic regression analysis of participants with at least two study visits (575) compared those who were Sometimes Hazardous Drinkers (n=171) with Always Hazardous Drinkers (n=129).

Results: At baseline 40% of participants were Hazardous Drinkers, but there was a significant decline in hazardous drinking by visit and Hazardous Drinkers were not significantly associated with high risk sex. Always Hazardous Drinkers had significantly more high risk sex and gay bar attendance, but less often sought Internet sex partners compared to Sometimes Hazardous Drinkers.

Conclusions: Analyses did not support the first two hypotheses, but distinguishing between Always and Sometimes Hazardous drinkers identified a young GBM sub-group associated with significantly higher levels of high risk sex and social support measures. These results suggest interventions programs based on Social Norms Theory, which predicts peer norms among youth are important factors in regulating drinking patterns, may be effective for these men.

Keywords

Gay and bisexual men; gay bars; Hazardous Drinking; AUDIT; repeated measures analysis

Introduction

High levels of problem drinking, measured as heavy episodic drinking, binge drinking, and/or hazardous drinking, are recorded in recent cross-sectional studies of gay and bisexual men (GBM). Santos, Jin & Raymond (2014) showed that 67% of a sample of San Francisco GBM reported binge drinking, while in a study of twenty United States' urban centers (Hess et al., 2015) this same measure was 59%. Using another measure of heavy drinking behavior, Tobin, Davey-Rothwell, Yang, Siconiofi & Latkin (2013) reported that 43% of their sample of Baltimore, Maryland African-American GBM were classified by the Alcohol Use Disorder Identification Test (AUDIT) as Hazardous Drinkers, a pattern of alcohol consumption of public health concern because it "... increases the risk of harmful consequences for the user or others despite the absence of any current individual disorder" (Babor, Higgins-Biddle, Saunders, & Monteiro, 2001, p.5).

GBM drinking levels are also associated with sexual and cultural factors. In the first regard, two meta-analyses (Woolf & Maisto, 2009; Vosburgh, Mansergh, Sullivan, & Purcell, 2012) found statistically significant associations between binge drinking and high-risk GBM sexual behaviour, no matter how risk was defined, e.g. condomless anal sex, condomless receptive anal sex, any anal sex. Likewise, in the afore-mentioned United States' 2011

National HIV Behavioral Surveillance data, analysis found binge drinking among HIV-negative/unknown sero-status GBM significantly associated with condomless anal intercourse with an HIV-positive or unknown sero-status partner, having exchanged sex for money and/or drugs in the past year, and having more concurrent and condomless anal sex partners in the past year, compared to non-binge drinkers (Hess et al., 2015). Culturally, GBM alcohol use focused upon the social institution of gay bars/clubs, which formed safe locales providing security and friendship (Achilles, 1967; Israelstam and Lambert, 1984; Brown, Bettani, Knopp, & Childs, 2014; Croff, Hubach, Currin, & Frederick, 2017; Shelton, 2017) and served as sites of socialization, identity and resistance (Wong, Kipke & Weiss, 2008; Jones-Webb, Smolenski, Brady, Wilkerson, & Rosser, 2013).

However, recent events including the diffusion of GBM Internet sex sites and telephone apps, legalization of same sex marriage, and gentrification of heavily gay geographical neighborhoods, initiated social and structural changes in gay communities and culture (Rosser, West & Reinmeyer, 2008; Zablotska, Holt, & Prestage, 2012). As a result, Nash (2013) postulated that in areas where sexual minority stigma is reduced the need for gay bars diminishes, and Miller (2015) suggested that on-line social networking websites now represent the “New Gay Bar”, providing both social and sexual connections in a safer, more easily accessed digital environment.

Considering these suggestions and based on the cross-sectional analyses noted above, we analysed repeated measures data spanning the period 2012-2015 for GBM enrolled in the Vancouver Momentum Health Study to test three hypotheses about GBM drinking patterns. The first is that hazardous drinking levels remain high over all study visits, and the second is that GBM classified as Hazardous Drinkers are consistently associated with high risk sex. Thirdly, our repeated measures approach allowed us to hypothesize significant differences between GBM sometimes classified as Hazardous Drinkers over the study period compared to those always classified as Hazardous Drinkers. Specifically, we hypothesize that the latter group, Always Hazardous Drinkers, will feature significantly more high risk sex and gay bar attendance, but less often seek Internet sex partners, compared to GBM only sometimes classified as Hazardous Drinkers.

Methods and Materials

Protocol

The Momentum Health Study is a prospective cohort study investigating the sexual, psychosocial, and substance use patterns of Vancouver GBM. Momentum uses respondent-driven sampling (RDS, Heckathorn, 1997) to recruit HIV-positive and HIV-negative GBM. Developed for so-called hidden populations, i.e. those without probability-based sampling schemes, RDS first identifies and selects “seeds” who share key characteristics, for example sexual orientation or substance use, with a target population. Seeds subsequently recruit a fixed number of peers in a long-chain sampling approach. Successive recruitment waves permit population parameter estimation via Markov Chain procedures (Heckathorn, 2002). After receiving training from Momentum office staff, seeds distributed a maximum of 6 paper and/or electronic vouchers to Vancouver GBM, who were subsequently screened for study eligibility criteria.

Eligibility criteria included being 16 years of age or older, identifying as male (regardless of sex at birth), reported having sex with a man in the past six months, living in the Greater Vancouver Area region, and competency in understanding a questionnaire written in English. Eligible participants completed a computer-assisted self-interview (CASI) questionnaire and biological tests consisting of point-of-care HIV testing, blood tests for hepatitis C and syphilis serology, and optional tests for gonorrhea and chlamydia. Study participants received a fifty-dollar honorarium for each visit, earned an additional ten dollars for each eligible recruit who completed the survey and tests. Instead of the cash incentives participants could choose to enter monthly draws for a \$250 gift card or a six-monthly draw for a \$2000 travel voucher. Once their eligibility was established and they completed their baseline interview participants were contacted by office staff and returned every six months from their initial visit date for repeated tests and surveys. Repeat visitation dates reflect baseline interview times and vary with respect to calendar dates. Data are therefore organized and analyzed by visit. All procedures received human ethics clearances from Simon Fraser University, the University of British Columbia, and the University of Victoria.

Dependent Variable

The study's dependent variable was the Alcohol Use Disorders Identification Test's (AUDIT, Babor, Higgins-Biddle, Saunders, & Monteiro, 2001) scoring system. This classifies alcohol use groups as: 1) Abstainers (AUDIT scores = 0), 2) Low Risk Drinkers (AUDIT score 1-7), 3) Hazardous Drinkers (AUDIT score 8-14), and 4) High Risk/Alcohol Dependent Drinkers (AUDIT Score ≥ 15). Following previous approaches (Tobin et al., 2013) we dichotomized scores into: 1) Non-Hazardous Drinkers (<8), and 2) Hazardous Drinkers (≥ 8). Membership in each category formed the dependent variable throughout all analyses.

Independent Variables

Independent variables represented socio-demographic, sexual behavior, substance use, gay community involvement, and psycho-social factors. For the last category, eight validated scales, all with Cronbach's alpha values above the accepted cut-off rate of 0.70 (Tavakol & Dennick, 2011), were used. These included the following: 1) *Cognitive Escape Scale* (McKirnan, Vanable, Ostrow, & Hope, 2001, 12 questions, Cronbach's study $\alpha = 0.90$), assessing if GBM used alcohol and illicit substances to diminish cognitive recognition of sexual risk, e.g. "When I am high, I find it difficult to stay within my sexual limits", 2) *Sexual Sensation Seeking Scale* (Kalichman & Rompa, 1995, revised, 11 questions, study $\alpha = 0.73$), measuring respondents' attitudes towards sexual thrill-seeking, e.g. "I like wild, "uninhibited" sexual encounters", 3) *HAART Treatment Optimism Scale* (Van Den Ven, Crawford, Kippax, Knox, & Prestage, 2000, 12 questions, study $\alpha = 0.84$), examining possible changing sexual risk perceptions associated with HIV/AIDS treatment, e.g. "HIV/AIDS is a less serious threat than it used to be because of new treatments", 4) *Self-Esteem Scale* (Herek & Glunt, 1995, 7 questions study $\alpha = 0.90$), relating to personal feelings of self-worth, e.g. "I take a positive view of myself", with higher scores reflecting lower self-esteem, 5) *Social Support Scale* (Lubben et al., 2006, study $\alpha = 0.87$), 6 questions asking about neighborhood friends, e.g. "How many friends do you feel at ease with that you can talk about private matters", 6) *Loneliness Scale* (de Jong Gierveld & van Tilburg, 2006, 6

questions about social isolation, study $\alpha = 0.78$), e.g. “There are enough people I feel close to”, 7) *Hospital Anxiety/Depression (HAD) Scale* (Zigmond & Snaith, 1983) - Anxiety sub-scale, 6 questions, study $\alpha = 0.85$), e.g. “I feel tense or ‘wound up’”, and, 8) *Hospital Anxiety/Depression Scale (HAD)* - Depression sub-scale (Zigmond & Snaith, 1983, 6 questions, study $\alpha = 0.81$), e.g. “I have lost interest in my appearance”.

Socio-demographic variables included measures of age, education, annual income, ethnicity, sexual orientation, self-reported HIV-status, and current housing conditions. Sexual behavior questions asked the number of male sex partners and male anal sex partners in the past six months. We also asked whether respondents had engaged in condomless anal sex during this time period, distinguishing between condomless anal sex with sero-concordant and with sero-discordant and/or unknown status partners, with only the latter considered “high risk sex”. Additional sexual behavior questions asked if respondents attended group sex events, been a male escort, or received money, drugs or goods for sex in the past six months. Substance use questions asked about the use of erectile dysfunction drugs (EDD), poppers, crystal methamphetamine, GHB, and Ecstasy in the same time period. A section on gay community involvement asked respondents whether they attended gay bars/clubs, engaged with gay-specific groups (e.g. athletic groups), read gay newspapers/magazines, and used gay Internet sites, chat lines or telephone apps to seek sex partners within the past six months. A final question asked if they attended Gay Pride activities in the past year.

Statistical Analysis

We assessed differences between Hazardous and Non-Hazardous Drinkers at baseline, using Wilcoxon Rank-Sum tests for continuous variables and Chi-Squared tests for categorical variables. Subsequently, the Cochran-Mantel-Haenszel Test identified possible trends in hazardous drinking. Univariable and multivariable Generalized Estimating Equation (GEE) analyses (Allison, 2012) using the SAS® (Ver. 9.4) PROC GENMOD sub-routine compared Hazardous Drinkers to Non-Hazardous Drinkers over all six-month visits (n. visits=2,624). Our repeated measures research design allowed us to test our final hypothesis predicting significant differences between study participants who sometimes were classified as Hazardous Drinkers compared to those who were always Hazardous Drinkers. To make this comparison we used univariable and multivariable logistic regression with the SAS® (Ver. 9.4) PROC LOGISTIC sub-routine with participants who had at least two study visits (n=575). Analysis compared GBM sometimes classified as Hazardous Drinkers (termed hereafter Sometimes Hazardous Drinkers, n=171) with those always classified as Hazardous Drinkers (termed hereafter Always Hazardous Drinkers, n=129). Univariable analysis showed that the two groups differed significantly in terms of AUDIT scores (median Always Hazardous Drinkers= 14, Q1-Q3 = 11-19, median Sometimes Hazardous Drinkers= 8, Q1-Q3 = 6-11, $p < .001$), but not for number of visits (median Always Hazardous Drinkers=4, Q1-Q3 = 3-5, median Sometimes Hazardous Drinkers= 4, Q1-Q3 = 3-6, $p=0.173$).

All final multivariable models were determined using a backward elimination procedure based on the Quasi-Likelihood Information Criterion (QIC) and Type-III p-values (Lima et al., 2007). We used a lower alpha than customary, $p < 0.20$, to move as many possibly significant variables into the multivariable model for final assessment and applied the

backward elimination technique for multi-variable model selection. In this approach the variable with the least significant likelihood ratio statistic was removed in each step until reaching the optimal QIC value, which assessed the trade-off between goodness of fit and model complexity (Lima et al., 2007).

Results

Longitudinal Sample Description

Altogether, a total of 774 GBM, including 134 (17.3%) seeds, were recruited for the study period, February 2012- February 2015. Of this total, 698 consented to be part of the cohort analysis in addition to the base-line cross-sectional sample. An additional five men were removed due to missing values, reducing the final sample to 693. Total participant visits numbered 2,624, representing six possible six-month visits (median visit = 3, Q1-Q3 = 1-4). At baseline differences between the level of Hazardous and Non-Hazardous drinkers across the 693 who enrolled in the cohort study versus the 76 who did not ($p=0.55$), or between the 125 seeds and 568 non-seeds who comprised the final sample ($p=0.48$) were non-significant. Table 1 shows baseline descriptive sample statistics for the final sample, divided into Non-Hazardous Drinkers ($n= 413$, 60%) and Hazardous Drinkers ($n=280$, 40%). Univariable analysis revealed that at baseline Hazardous Drinkers were significantly younger, HIV-negative/unknown, and Indigenous. They also scored significantly higher on the Cognitive Escape, Social Support, and HAD Anxiety Scales, significantly more often attended gay bars/clubs, used Ecstasy, and received goods for sex in the past 6 months. In contrast, they significantly less often self-identified as Asian, used internet chat lines and sites to seek sexual partners, and used erectile dysfunction drugs in the past six months.

Longitudinal Analysis: Trend and Generalizing Estimating Equation Results

Figure 1 plots the percentages of Hazardous versus Non-Hazardous Drinkers over the six study visits. While this shows the percentage of Hazardous Drinkers never fell below 33% at any one visit, the Cochran-Mantel-Haenszel Test revealed a statistically significant negative trend ($OR = 0.95$, 95% $CI = 0.92-0.98$, $p = 0.001$). Next, GEE models identified characteristics of Hazardous versus Non-Hazardous Drinkers. As shown in Table 2, in the final multivariable model Hazardous Drinkers were significantly younger, scored higher on the Cognitive Escape and HAD Anxiety Scales, significantly more often attended gay bars/clubs, read gay newspapers/magazines, self-identified as Indigenous and used Ecstasy in the past 6 months. Conversely, they were significantly less often HIV-positive, self-identified as Asian, and used Internet sites to seek sexual partners. Differences in all sexual variables, including number of sex partners, number of anal sex partners, and high risk sex, were non-significant in the final multivariable model.

Logistic Regression Analysis: Always versus Sometimes Hazardous Drinkers

While GEE analysis distinguished Hazardous from Non-Hazardous Drinkers by repeated visits, it could not identify study participants sometimes classified as Hazardous Drinkers from those always classified as Hazardous Drinkers. Figure 2 shows that these classifications were extremely fluid and featured substantial loss to follow-up. To test our third hypothesis, that Always Hazardous Drinkers ($n =129$) differed significantly from

Sometimes Hazardous Drinkers (171), logistic regression compared these two groups for GBM who completed at least 2 visits. As shown in Table 3, in the multivariable model Always Hazardous Drinkers scored significantly higher on the Self-Esteem (signifying lower self-esteem) and Social Support Scales. They also had significantly higher annual incomes, and significantly more often attended gay bars, self-identified as Indigenous, used Ecstasy, and reported high risk sex. Always Hazardous Drinkers significantly less often used Internet sites to seek sex partners.

Summary and Discussion

We analysed repeated measures data representing repeated six-month visits collected for 693 GBM enrolled in the Vancouver Momentum Health Study from July, 2012 to June, 2015. Based on recent cross-sectional analyses of GBM drinking patterns and covariates, we hypothesized that over the study period: 1) hazardous drinking levels would remain high, 2) GBM classified as Hazardous Drinkers would invariably be associated with high risk sex, and 3) GBM classified as Always Hazardous Drinkers would differ significantly from Sometimes Hazardous Drinkers. Initial analysis recorded high levels of hazardous drinking throughout the study period, paralleling previous cross-sectional studies of North American GBM (Hess et al., 2015). However, the Cochran-Mantel-Hanszel Test revealed a declining trend of hazardous drinking, which did not support the first hypothesis. The second hypothesis was not supported either, as GEE analysis revealed no significant difference in high risk sexual behavior, or indeed any sexual behaviors, between Hazardous and Non-Hazardous Drinkers.

However, analyses did show significant differences in demographic, psycho-social, substance use and gay community involvement measures. One important variable throughout was age, with Non-Hazardous drinkers fully nine years older than Hazardous Drinkers at baseline (median Non-Hazardous = 39, Q1-Q3 = 28-49, median Hazardous Drinkers = 30, Q1-Q3 = 24-39, $p < 0.001$). Age remained a significant variable in the GEE analysis, supporting previous studies reporting increased risk of problem drinking among young GBM (Marshal et al., 2015; Janulis, Birkett, Phillips, & Mustanski, 2015). Another important result at baseline was the significantly higher scores for the Social Support Scale for Hazardous Drinkers. While also significant in the univariable GEE analysis, this variable was not selected for the final GEE multivariable model. However, it does remind us that “Alcohol is typically a social behavior (Tobin et al., 2013, p. 218). Significant psycho-social variables in the GEE multivariable analysis included higher HAD Anxiety and Cognitive Escape scores, two variables previously reported in association with GBM substance use (McKirman, Venable, Ostrow, & Hope, 2001; Downing, Chiasson, & Hirshfield, 2015). The only significant substance result from the GEE analysis was that Hazardous Drinkers more often used Ecstasy. In terms of gay community variables GEE analysis showed that Hazardous Drinkers significantly more often reported attending gay bars/clubs and reading gay newspapers/magazines in the past six months, but less often used Internet sites to seek sex partners.

Although GEE analysis did not find evidence for high risk sexual behavior associated with Hazardous Drinkers, our repeated measures data allowed a multivariable logistic regression

comparison of Always Hazardous Drinkers with Sometimes Hazardous Drinkers, based on participants who had at least two study visits. In this analysis Always Hazardous Drinkers were significantly younger, and significantly more often reported high risk sex, frequented gay bars, scored higher on the Social Support Scale, and had higher annual incomes, but less frequently used Internet sites to seek sexual partners compared to Sometimes Hazardous Drinkers. We consider these results, which supported our third hypothesis, the most important of our analyses for several reasons. First, they delineate an important sub-group within our sample of Hazardous Drinkers, young GBM who are Always Hazardous Drinkers. Equally important, results show that for this group gay bars remain important social centers where they can meet friends, as suggested by the higher Social Support Scales, and meet sexual partners, as indicated by the significantly lower use of Internet sex sites, but higher levels of high risk sex. Furthermore, this analysis highlighted the role of income, linking Always Hazardous Drinkers with having sufficient disposable income to buy alcohol in public venues. While the aforementioned suggestion that “the Internet is the new gay bar” (Miller, 2015), is supported by the Grov, Hirschfield, Remien, Humberstone, & Chiasson (2013) analysis of a US GBM national survey showing the majority of participants (63%) met their most recent sexual partner on-line, the next most popular venue for meeting sexual partners was bars/clubs (13%). Our results strongly suggest that Always Hazardous Drinkers would be heavily represented in the latter group.

All analyses highlight the need for GBM alcohol education/intervention programs. However, a recent systematic review reported that theoretically informed research on effective GBM alcohol intervention is scarce (Wray et al., 2016). This study’s finding that Always Hazardous Drinkers are young, and feature high Social Support Scale scores indicate that social norms-based interventions may be effective for this GBM sub-group. In particular, Social Norms Theory, frequently applied to young drinkers (Miller & Prentice, 2016) may be relevant. This theory is operationalized by asking survey respondents to estimate both their peers’ and their own behavior, assuming that descriptive social norms lead respondents to overestimate peers’ risky behaviors, e.g. binge drinking, while underestimating peers’ protective behaviors e.g. condom use during intercourse (Lewis, Litt, Cronce, Blayney & Gilmore, 2014). Hypothesizing that survey respondents mistake such inaccuracies for social norms that increase risky behaviors, the theory predicts that risky behaviors can be reduced and protective behaviors increased when accurate survey results are tabulated and shown to survey participants (Lewis, Patrick, Mittmann, & Kaysen, 2014). Reviews of social norms interventions suggest small, but positive, effects on alcohol consumption linked to changing social influences (Dotson, Dunn & Bowers, 2015; Miller & Prentice, 2016). Based on this study’s results, particularly the final analysis linking young, Always Hazardous Drinkers to high levels of social support and high risk sex, we recommend initiating social norms-based alcohol interventions in combination with sexual risk reduction/awareness programs.

This paper has limitations. Social desirability bias may be present among participants who did not want to recognize problematic drinking and/or high risk sexual behavior, resulting in underestimates of both factors. Secondly, while respondent driven sampling attempts to provide a more representative sample our sample cannot be extrapolated to GBM populations in other settings. In addition, because of the complex pattern of loss-to- follow-up shown in Figure 2, we could not determine if trend analysis was describing a population

effect as the cohort aged, or a cohort effect with Hazardous Drinkers at a disproportionate risk of being lost. Further, some research shows the AUDIT system is not very effective in classifying adolescent drinking levels (Fairlie, Sindelar, Eaton & Spirito, 2006), which may be problematic for this study which accepted GBM over age 16. Finally, while repeated measures data were used, we make no claims for causality, e.g. that attendance at gay bars leads to problem drinking. Despite these caveats, this analysis revealed high levels and distinctive patterns of hazardous drinking by Momentum Health Study GBM participants, and suggested the potential for education and intervention programs grounded in Social Norms theory.

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Glossary

AUDIT

Acronym standing for The Alcohol Use Disorders Identification Test, a WHO constructed screening test to identify hazardous and alcohol dependent drinking patterns.

High Risk Sexual Behavior

Defined for gay and bisexual men as condomless anal sex with a sero-discordant or unknown sero-status partner.

Social Norms Theory

Predicts that one's behavior is largely influenced by misperceptions of how peers act; specifically that peers levels of high risk behavior is overestimated and mistaken for a social norm.

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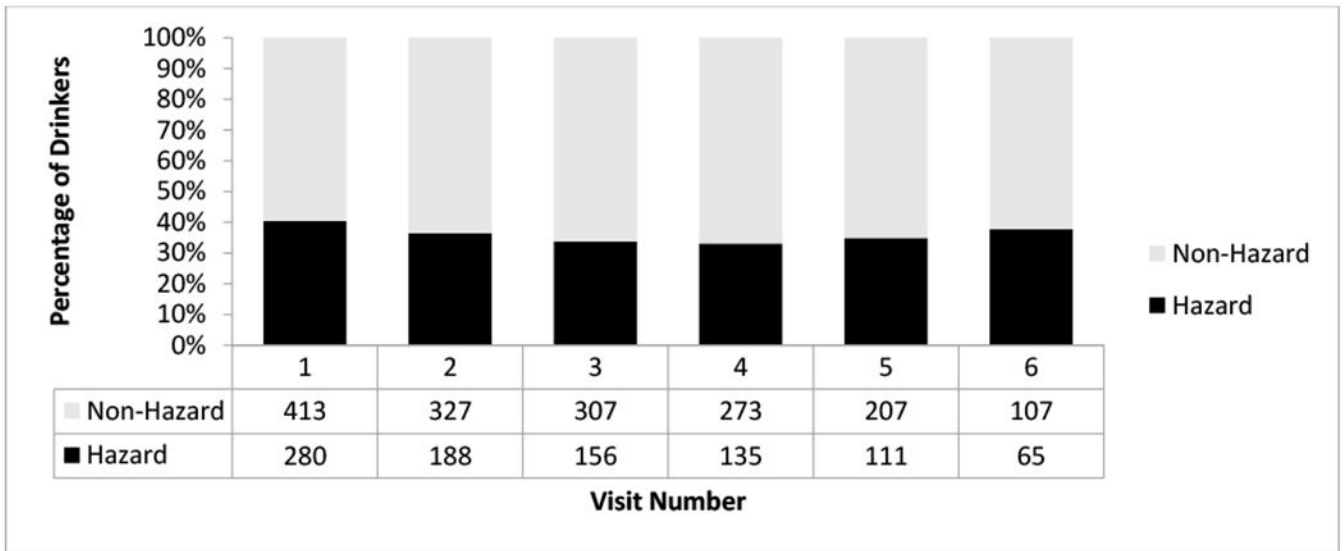


Figure 1.
Distribution of Hazardous and Non-Hazardous Drinkers over 6 study visits.

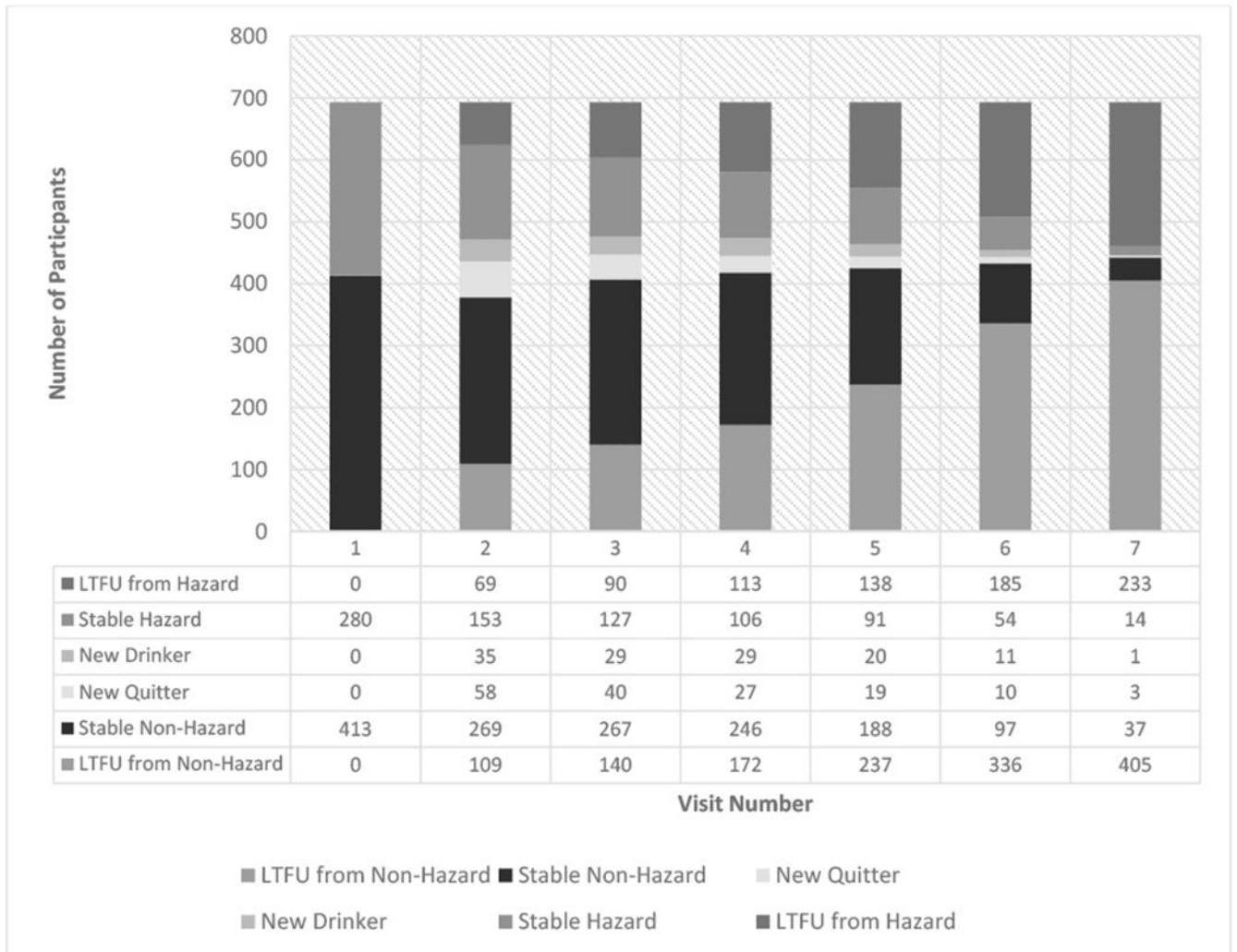


Figure 2. Distribution showing classification from one visit to the next. Classifications include: 1) **Stable Hazardous** – Hazardous Drinker from one visit to the next, 2) **Stable Non-Hazardous** – Non-Hazardous drinker from one visit to the next, 3) **New Non-Hazardous Drinker** – transition from Hazardous to Non-Hazardous Drinker, 4) **New Hazardous Drinker** – transition from Non-Hazardous to Hazardous Drinker, 5) **LTFU from Hazardous** – lost to follow up from Hazardous Drinker, 6) **LTFU from Non-Hazardous** – lost to follow-up from Non-Hazardous Drinker.

Table 1.

Baseline descriptive statistics comparing Non-Hazardous (n=413) and Hazardous Drinkers (n=280). Measures include median and Q, Q3 values for continuous variables, number and percentage (in parentheses) for categorical variables. Probability values (p-values) determined for categorical variables via chi-squared tests and for continuous variables by Wilcoxon Rank-Sum tests. Significant variables (p<.05) in bold.

VARIABLE	NON-HAZARDOUS DRINKERS	HAZARDOUS DRINKERS	PROBABILITY
Age	39 28,49	30 24,39	<0.001
Number Sex Partner P6M	5 2,15	6 3,15	0.288
Number Anal Sex Partner – P6M	3 1,9	4 2,9	0.273
Sexual Sensation Seeking Scale	31, 28,34	31 29,34	0.060
HAART Treatment Optimism Scale	25 21,29	24 21,27	0.102
Cognitive Escape Scale	27 23,32	30 27,34	<0.001
Self-Esteem Scale	7 3, 9	7 3,10	0.729
Social Support Scale	10 8,13	11 9,13	<0.001
Loneliness Scale	2 1, 4	2 1, 4	0.292
HAD Anxiety Scale	7 5,10	8 6, 11	0.005
HAD Depression Scale	3 1,6	3 2, 6	0.678
Self-Reported HIV Status			
Negative/Unknown	264 (63.9)	232 (82.9)	<0.001
Positive	149 (36.1)	48 (17.1)	
Annual Income			
<\$30,000	255 (61.7)	167 (59.6)	
\$30-\$60,000	107 (25.9)	80 (28.6)	0.740
>\$60,000	51 (12.4)	33 (11.8)	
Ethnicity			
White	312 (75.5)	213 (76.1)	
Asian	52 (12.6)	17 (6.1)	<0.001
Indigenous	11 (2.7)	27 (9.6)	
Other	38 (9.2)	23 (8.2)	
Education			
Completed High School or Less	77 (18.6)	58 (20.7)	0.500
More Than High School	336 (81.4)	222 (79.3)	
Sexual Identity			
Gay	358 (86.7)	238 (85.0)	0.531

VARIABLE	NON-HAZARDOUS DRINKERS	HAZARDOUS DRINKERS	PROBABILITY
Bisexual/Other	55 (13.3)	42 (15.0)	
Housing Stable			
Yes	358 (88.0)	249 (89.9)	0.433
No	49 (12.0)	28 (10.1)	
Attended Pride Parade Past Year			
No	163 (39.5)	93 (33.2)	0.094
Yes	250 (60.5)	187 (66.8)	
Attended Gay Bar/Club P6M			
No	111 (26.9)	28 (10.0)	<0.001
Yes	302 (73.1)	252 (90.0)	
Attended Gay-Specific Groups P6M			
No	252 (61.0)	174 (62.1)	0.765
Yes	161 (40.0)	106 (37.9)	
Used Chat Lines to Seek Sex P6M			
No	351 (85.0)	254 (90.7)	0.026
Yes	62 (15.0)	26 (9.3)	
Used Smart Phone Apps to Seek Sex P6M			
No	193 (46.7)	112 (40.0)	0.080
Yes	220 (53.3)	168 (60.0)	
Used Internet Sites to Seek Sex P6M			
No	131 (31.7)	116 (41.4)	0.009
Yes	282 (68.3)	164 (58.6)	
Read Gay Newspapers/Magazines P6M			
No	76 (18.4)	36 (12.9)	0.052
Yes	337 (81.6)	244 (87.1)	
Condomless Anal Sex P6M			
No	134 (32.9)	93 (34.2)	
Yes	115 (28.3)	66 (24.3)	0.508
High Risk Sex	158 (38.8)	113 (41.5)	
Attend Group Sex Event P6M			
No	301 (72.9)	209 (74.6)	0.606
Yes	112 (27.1)	71 (25.4)	
Used Erectile Dysfunction Drug P6M			
No	293 (70.9)	224 (80.0)	0.007
Yes	120 (29.1)	56 (20.0)	
Used Poppers P6M			

VARIABLE	NON-HAZARDOUS DRINKERS	HAZARDOUS DRINKERS	PROBABILITY
No	262 (63.4)	164 (58.6)	0.196
Yes	151 (36.6)	116 (41.4)	
Used Crystal Methamphetamine P6M			
No	333 (80.6)	223 (79.6)	0.749
Yes	80 (19.4)	57 (20.4)	
Used Ecstasy P6M			
No	339 (82.1)	177 (63.2)	0.001
Yes	74 (17.9)	103 (36.8)	
Used GBH P6M			
No	339 (82.1)	220 (78.6)	0.251
Yes	74 (17.9)	60 (21.4)	
Work as Escort P6M P 6 M			
No	392 (94.9)	250 (92.9)	0.260
Yes	21 (5.1)	20 (7.1)	
Received Money for Sex P 6 M			
No	337 (91.3)	257 (91.8)	0.816
Yes	36 (8.7)	23 (8.2)	
Received Drugs for Sex P 6 M			
No	385 (93.2)	252 (90.0)	0.127
Yes	28 (6.8)	28 (10.0)	
Received Goods for Sex P6M			
No	400 (96.9)	260 (92.9)	0.015
Yes	13 (3.2)	20 (7.1)	

Table 2.

Univariable and multivariable GEE model results, all visits (n=2,624). Statistically significant variables (p<.05) in bold. Non-Hazardous Drinkers as referent group.

VARIABLE	UNIVARIABLE MODEL		MULTIVARIABLE MODEL	
	OR ¹	95% CI	OR ²	95% CI
Age	0.96	0.95, 0.97	0.98	0.96, 0.99
Number Sex Partner P6M	1.00	1.00, 1.00		
Number Anal Sex Partner – P6M	1.00	1.00, 1.00		
Sexual Sensation Seeking Scale	1.03	1.00, 1.07	NOT SELECTED ³	
HAART Treatment Optimism Scale	0.98	0.97, 0.99	NOT SELECTED ³	
Cognitive Escape Scale	1.04	1.03, 1.06	1.05	1.03, 1.06
Self-Esteem Scale	1.03	1.01, 1.05	NOT SELECTED ³	
Social Support Scale	1.04	1.00, 1.07	NOT SELECTED ³	
Loneliness Scale	1.04	1.00, 1.08	NOT SELECTED ³	
HAD Anxiety Scale	1.05	1.03, 1.07	1.05	1.03, 1.08
HAD Depression Scale	1.02	0.99, 1.04		
Self-Reported HIV Status				
Negative/Unknown		1.00		1.00
Positive	0.35	0.25, 0.48	0.37	0.26, 0.54
Annual Income				
<\$30,000		1.00		
\$30-\$60,000	1.02	0.85, 1.23		
>\$60,000	0.91	0.69, 1.20		
Ethnicity				
White		1.00		1.00
Asian	0.45	0.27, 0.74	0.39	0.24, 0.65
Indigenous	2.42	1.37, 4.26	2.98	1.63, 5.44
Other	1.01	0.63, 1.61	1.00	0.62, 1.60
Education				
Completed High School or Less		1.00		
More Than High School	0.91	0.67, 1.24		
Sexual Identity				
Gay		1.00		

VARIABLE	UNIVARIABLE MODEL		MULTIVARIABLE MODEL	
	OR ¹	95% CI	OR ²	95% CI
Bisexual/Other	1.12	0.85, 1.46		
Housing				
Unstable		1.00		
Stable	0.90	0.70, 1.15		
Attended Pride Parade Past Year				
No		1.00		
Yes	1.01	0.88, 1.16		
Attended Gay Bar/Club P 6 M				
No		1.00		1.00
Yes	1.73	1.47, 2.03	1.87	1.55, 2.26
Attended Gay-Specific Groups P 6 M				
No		1.00		
Yes	1.00	0.87, 1.14		
Used Chat Lines to Seek Sex P 6 M				
No		1.00		
Yes	0.93	0.70, 1.22		
Used Smart Phone Apps to Seek Sex P 6 M				
No		1.00		NOT SELECTED ³
Yes	1.22	1.04, 1.42		
Used Internet Sites to Seek Sex P 6 M				
No		1.00		1.00
Yes	0.90	0.77, 1.05	0.80	0.67, 0.95
Read Gay Newspapers/Magazines P 6 M				
No		1.00		1.00
Yes	1.32	1.12, 1.57	1.33	1.09, 1.61
Condomless Anal Sex P 6 M				
No		1.00		
Yes	1.00	0.84, 1.19		
High Risk Sex	0.98	0.83, 1.15		
Attended Group Sex Party P 6 M				
No		1.00		
Yes	1.02	0.87, 1.19		
Used Erectile Dysfunction Drugs P6M				
No		1.00		
Yes	1.03	0.86, 1.23		

VARIABLE	UNIVARIABLE MODEL		MULTIVARIABLE MODEL	
	OR ¹	95% CI	OR ²	95% CI
Used Poppers P 6 M				
No		1.00	NOT SELECTED ³	
Yes	1.17	1.02, 1.35		
Used Crystal Methamphetamine P6M				
No		1.00		
Yes	1.19	0.96, 1.48		
Used Ecstasy P 6 M				
No		1.00		1.00
Yes	1.51	1.24 1.84	1.36	1.10, 1.69
Used GHB P 6 M				
No		1.00		
Yes	1.13	0.91, 1.42		
Worked as Escort P6M				
No		1.00		
Yes	1.23	0.78, 1.92		
Received Money for Sex P6M				
No		1.00	NOT SELECTED ³	
Yes	1.43	1.02, 2.01		
Received Drugs for Sex P6M				
No		1.00	NOT SELECTED ³	
Yes	1.55	1.11, 2.17		
Received Goods for Sex P6M				
No		1.00	NOT SELECTED ³	
Yes	1.56	1.09, 1.23		

¹ Odds Ratio

² Adjusted Odds Ratio

³ Not selected by QIC

Table 3.

Univariable and multivariable logistic regression model results comparing Sometimes Hazardous Drinkers (n= 171) with Always Hazardous Drinkers (n= 129), and using the former as the referent group. Statistically significant variables (p<.05) in bold.

VARIABLE	UNIVARIABLE MODEL		MULTIVARIABLE MODEL	
	OR ¹	95% CI	AOR ²	95% CI
Age	1.00	0.97, 1.02		
Number Sex Partner P6M	1.00	0.99,1.00		
Number Anal Sex Partner – P6M	1.00	0.98, 1.01		
Sexual Sensation Seeking Scale	1.06	1.00, 1.12	NOT SELECTED	
HAART Treatment Optimism Scale	0.97	0.93, 1.02		
Cognitive Escape Scale	1.05	1.01, 1.09	NOT SELECTED	
Self-Esteem Scale	1.07	1.01, 1.14	1.17	1.08, 1.26
Social Support Scale	1.05	.097, 1.14	1.10	1.00, 1.22
Loneliness Scale	1.02	0.91, 1.14		
HAD Anxiety Scale	1.08	1.01, 1.14	NOT SELECTED	
HAD Depression Scale	1.02	0.95, 1.09		
Self-Reported HIV Status				
Negative/Unknown		1.00		
Positive	0.77	0.42 1.41		
Annual Income				
<\$30,000		1.00		1.00
\$30-\$60,000	1.83	1.08, 3.11	2.06	1.11, 3.83
>\$60,000	1.66	0.80, 3.46	3.61	1.50, 8.68
Ethnicity				
White		1.00		1.00
Asian	0.59	0.23, 1.49	0.65	0.23, 1.92
Indigenous	1.84	0.81, 4.18	3.86	1.42,10.50
Other	1.01	0.46, 2.24	1.40	0.57, 3.46
Education				
Completed High School or Less		1.00		
More Than High School	1.01	0.56, 1.81		
Sexual Identity				
Gay		1.00		

VARIABLE	UNIVARIABLE MODEL		MULTIVARIABLE MODEL	
	OR ¹	95% CI	AOR ²	95% CI
Bisexual/Other	1.14	0.60, 2.14		
Housing				
Unstable		1.00		
Stable	1.03	0.50, 2.11		
Attended Pride Parade Past Year				
No		1.00		
Yes	1.20	0.74, 1.96		
Attended Gay Bar/Club P 6 M				
No		1.00		1.00
Yes	2.85	1.19, 6.83	3.89	1.48, 10.22
Attended Gay-Specific Groups P 6 M				
No		1.00		
Yes	0.90	0.56, 1.44		
Used Chat Lines to Seek Sex P 6 M				
No		1.00		
Yes	0.46	0.21, 1.03		
Used Smart Phone Apps to Seek Sex P 6 M				
No		1.00		
Yes	1.01	0.64, 1.61		
Used Internet Sites to Seek Sex P 6 M				
No		1.00		1.00
Yes	0.68	0.43, 1.09	0.49	0.28, 0.85
Read Gay Newspapers/Magazines P 6 M				
No		1.00		
Yes	1.15	0.56, 2.36		
Condomless Anal Sex P 6 M				
No		1.00		1.00
Yes	1.16	0.62, 2.17	0.92	0.46, 1.82
High Risk Sex	2.40	1.39, 4.13	2.68	1.41, 5.06
Attended Group Sex Event P 6 M				
No		1.00		
Yes	1.51	0.89, 2.56		
Used Erectile Dysfunction Drug P6M				
No		1.00		1.00
Yes	0.76	0.42, 1.37	0.49	0.24, 1.01

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VARIABLE	UNIVARIABLE MODEL		MULTIVARIABLE MODEL	
	OR ¹	95% CI	AOR ²	95% CI
Used Poppers P6M				
No		1.00		
Yes	1.53	0.95, 2.46		
Used Crystal Methamphetamine P6 M				
No		1.00		
Yes	1.08	0.59, 1.95		
Used Ecstasy P6M				
No		1.00		1.00
Yes	1.88	1.15, 3.09	1.98	1.10, 3.56
Used GBH P6M				
No		1.00		
Yes	0.83,	0.46, 1.50		
Worked as an Escort P6M				
No		1.00		
Yes	0.36	0.12, 1.50		
Received Money for Sex P6M				
No		1.00		
Yes	0.37	0.13, 1.02		
Received Drugs for Sex P6M				
No		1.00		
Yes	1.13	0.49, 2.62		
Received Goods for Sex P6M				
No		1.00		
Yes	0.76	0.29, 1.99		

¹ Odds Ratio

² Adjusted Odds Ratio

³ Not Selected by QIC