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Age at First Alcoholic Drink as Predictor of Current HIV Sexual Risk Behaviors Among a Sample of Injection Drug Users (IDUs) and Non-IDUs who are Sexual Partners of IDUs, in St. Petersburg, Russia

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Abstract

This study investigates whether age at first alcoholic drink is associated with sexual risk behaviors among injection drug users (IDUs) and non-IDUs who are sexual partners of IDUs in St. Petersburg, Russia. A path analysis was used to test a model of age at first drink, age at sexual debut, age at first drug use, current substance use patterns and current sexual risk behaviors among 558 participants. Results revealed that age at first drink had an effect on multiple sex partners through age at sexual debut and injection drug use, but no effect on unprotected sex. Age at first drug use was not related to sexual risk behaviors. Investigation of age of drinking onset may provide useful information for programs to reduce sexual risk behaviors and injection drug use. Different paths leading to unprotected sex and multiple sexual partners call for different approaches to reduce sexual risk behaviors among this population.

Keywords

Age at first alcoholic drink; HIV sexual risks; IDU; Russia; Age at first drug use; Sexual debut

Introduction

To date, the majority of HIV/AIDS cases in Russia have been diagnosed among IDUs [1]; however, concerns about sexual transmission of HIV to non-drug using populations have

increased [2]. Research on factors contributing to the high HIV prevalence among IDUs indicate that the drugs most commonly injected in Russia, heroin and ephedrine derivatives, including methamphetamines [3], have been associated with practices that increase the risk for HIV transmission [4, 5]. Compounding the risks associated with injection drug use in Russia is the fact that alcohol consumption and alcohol related problems in Russia are reportedly among the highest in the world today [6, 7]. Alcohol use in Russia is also associated with risky sexual behaviors such as unprotected sex and high rates of partner change that place non-drug using individuals at risk for HIV [8, 9]. Thus, drug and alcohol abuse are important factors to investigate in the context of the Russian HIV epidemic.

Several studies have reported an increase in alcohol use during the post-Soviet era [7, 10], a decrease in the age of drinking onset and an increase in the prevalence of alcohol use among adolescents [11, 12]. One study identified 87% of 15-year-olds in Russia as drinkers [13], suggesting that drinking at an early age has become an important public health concern in Russia. Several reasons make the onset of drinking at an early age an important health concern. For instance, alcohol use at an early age may interfere with brain development and lead to cognitive and behavioral dysfunctions that propitiate risk taking [14, 15]. Early drinking onset may contribute to maladaptive patterns of using alcohol to cope with stress [16]. Furthermore, early drinking onset may be associated with later substance use problems [17, 18]. Thus, investigating the age at drinking onset may provide helpful information for studies that investigate risk outcomes among individuals with other types of substance use disorders, however, to our knowledge, little research has investigated the factors associated with the early onset of drinking in Russia.

The literature suggests both direct and indirect links between early onset of alcohol use and sexual risk behavior. For example, early initiation of alcohol use can be directly associated with later problematic use of alcohol and sexual risk behaviors [19, 20]. Indirect links are also suggested because an early onset of alcohol use is associated with a large number of alcohol related problems and heavy alcohol use patterns [21, 22], while heavy drinking patterns and binge drinking are associated with sexual risks such as unwanted pregnancies, sexual coercion, sexually transmitted infections or multiple sexual partners [23–25]. Furthermore, research has found that age of alcohol use initiation is associated with dating violence [26], and other research has found that dating violence is associated with unprotected or involuntary sex [27]. Therefore, study methodologies that can simultaneously analyse the direct and the indirect associations between age at drinking onset and sexual risk behaviors may provide useful information regarding alcohol related sexual risk behaviors in Russia.

This study used path analysis to simultaneously investigate whether initiation of alcohol consumption at an early age was directly or indirectly associated with current sexual HIV risk among a sample of IDUs and non-IDUs who were sexual partners of IDUs in St. Petersburg, Russia. The following two research questions were addressed: (1) was the age of initiation of alcohol use directly related to current sexual risk behaviors? (2) did age at sexual debut, age of initiation of substance use, and current substance use patterns mediate the relationship between age at drinking onset and current sexual risk behaviors?

Methods

Study Population and Recruitment into the SATH-CAP Study

The current analysis was conducted using data from a study in St. Petersburg, Russia that was part of a large multi-site project, the Sexual Acquisition and Transmission of HIV Cooperative Agreement Program (SATH-CAP) [28]. The goal of SATH-CAP was to collect and analyse data on sexual and drug use practices and other social, environmental and

biological factors that may influence HIV transmission from the IDU population, which has a high-prevalence of HIV, to other populations. The SATH-CAP study protocol was approved by the Institutional Review Boards of Yale University, the Biomedical Center in St. Petersburg and RAND Corporation. Participants were recruited between November 2005 and December 2008 using a modified form of respondent driven sampling (RDS) [28, 29]. RDS is a chain-referral sampling methodology that uses structured incentives (i.e., participants receive incentives upon completing an interview, making a successful referral or both) and coupon disbursement procedures for peer referrals. Conventional RDS methods were modified [28] in this study to recruit individuals at high risk for HIV [i.e., IDUs and men who have sex with men (MSMs)] and their sex partners, regardless of whether the sex partners were also IDUs or MSMs. Briefly, the enrolled IDUs or MSMs were given coupons to distribute to their injection peers and sex partners. The coupons invited the individuals to present at the study site for eligibility screening and enrollment. Newly enrolled IDUs or MSMs were in turn offered coupons to recruit their own injection peers and sexual partners. Participation was anonymous. A number of biomeasures, including forearm length and wrist circumference, were collected to prevent repeat participation [30, 31]. Because the focus of the current analysis was on individuals who injected drugs or their sexual partners, MSMs and their sex partners were excluded.

Participants completed structured interviews and were given pre-test counseling before biological specimens were collected for HIV testing. All of the participants received incentives. They were given the choice to receive either mobile phone cards or personal care items; all of them received subway tokens, condoms and HIV prevention information. Participants were given instructions for when to return to the site to receive their laboratory test results and post-test counseling. Participants were referred for other medical services as needed.

Interview Data Collection

Interviews that lasted 90–120 min were conducted using computer-assisted survey interviews on laptop computers. Collected demographic data included gender, age, income, education, marital status and whether the participant considered him/herself homeless. Participants were asked whether they had ever been tested for HIV and the result of their HIV test from a list of five options: refuse to answer, did not know, did not get results, HIV-negative and HIV-positive.

Participants were asked the first three questions of the Alcohol Use Disorders Identification Test (AUDIT-C): number of days in the last month during which alcohol was used, average number of drinks at each drinking event, and number of days in the last month during which they had greater than four drinks within 2 h. Those who drank alcohol were asked to provide the age at which they drank their first alcoholic beverage (*Age at First Alcoholic Drink*). *Alcohol Problems* corresponded to scores on the first three AUDIT-C questions of greater than three for males and greater than two for females [32]. *Binge Drinking* was defined as having had five or more drinks in 2 h at least twice in the last month [33]. Previous studies have shown that these measures can effectively identify alcohol misuse [34, 35].

Participants were asked whether they injected drugs in the last 6 months, they were also asked to specify the type of injectable or non-injectable drugs they used in the last 30 days from a list of ten types of drugs, and they were asked to specify the age they first used these drugs (*Age at First Drug Use*). In this analysis, *Methamphetamine Use* consisted of having used methamphetamine in the last 30 days, whether injected or not. *Injection Drug Use* corresponded to having injected illicit drugs in the last 6 months.

Information on sexual behaviors included number of male and female sex partners in the 6 months prior to the interview, the number of these sexual partnerships which had less than 3 months duration, whether they had unprotected sexual intercourse at their last sexual act and the age at which they had their first sexual intercourse (*Age at First Sex*). This analysis used two variables as sexual risk behavior outcomes: *Multiple Sex Partners*, i.e., reporting more than one sex partner in the prior 6 months and *Unprotected Intercourse*, i.e. unprotected sex with a new or non-main partner at the last sexual act. These outcome variables were chosen because sexual risk behaviors vary significantly on the basis of whether an individual is with a main or a non-main sexual partner [36, 37] and because these variables better represent the risk for the sexual transmission of HIV beyond the IDU population in Russia.

HIV Detection

Blood samples were obtained from all participants. Serum specimens were tested for HIV-1 as previously described [38].

Preliminary Analysis

The criteria for inclusion into this analysis were: injection drug use in the last 6 months or having a sex partner who is an IDU; if male, reporting only sex with females; being sexually active in the last 6 months; and providing data on sexual partnerships. The completed SATH-CAP study recruited 1,023 IDUs, MSM and their sexual partners in St. Petersburg. After excluding the MSMs (253) and those who reported zero sex partners (71), or those who did not report the number of sex partners in the prior 6 months (112), 588 participants were included in the current analysis. Statistical analyses to describe the study population and collinearity tests between the variables used in the path analyses were conducted using SPSS 17.

Path Analysis

A hypothesized model of the impact of *Age at First Alcoholic Drink* on current sexual risk behaviors among Russian IDUs and their sexual partners was tested using path analysis. *Age at First Sex*, *Age at First Drug Use*, *Methamphetamine Use*, *Injection Drug Use*, *Alcohol Problems* and *Binge Drinking* were included as covariates in the analysis.

Path analysis was used to simultaneously examine the multiple relationships between *Age at First Alcoholic Drink* and current sexual risk behaviors considering the various covariates that may mediate these relationships. Specifically, we analysed a model that proposed the following: (1) having an early age at drinking onset is directly associated with both *Unprotected Sex* and *Multiple Sexual Partners*; (2) early initiation of alcohol use affects sexual risks indirectly through its effects on early sexual debut and early initiation of drug use, which in turn leads to current sexual risks; and (3) early initiation of alcohol use affects sexual risks indirectly through its effects on current substance use behavior, which in turn leads to current sexual risks.

Path analysis provides the overall fit of the hypothesized model and the significance of the direct and indirect structural paths between the predictor and outcome variables. It has been suggested that collinearity becomes worrisome when bivariate correlations exceed 0.8 in regression-based data analyses [39]; however, correlations between the variables in this study did not approach this level. Furthermore, collinearity diagnostics were conducted on the basis of the recommendation that multicollinearity is indicated if tolerance values are 0.10 or less [40]; the values for the current data ranged from 0.63 to 0.98, indicating that multicollinearity was not a serious concern.

The goodness-of-fit χ^2 , the RMSEA, the Comparative Fit Index (CFI), and the Tucker-Lewis Index (TLI) were used to evaluate the overall fit of the model. The goodness of fit χ^2 assesses the magnitude of discrepancy between the sample and model covariance matrices. A non-significant χ^2 value indicates that the hypothesized model does not differ significantly from the actual covariance structure of the data [41]. The RMSEA assesses absolute fit, taking into account the degrees of freedom in the model. RMSEA values under 0.06 indicate relatively good fit [41]. The CFI and the TLI assess incremental fit by comparing the absolute fit with an independence model that assumes no relationships among variables. CFI and TLI values equal to or greater than 0.95 indicate good fit [41]. Missing data was handled by using multiple imputation procedures [42]. Ten imputed data sets were created using the Stochastic Regression option in AMOS 18. Data analyses were run independently on each imputed data set, and then results were combined following rules proposed by Rubin [43]. Because the current study used both dichotomous indicator variables and ordinal categorical outcome variables, the hypothesized structural model was evaluated using WLSMV, which is available with the computer program Mplus 6.

Results

Table 1 presents information on the demographic characteristics, substance use and sexual risk behaviors, and mean ages of initiation of substance use and sexual activity among the 558 study participants. Table 2 presents the correlation matrix for all variables included in the path analysis.

The fit of the hypothesized path model was tested independently on ten imputed data sets, and achieved good fit across all analyses, with a non-significant χ^2 in nine of ten models (average χ^2 (9) = 14.54, range 12.70–17.85; χ^2/df = 1.62). Both CFI and TLI were above 0.95 in all analyses (average CFI = 0.996, range 0.995–0.998; average TLI = 0.984, range 0.976–0.990), and RMSEA was below 0.06 in all analyses (average RMSEA = 0.032, range 0.026–0.041). Figure 1 shows significant direct pathways in bold and pathways that approached significance in grey. Non-significant paths were removed so that the model was easier to read. Five covariances were added to the hypothesized original path model to improve model fit. Path coefficients shown are combined results based on the multiple imputation procedure and significance tests accounted for the uncertainty associated with predicting missing values. Table 3 presents summed coefficients of the indirect paths modeled in Fig. 1 that lead from *Age at First Alcoholic Drink* to *Multiple sexual Partners*. The indirect paths 1 and 3 were significant, suggesting that *Age at First Sex* and current *Injection Drug Use* mediated the relationship between *Age at First Alcoholic Drink* and *Multiple Sexual Partners*. Given the borderline significance of path 2 (P = 0.054), *Injection Drug Use* by itself might also mediate the relationship between *Age at First Alcoholic Drink* and *Multiple Sexual Partners*.

Summary of Significant Results

Following is a summary of the significant results: (1) there was no significant direct effect from *Age at First alcoholic Drink* to *Unprotected Sex* and *Multiple Sexual Partners* in bivariate correlations or the path model. (2) *Age at First Alcoholic Drink* had an indirect effect on *Multiple Sexual Partners* through *Age at First Sex* and current *Injection Drug Use*. Specifically, the younger the *Age at First Alcoholic Drink* the younger the *Age at First Sex* and/or the greater the likelihood for *Injection Drug Use*. Conversely, the younger the *Age at First Sex*, the more-likely he or she is to have *Multiple Sexual Partners* and/or to engage in *Injection Drug Use*. *Injection Drug Use* was associated with a lower likelihood of having *Multiple Sexual Partners* and *Age at First Sex* was associated with greater likelihood of having *Multiple Sexual Partners*. (3) *Age at First Drug Use* was not directly related to current sexual risk variables. However, relationships between the *Age at First Drug Use* and

both *Methamphetamine Use* and *Unprotected Intercourse* were significant or approached significance in seven and five of our imputed data sets, respectively, although these relationships failed to reach significance in the combined results. (4) *Unprotected Sex* and *Multiple Sexual Partners*, which were not significantly associated in bivariate analyses, displayed separate predictive paths and had no overlapping mediators.

Discussion

Our results provide support for the hypothesis that early initiation of alcohol use contributes to current sexual risk. This is consistent with studies in other populations that have demonstrated a link between early alcohol use and sexual risk at an older age [19, 20] and suggest that the age of drinking onset may be an important marker for studies of HIV sexual risk behaviors in Russia.

Our study showed that the younger an individual is at the time he or she begins drinking, the more-likely he or she is to use drugs of injection and/or to initiate sexual activity and have multiple sexual partners. The results suggest that there is a need for future studies to identify factors that may impact individuals' drinking trajectories [44] and lead to sexual behaviors [45] and/or injection drug use [26, 46]. Such studies may prove useful in developing interventions to prevent or reduce the risk of injection drug use and sexual risk behaviors in Russia. This is particularly true given that illicit drug injection is the major risk factor for HIV in Russia and the rates of sexual transmission of HIV appear to be on the rise [1].

Unprotected sex and multiple sexual partners, the two sexual risk variables investigated in this study, displayed separate predictive paths with no overlapping mediators. This finding suggests that each variable may originate from distinct risk factors or follow different developmental trajectories. Having multiple sexual partners was affected by age at first sex and by injection drug use. Alternatively, the relationship between unprotected intercourse and age at first drug use approached significance. It is possible that our sample, which consisted primarily of substance users, did not have enough variability to allow for the observation of a significant relationship between these variables. Future research on patterns of substance use and sexual behavior among Russian populations may help elucidate these relationships. If developmental trajectories leading to sexual risk behaviors are indeed distinct, then interventions to reduce HIV sexual risk behaviors among this population might benefit from considering these differences. For example, if having multiple sexual partners can be traced back to initiation of drinking at an early age [47, 48], then public health programs to reduce adolescent drinking may lead to a delay in sexual debut and a reduction in number of sexual partners. Furthermore, if having unprotected sex is related to the choice of substances currently used, particularly the use of methamphetamines [49], then interventions must prevent or treat substance use problems in order to reduce unprotected intercourse among substance users [50, 51].

A surprising finding is that the age at first drug use is not related to any of the measured current substance use or sexual risk variables. The lack of association between sexual risks and early initiation of drug use is consistent with a previous finding [52] and further confirms the importance of early drinking in establishing sexual risk behaviors, even among a study sample consisting of a large number of illicit drug users.

This study had several limitations. First, participants recruited into this study were IDUs and non-IDUs who reported at least one sexual partner who was an IDU; thus, the results may not apply to non-IDUs who have never had sex with an IDU. Second, because the capacity of RDS to produce probability samples is limited [53], the generalizability of these results even within the sampled populations may also be limited. Third, sexual risk behaviors may

relate to the type of substance used; therefore, behaviors might have been different if the proportions of heroin, methamphetamine and alcohol users had been different. Finally, this study may have recruited individuals who were more comfortable participating in research projects compared with those IDUs who were harder to reach. Conversely, certain or all risk behaviors may have been underreported because of social desirability or other types of bias.

Conclusions

Age at first alcoholic drink appears to have greater impact on current substance use and sexual risk behaviors than early onset of drug use among our study population in St. Petersburg, Russia. The different paths that lead to unprotected sex and multiple sexual partners call for different approaches to reduce these two sexual risk behaviors. The investigation of the factors related to the early initiation of alcohol use may provide relevant information for programs to prevent injection drug use and sexual risk behaviors among this population. If these results are confirmed, delaying the age of drinking onset may help reduce the risk for sexual risk behaviors and injection drug use among similar populations that are at risk for HIV in Russia.

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Fig. 1. Final path model predicting substance use and HIV sexual risk among a sample of Russian injection drug users and their sexual partners ($N= 588$). *Note:* only significant direct paths are shown for ease of interpretation. Five significant covariances (represented by *curved lines*) were added based on modification indices. Two paths that approached significance are shown with *light grey lines*

Table 1

Characteristics of a sample of 588 heterosexual IDUs and non-IDUs who are sexual partners of IDUs in St. Petersburg, Russia

	<i>n</i>	%
Basic demographic characteristics and HIV status		
Male	382	65
Age (mean $\pm$ SD; min 18, max 58)	28.6 ($\pm$ 6.5)	
Receives a legal income	448	76
Completed post secondary education	341	58
Homeless	109	19
Married or live with primary partner	219	38
Received a positive HIV test result	217	37
Reportedly knew of having a positive HIV status	87	15
Substance use behaviors		
Consumed alcohol in the last month	467	83
Engaged in binge drinking ^a	214	39
Engaged in problem drinking (i.e. per AUDIT-C score)	368	66
Injected drugs in the past 6 months	489	83
Used methamphetamines in the last 30 days	100	17
Sexual risk behaviors		
Had more than one sexual partner in the past 6 months	243	41
Unprotected sex with non primary or new sexual partners at last sexual act	207	39
Age of initiation of substance use and sexual activity		
Age at first alcohol use (mean $\pm$ SD; min 1, max 25) ^b	14.2 ($\pm$ 2.8)	
Age at first illicit drug use (mean $\pm$ SD; min 9, max 45) ^c	16.8 ($\pm$ 4.2)	
Age at first sexual intercourse (mean $\pm$ SD; min 1, max 35)	15.5 ($\pm$ 2.5)	

^aWas drunk or had five or more drinks in 2 h more than twice a month in the last month

^bAmong 573 participants who consumed alcohol

^cAmong 555 participants who had used drugs

Table 2

Correlation matrix showing associations between predictor variables and HIV sexual risk variables

Variable	1	2	3	4	5	6	7	8	9
1. Unprotected intercourse	–								
2. Multiple sex partners	.22 ^a	–							
3. Know HIV status	.03 ^a	–.03 ^a	–						
4. Methamphetamine use	.06 ^a	.12 ^a	.01 ^a	–					
5. Injection drug use	.01 ^a	–.05 ^a	–.03 ^a	–.01 ^a	–				
6. Binge drinking	.03 ^a	.07 ^a	–.05 ^a	.14 ^a	–.11 ^a	–			
7. Alcohol problems	.04 ^a	.11 ^a	–.05 ^a	.09 ^a	–.01 ^a	.58 ^a	–		
8. Age at first drug use	–.08 ^b	–.07 ^b	–.03 ^b	–.09 ^b	–.08 ^b	–.13 ^b	–.05 ^b	–	
9. Age at first sex	–.01 ^b	–.16 ^b	.01 ^b	–.08 ^b	–.15 ^b	–.09 ^b	–.07 ^b	0.25	–
10. Age at first alcoholic drink	–.05 ^b	–.01 ^b	.01 ^b	–.05 ^b	–.17 ^b	–.13 ^b	–.07 ^b	0.41	0.28

Numbers in bold signify a significant relationship, $P < 0.01$ ^aKendall's tau coefficient^bSpearman correlation coefficient, otherwise Pearson correlation coefficient

Table 3

Indirect effects of paths from age at first alcoholic drink on multiple sex partners

Intermediate variables		Multiple partners	
		Parameter	S.E.
Age at first alcoholic drink			
Indirect effects			
Path 1: through	Age at first sex	-0.036 ^a	0.017
Path 2: through	Injection drug use	0.027 ^b	0.014
Path 3: through	Age at first sex, injection drug use	0.008 ^a	0.004

^aValue significant, $P < 0.05$ ^bBorderline significant, $P = 0.054$