Prevalence of HIV and Risky Sexual Behaviors Among Rural Drug Users: Does Age Matter?

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Abstract

Objectives—To determine the seroprevalence of HIV among a representative sample of rural drug using adults. Also, to determine whether young rural drug users engage in greater levels of sexual risk behavior than their older counterparts.

Methods—Cross-sectional study of 503 adult drug users. Rapid tests for antibodies to HIV were used and self-reported data was collected via computer.

Results—None of the participants tested positive for antibodies to HIV. In bivariate tests only two differences were observed between young and older participants. Young males were more likely to engage in unprotected vaginal sex (*P*=.018) and young females were more likely to engage in unprotected sex with persons injecting drugs (*P*=.016). In controlled multivariate analyses, age had a modest but significant association with an 8-item index of sexual risk behavior (b= −.15) and a reduced 6-item index of risk (b= −.18).

Conclusion—Despite a fairly dense and interactive sexual network and relatively high-levels of sexual risk behaviors, this rural population has not yet been affected by the HIV epidemic. In the event an outbreak of HIV in this population the observed levels of sexual behavior suggest that rapid sexual transmission could occur among drug-using populations and may include persons of all ages.

Keywords

HIV; rural; sexual networks; drug use

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Introduction

The US epidemic of HIV/AIDS continues to escalate among persons 15 through 24 years of age.[1] However, the most recent HIV/AIDS surveillance report issued by the Centers for Disease Control and Prevention suggests that rates are also escalating among persons 55 through 59 years of age.[1] Further, that same report suggests that while HIV infection rates have declined among injection drug users, this same decline does not apply to the heterosexual transmission of the virus. Consequently, it is important to consider the sexual behaviors of persons (young and older) who inject drugs or may inject in the future (e.g., persons who are using illicit drugs).

Perhaps one of the least studied populations of drug-dependent adults regarding HIV risk behavior is people residing in rural areas of the US. In 2009, the rate of HIV diagnosis among rural Americans was 7.4 per 100,000.[1] Although far lower than the rate of urban Americans (22.2 per 100,000) the "rural epidemic" is nonetheless significant and warrants empirical investigation regarding risk behaviors. Rurality contributes to substantial health disadvantages.[2–5] Rural Americans may greatly differ from their non-rural counterparts on several key dimensions. These include relatively poorer health and greater levels of health risk behaviors, as well as limited access to health care. Many rural residents live in communities characterized by lower socioeconomic status, increased numbers of older residents, higher rates of unemployment, higher rates of health illiteracy, increased poverty, and geographic isolation.[6–9] Rural Appalachia is a particularly "distressed" area of rural America and this is exceedingly true in the state of Kentucky.[10]

The purpose of this study was twofold. First, we sought to determine the seroprevalence of HIV in a rural Kentucky-based Appalachian population of adult drug users, 18 to 65 years old. The second purpose was to characterize the HIV-associated sexual risk behaviors of this population by gender and by young versus older age. Specifically, we determined whether young rural drug users engaged in greater levels of sexual risk-taking behavior than their older counterparts.

Methods

Study Sample

Study participants were enrolled in the Social Networks among Appalachian People (SNAP) study, an epidemiological study examining social networks and HIV risk among rural Appalachian drug users. A storefront location in a rural Appalachian town of approximately 10,000 residents was used for participant recruitment and interviews. This small town serves as a "hub" of activity for several surrounding counties thus many participants from extremely remote areas were enrolled. Study recruitment began in November, 2008 and was completed in August, 2010. Participants were recruited using respondent-driven sampling (RDS), which is often the most appropriate sampling technique for hidden populations such as drug users.[11,12] Those eligible for participation included drug users age 18–65 years who resided in Appalachian Kentucky and had used one of the following substances to get high in the prior 30 days: prescription opioids, cocaine, heroin or methamphetamine. The study was approved by the Institutional Review Board at the University of Kentucky. Participants were compensated $50 for their time. A total of 939 people were screened for study eligibility. Of those screened, 742 were determined to be eligible. Unfortunately it was not always possible to schedule people to return for the baseline assessment thus study enrollment procedures and baseline assessments were completed by 503 participants thus yielding a 68% participation rate. The 503 people completing baseline assessments comprised the sample for this cross-sectional study.

Recruitment

Seeds were recruited via community outreach. Given our interest in HIV-risk behaviors, all of the seeds had a lifetime history of injection drug use. Once the seed IDUs completed their baseline interview, they were given three coupons and asked to recruit their drug using peers (regardless of injection status). If the coupon was redeemed (i.e., their peer was eligible for the study and completed the baseline interview), the participant who distributed the coupon was given $10. A total of 107 seeds were enrolled to recruit a total sample of 503 participants. The process required 14 waves of recruitment.

Study Procedures

The questionnaire was interviewer-administered and responses were entered directly into a touch screen laptop enabled with computer-assisted personal interviewing (CAPI) software (Questionnaire Development System [QDS], Nova Research Company, Bethesda, MD). All interviewers were residents of the recruitment area and received extensive training in interviewing and locating, as well as receiving certifications as HIV counselors.

After completing the interview, participants were tested for antibodies to HIV using rapid tests (OraQuick, OraSure Technologies, PA). Pre- and post-test counseling was provided in accordance with CDC guidelines.

Measures

Nine measures of sexual risk were assessed. First, all participants were asked how many of their male sex partners were injection drug users. Then, the same question was repeated for female sex partners. These first two measures were not bounded by a recall period. Next, using a 6-month recall period, participants were asked how many sex partners they had in this time frame. They were then asked how often they had sex without using condoms with a partner "who was not your spouse or primary partner" and they were asked how often they had sex without using condoms with a partner "who shot drugs with needles." A similar question followed which asked how often they had sex without using condoms while trading sex for money, drugs, or gifts. Response options to these three questions about were provided on a 5-point scale ranging from "never" to "about every day." Finally, using a 30-day recall period, participants were asked how many partners they had sex with, how many times they had penile-vaginal sex without using condoms, and how many times they had penile-anal sex without using condoms.

Data Analysis

Each of the nine measures, described in the previous paragraph, was used in two ways: in the original form as continuous variable and in a dichotomized form. The dichotomies were created by simply comparing those who reported engaging in the sexual risk behavior at all during the recall period to those not reporting the behavior during that period of time. In turn, the dichotomized measures were used to create a composite index of risk. Each variable was coded as "1" for risk and "0" for the referent category thus the index was created by simply summing the dichotomized variables. Two of the nine variables (having 2 or more partners in the past 30 days) were redundant in the recall periods (having 2 or more partners in the past 6 months) so only the 6-month measure was used in the index thus leaving an 8-item index. Because the first two items comprising the index were not bounded by a recall period, we were quite cognizant of the potential colinearity with age so we also created and analyzed a 6-item index that excluded these two variables.

For descriptive purposes, all bivariate analyses were stratified by gender. To determine whether young rural drug users engaged in greater levels of sexual risk behavior than their older counterparts, the age distribution was dichotomized by performing a median split (32

years or less vs. 33 years or older). Bivariate associations between age and the nine selected risk behaviors were assessed by independent groups t-tests for continuous outcome variables and by contingency table analyses for the corresponding dichotomous outcome variables. To examine the data from a somewhat different perspective, the 8-item risk index was used as the outcome variable in a hierarchical linear regression model that was constructed using stepwise entry. This model tested for the association of age on risk behavior in the context of selected covariates. The first block contained basic demographic covariates (gender, employment, marital status, history of STDs) plus age in its continuous form. Because of the extremely low number of minority members in the sample race/ethnicity was not analyzed as a covariate. The second block contained two behavioral covariates: having used a "dirty needle" at least once in the past 6 months and never being previously tested for HIV. Although a wide range of behavioral covariates could have been included, the selection of just these two served as a reasonable proxy of risk-taking propensity. The use of the measure asking participants if they had used a "dirty needle" was particularly important as it created a division in the sample based on recent HIV-risk from a injection-drug using perspective. The same regression model was applied to the 6-item risk index.

Finally, network density was calculated. Density, at the ego level, is defined as the observed number of ties between an actor's immediate connections divided by the number of ties possible. This formula produces a proportion between 0 and 1 that describes the extent that all actors in an individual's network are connected. A maximally dense or `complete' binary network, where ties are valued as 1 for existing and 0 if no tie exists, would have a density of 1 or 100% if expressed as a percentage.

Results

Characteristics of the Sample

The sample was comprised of slightly more males (n = 286, 56.9%) than females (n = 217, 43.1%). The mean age of the males was 32.8 years (sd = 8.32) and the mean age of the females was 32.2 years (sd = 8.86). Less than 6% identified as a member of a racial or ethnic minority. Just over one-quarter of the participants were married (26.2%). Unemployment was high, with the mean number of days worked in the past 30 days being 6.7 (sd = 9.7) but more than 50% reported not working at all in the past 30 days. Nearly one of every ten (8.3%) reported having ever been diagnosed with genital herpes, syphilis, gonorrhea, or Chlamydia. Nearly one of every five (18.3%) reported they had used a "dirty needle" in the past 6 months. More than one-third (36.0%) reported never being tested for HIV (previous to study enrollment).

Unlike other parts of the country where injection of methamphetamine and/or heroin are highly prevalent, that is not the case in rural Appalachian Kentucky. In fact, only 39 (7.7%) of the entire sample had ever injected meth, and fewer still (n=8) had injected methamphetamine in the 6 months prior to the baseline interview. Likewise, heroin use was also negligible. Less than 1 in 5 study participants had ever injected heroin (18.9%), and when queried about prior 6-month injection, only 31 reported any heroin injection.

Seroprevalence of HIV

All 503 rapid tests produced determinant results and none of the results were positive. The complete lack of seroprevalence in this population occurred despite many individuals being embedded in a rather dense and interactive sexual network. Of the 503 participants 310 (61.63%) were linked to another network member through a sexual relation in the last 6 months. These network members were linked together by a total 412 sexual ties. Overall network density among this sample was .43%.

Bivariate Associations Between Young Versus Older Age and Sexual Risk Behaviors

Table 1 displays means and the corresponding results from the independent groups t-tests, stratified by gender. Of note, only 4 males reported having sex with other males therefore the analysis pertaining to sex with a male partner who injects drugs is omitted for males due to low numbers. As shown, only one of the 17 comparisons yielded a significant difference between younger and older participants: younger males reported having significantly more unprotected vaginal sex in the past 30 days.

Table 2 displays the number and percentages of younger and older participants reporting risk behaviors, stratified by gender. Again, the analysis pertaining to male sex partner who injected drugs is omitted for males. As shown, similar to Table 1, only one of the 17 comparisons yielded a significant difference between younger and older participants. The difference pertained to females, with those being younger being more likely to report unprotected sex with a known injection drug user than their older counterparts.

Associations with the Risk Index

The 8-item risk index had a mean of 2.49 (sd = 1.60), with a median value of 2 (range = 0 – 7), meaning that about one-half of the sample reported at least 3 HIV-associated sexual risk behaviors. Of note, the mean for males was 2.39 and the mean for females was 2.60 – this difference was not significant (t = 1.48 [501], P = .14). Also, the mean for those 32 years of age or younger was 2.61 while the mean for their older counterparts was 2.33 – this difference was also not significant (t = 1.93 [501], P = .055). The observed mean for the 6-item index was 1.88 (sd = 1.31), with a median of 2 (range = 0 to 5). Means for this index did not vary by gender (males = 1.89, females = 1.88, t = 07 [501], P = .95). However, younger participants had a significantly higher mean (2.00) on this index (abridged from the two age-related measures of risk) than their older counterparts (1.74) (t = 2.26 [501], P = .02).

Table 3 displays the Beta weights and respective P-values from the linear model regressing the 8-item index on age and the selected covariates. Although the model was significant (F = 6.72, 7,495 df, P < .001) the Beta weights were quite small and the overall R^2 was low (.087). Nonetheless, the second largest Beta weight occurred for age (−.15), with the largest weight being observed for the covariate of using dirty needles in the past 6 months (β = .19). Being single and ever having an STD were also significant correlates of sexual risk behavior.

Table 3 also displays the Beta weights and respective P-values from the linear model regressing the 6-item index on age and the selected covariates. Again, the model was significant (F = 5.95, 7,495 df, P < .001); however, the Beta weights were quite small and the overall R^2 was low (.078). In this model the largest Beta weight occurred for age (−.18), with the next largest being observed for the covariate of using dirty needles (β = .14). Again, being single and ever having an STD were significant correlates.

Of note, the decision to use age as a continuous variable in these two regression models was arrived upon by also constructing models using age in its dichotomous form – in each of these models age was not significantly associated with sexual risk (data not shown in tables). In the model regressing the 8-item index on age and the selected covariates, the obtained Beta weight for age was .06 (P = .15). In the model regressing the 6-item index on age and the selected covariates, the obtained Beta weight for age was .08 (P = .07). Thus, a more conservative approach to investigating the research question was to construct the two models using age in its continuous form.

Discussion

Study findings suggest that this population of rural Appalachian drug users is, thus far, isolated from the HIV epidemic thereby making their levels of HIV-associated sexual risk behavior a rather mute point for the time being. This isolation from the epidemic could quickly change if HIV was "imported" into a rural sexual or drug-using network from another location. In that event, the observed levels of sexual risk behavior suggest that the spread of HIV in this rural network may be quite rapid in the absence of immediate intervention. It would appear that the assessed sexual and drug-using networks may experience a type of "isolative protection" against HIV that could be easily compromised by mixing patterns that bridge sexual partners and drug-use partners from high HIV seroprevalence areas. Avoiding these bridge partners may therefore become the basis of counseling and education messages to persons living in rural isolative protection.

The descriptive data shown in Tables 1 and 2 suggest that both drug-using men and women (regardless of age) are likely to have unprotected sex with potentially risky partners. For example, in Table 2, more than 50% of the males and females reported ever having unprotected sex with a person who injects drugs. When using only the past 6 months as the recall period, relatively high proportions of both men and women nonetheless reported this risky behavior. Clearly, the intersection of drug use networks with sexual networks in this "closed community" creates a potential for rapid spread of HIV.

The descriptive (bivariate) findings suggest that older adults may be equally at-risk, as their younger counterparts, of HIV acquisition in the event of a network outbreak. Although two significant differences were observed (one for males and one for females) it is clearly worth noting that multiple bivariate comparisons were made thereby magnifying the odds of chance findings. The weight of evidence from these bivariate comparisons suggests that a rural Appalachian outbreak of HIV among drug users may be as likely to involve people in their 50's and 60's as those who are only in their 20's.

Several observations from the two bivariate tables are warranted. First, although only a few men reported having same sex partners, 70 (32.2%) women reported sex with other women. While not a risk factor for HIV acquisition, these relationships do offer opportunity for needle/syringe sharing, among those who inject, and thus deserve consideration in the event of an outbreak. Second, the frequency of unprotected sex while trading sex for money or drugs was relatively low in this rural population of drug users, perhaps suggesting that other differences between rural and urban populations of drug users may exist. Third, the observed frequency of unprotected anal receptive sex for women is quite high in contrast to national estimates.[13] This and other descriptive findings clearly suggest that drug using populations in rural areas may benefit from condom social marketing programs and related efforts to promote safer sex behaviors. Finally, it is worth noting that a large portion of older males (41.1%) and of older females (24.5%) reported having unprotected sex with at least two partners in the past 6 months – this extraordinarily high in contrast to national estimates of simply having sex (protected or not) among persons 35 and older (ranging from 14% to 4% depending on age between 35 and 59 years).[14]

In both regression models age had a modest but significant and inverse association with the index of sexual risk behaviors. It is important to note that this association occurred independently from gender, marital status, recent employment, and history of having STDs. Thus, it does appear that the expected inverse association between age and sexual risk exits for this population of drug users; however, it is equally important to note that the magnitude of the observed association is quite weak (explaining, at best, only about 3% of the variance in the 6-item risk index). A perhaps more informative statistic is the comparison of means

for the 6-item measure, with the absolute difference between the two age groups being .26 with a range from 0 through 5 – although the difference is statistical significant, .26 represents only about one-fifth of one standard deviation for this distribution.

Limitations

Findings are limited by the validity of the self-reported behavioral variables. Also, the participation rate of 68% creates a possibility of sample bias that limits the generalizability of the findings. Further, the use of only one catchment area for the study limits the generalizability of the findings.

Conclusion

This study of rural Appalachians illustrates the concept of HIV as a network phenomenon. Despite relatively high levels of sexual risk behavior, the men and women in our sample of just over 500 drug-using adults all tested negative for antibodies to HIV. While the variable of age made a modest contribution to a regression model of sexual risk behavior, the weight of evidence suggests that older adults may be on par with their younger counterparts in the event of an outbreak of HIV in this network. Consequently, proactive efforts to develop safer sex interventions for heterosexual, drug-using, adults (of all ages) living in rural areas may be a valuable asset the control of HIV in the US.

Acknowledgments

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Table 1

Comparison of Sexual Risk Behaviors, Assessed by Continuous Data, Between Young and Older* Drug-Dependent Adults, By Gender (N = 503)

Risk Behavior	Males (n = 286)				Females (n = 217)			
	N/Mean	t-value	DF	P	N/Mean	t-value	DF	P
Number of female sex partners[1] who inject drugs								
Young	161/2.34				48/1.02			
Older	124/3.84	1.77	283	.08	22/2.14	1.24	68	.22
Number of male sex partners[1] who inject drugs								
Young					123/1.77			
Older					94/3.35	1.09	215	.28
Frequency of unprotected sex[2] with non-main partners[3]								
Young	156/.69				118/.53			
Older	114/.19	.15	268	.88	85/.61	.58	201	.56
Number of partners having unprotected sex[3]								
Young	162/2.66				123/1.86			
Older	124/2.68	.03	284	.97	94/1.56	.82	215	.41
Frequency of unprotected sex[2] with people injecting drugs[3]								
Young	162/.58				118/1.15			
Older	114/.71	.89	268	.37	85/.76	1.89	201	.06
Frequency of unprotected sex[2] when trading sex for money or drugs[3]								
Young	156/.10				118/.08			
Older	114/.19	1.23	268	.20	85/.18	1.29	201	.19
Number of vaginal, anal, and oral sex partners[4]								
Young	156/1.42				118/1.14			
Older	114/1.40	.09	268	.92	85/1.26	.96	201	.34
Number vaginal sex acts when condoms were not used[4]								
Young	145/14.99				110/12.88			
Older	96/10.99	2.39	239	.018	81/12.55	.26	189	.79
Number of anal sex acts when condoms were not used[4]								

Risk Behavior		Males (n = 286)				Females (n = 217)		
	N/Mean	t-value	DF	P	N/Mean	t-value	DF	P
Young	14/.07				47/.81			
Older	15/.33	.74	27	.46	40/.35	1.02	85	.31

^{1}Assessed over lifetime;

^{2}Response options ranged from "0" (never) to "4" (about every day);

^{3}Assessed for the past 6 months

^{4}Assessed for the past 30 days

Table 2

Comparison of Dichotomized Sexual Risk Behaviors Between Young and Older* Drug-Dependent Adults, By Gender (N = 503)

Risk Behavior	Males (n = 286)				Females (n = 217)			
	# w/ risk factor	N	%	P	# w/ risk factor	N	%	P
Ever had a female sex partner who inject drugs								
Young	81	161	50.5		16	48	35.3	
Older	62	124	50.0	.96	11	22	50.0	.18
Ever had a male sex partner who inject drugs								
Young					75	123	61.0	
Older					56	94	59.6	.83
Had unprotected sex with 2 or more partners[1]								
Young	78	162	48.1		45	123	36.6	
Older	51	124	41.1	.24	23	94	24.5	.06
Had unprotected sex[2] with non-main partners[1]								
Young	56	156	35.9		33	118	28.0	
Older	41	114	36.0	.99	24	85	28.2	.97
Had unprotected sex[2] with people injecting drugs[1]								
Young	48	156	30.8		53	118	44.9	
Older	28	114	24.6	.26	24	85	28.2	.016
Had unprotected sex[2] when trading sex for money or drugs[1]								
Young	9	156	5.8	.15	6	118	5.1	
Older	12	144	10.5		10	85	11.8	.08
Any sex act with two or more partners[3]								
Young	33	162	20.4		16	123	13.0	
Older	25	124	20.2	.96	14	94	14.9	.69
Any vaginal sex acts when condoms were not used[3]								
Young	133	145	91.7		101	110	91.8	
Older	82	96	85.4	.12	77	81	95.1	.38
Any anal sex acts when condoms were not used[3]								

Risk Behavior	Males (n = 286)				Females (n = 217)			
	# w/ risk factor	N	%	P	# w/ risk factor	N	%	P
Young	1	14	7.1		7	47	14.9	
Older	1	15	6.7	.96	5	40	12.5	.75

[1] Assessed for the past 6 months

[2] Response options ranged from "0" (never) to "4" (about every day)

[3] Assessed for the past 30 days

Table 3

Beta Coefficients for Selected Correlates of Two Outcomes (an 8-item Sexual Risk Index and a 6-item Sexual Risk Index) N = 503

Correlate	8-item Index		6-item Index	
	Beta	**P**	**Beta**	**P**
Age	−.15	.001	−.18	.001
Female gender	.07	.14	−.004	.93
Unemployed past 30 days	.07	.13	.07	.99
Not married	.10	.02	.10	.02
Ever diagnosed with an STD	.10	.028	.09	.04
Used "dirty needle" past 6 months	.19	.001	.14	.002
Never tested for HIV	.03	.62	.07	.13

*Each correlate was entered into two linear regression models. The first model used the 8-item index of sexual risk behavior as the outcome variable. The second model used the 6-item index of sexual risk behavior as the outcome.