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Rural Incarcerated Women: HIV/HCV Knowledge and Correlates of Risky Behavior

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Abstract

Rural incarcerated women have an increased risk of acquiring the Human Immunodeficiency Virus (HIV) and the Hepatitis C virus (HCV) due to prevalent engagement in drug use and sexual behaviors. Limited research has investigated HIV and HCV knowledge in this high-risk population. Furthermore, the interplay of sociodemographic factors (i.e., education, age, income, and sexual orientation) and risky behavior is understudied in this population. The present study evaluated a sample of adult, predominately White women from rural Kentucky (n = 387) who were recruited from local jails. The sample had high HIV and HCV knowledge, but also reported extensive risk behaviors including 44% engaging in sex work and 75.5% reporting a history of drug injection. The results of multiple regression analysis for risky sexual behavior indicated that sexual minority women and those with less HIV knowledge were more likely to engage in high-risk sexual behaviors. The regression model identifying the significant correlates of risky drug behavior indicated that HIV knowledge, age, and income were negative correlates and that sexual minority women were more likely to engage in high-risk drug use. When HCV knowledge was added to the regression models already including HIV knowledge, the interaction was significant for drug risk. Interventions for rural imprisoned women should consider the varied impact of sociodemographic background and prioritize HIV education to more effectively deter risky sexual and drug behaviors.

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Keywords

hepatitis C knowledge; HIV knowledge; HIV prevention; incarcerated women; rural women

The United States holds nearly a third of all female prisoners worldwide (Walmsley, 2011) and female incarceration rates continue to rise even faster than males (Bureau of Justice Statistics [BJS], 2011; Sabol, 2007). Imprisoned women are more likely than men to report severe substance abuse (Staton, Leukefeld, & Webster, 2003; Staton-Tindall, Leukefeld, Palmer, Oser, Kaplan et al., 2007) and one-quarter of women are incarcerated for drug crimes (BJS, 2012). Drug use, in particular injection drug use (IDU), facilitates risky sexual behavior including unprotected sex and sex exchange (Centers for Disease Control and Prevention [CDC], 2015a). Risky drug and sexual behaviors are associated with high risk of contracting diseases such as the human immunodeficiency virus (HIV) and the Hepatitis C virus (HCV; CDC, 2015a).

Incarcerated Women and HIV/HCV Risk

Women made up 19% (n = 8,328) of the new HIV diagnoses in the United States in 2014 (CDC, 2014). HIV rates are higher among incarcerated women (1.9%) than among men (1.5%; Maruschak, 2009). For women, HIV is most often transmitted through heterosexual contact and IDU (CDC, 2014). IDU among rural users may be uniquely risky. One study found that rural users reported between four and 15 daily injections, generations of family members who inject, and between one and six partners per injection event (Morbidity and Mortality Weekly Report, 2015). These conditions resulted in an HIV outbreak in one state, which highlights the need to better understand predictors of risk in rural populations to track epidemics and inform prevention efforts.

Like HIV, HCV is also a viral disease, but it attacks the liver. HCV is the most prevalent blood-borne disease in the United States and between 30-40% of inmates are infected (Armstrong, Wasley, Simard, McQuillan, Kuhnert, & Alter, 2006; Macalino, Hou, Kumar, Taylor, Sumantera, & Rich, 2003). One study of New York state inmates reported that 22.1% of women were infected compared to 12.8% of men (Correctional Association of New York, 2009). In the general population, one quarter of all people living with HIV are also co-infected with HCV and that number increases to 50% to 90% for HIV infected drug abusers (CDC, 2016a). Both diseases have similar transmission routes, yet there has been a limited focus on the extent to which health knowledge about these diseases prevents risk for transmission. Moreover, the relationship between knowledge and risky behavior may be unique among rural, female, White inmates who are understudied in the literature.

Much of the incarceration literature is based on samples of urban males (Bloom, Owen, & Covington, 2003). It is also based on prison samples rather than samples from jails, a more prevalent locale for women given that they are more likely to be jailed for non-violent drug related crimes (U.S. Department of Justice, 2011). Inmates awaiting trial or serving shorter sentences tend to be in jail rather than prison (Program Review and Investigations Committee, 2016). Across the country the rates of incarceration among White women increased by 47% and they represent the highest population of female inmates (The

Sentencing Project, 2013). In 2016, there were 2,207 women in Kentucky jails (Program Review and Investigations Committee, 2016). The characteristics of the population in this study (i.e., rural, poor, incarcerated, substance abusing, White women) individually represent health disparate groups and the amalgamation of these risk factors may pose a unique emerging threat for HIV and HCV transmission that has been understudied in the literature. White women incarcerated in rural settings have garnered limited attention despite the prevalence of risk factors for HIV and HCV including IDU and sex exchange (Belenko, Langley, Crimmins, & Chaple, 2004; Otis, Oser, Staton-Tindall, 2016). Understanding the risk and protective factors against risky behaviors in this population may better inform intervention and prevention strategies for this high-risk group.

Health Knowledge and Risky Behavior

Health knowledge is acquired information about specific health issues including the cause, consequence, treatment, and prevention of a disease (Freimuth, 1990). The 18-item Brief HIV Knowledge Questionnaire (HIV-KQ-18), which uses sum scores, is a commonly used measure of HIV knowledge (Carey & Schroder, 2002; Leukefeld, Havens, Staton Tindall, Oser, Mooney, et al., 2012; Volpe, Nelson, Kraus, & Morrison-Beedy, 2007). HCV knowledge, though less studied than HIV, is often measured in conjunction with assessments of knowledge of Hepatitis A and B, using seven summed items (Carey, Perlman, Friedmann, Kaplan, Nugent, et al., 2005). Many people are unaware that they are infected with HIV (1 in 8; CDC, 2016b) and/or HCV (50% to 75%; Colvin & Mitchell, 2010). This puts them at-risk for transmitting the viruses to others. HCV may be perceived as less dangerous due to its common occurrence in high-risk populations, a lack of media attention, limited provider and community awareness, and inconsistent screening recommendations (U.S. Department of Health and Human Services, 2011). However, more people die from HCV than HIV (Ly, Xing, Klevens, Jiles, Ward, & Holmberg, 2012). Health knowledge of one disease may be insufficient to address factual gaps about where infection routes diverge (e.g., HCV lives longer outside of the body than HIV; CDC, 2016c). These concerns are particularly salient for rural populations given the gaps in the educational infrastructure (e.g., fewer preschool programs and adults with bachelor’s degrees; National Center for Education Statistics, 2007) and the current opioid addiction epidemic (Havens Oser, Leukefeld, Webster, Martin et al., 2007; Wunsch, Nakamoto, Behonick, & Massello, 2009).

Interventions to increase both HIV and HCV knowledge may lead to positive behavior change and reduce transmission rates (Groessl, Sklar, Laurent, Lorig, Ganiats et al., 2016). Studies examining the relationship between health knowledge and behavior have produced mixed results (Kew, François, Lavanchy, Margolis, Van Damme et al., 2004; Mize, Robinson, Bockting, Scheltema, 2002; Oser, Leukefeld, Staton-Tindall, Havens, Webster et al., 2006) suggesting that other factors, such as sociodemographic characteristics should be considered.

Sociodemographics and Risky Behavior

Sociodemographic factors such as age, family income, education, and sexual orientation may be associated with risky drug and sexual behavior. For example, sexual debut at an

early age is correlated with risky sexual behavior including unprotected, casual, and multiple partnered sex at an older age (Baldwin, Shrestha, Potrepka, & Copenhaver, 2013). Similarly, early onset of substance use is associated with future sex work and IDU (Baldwin et al., 2013).

The findings for income are mixed. Youth from high-income families engage in more alcohol use, whereas low-income youth are more likely to smoke (Hanson & Chen, 2007; Martin & Pritchard, 1991). One longitudinal study of data from the National Survey on Drug Use and Health (NSDUH) on probationers and parolees found that lower income and use of government assistance programs was associated with substance use and dependence (Fearn, Vaughn, Nelson, Salas-Wright, DeLisi, & Qian, 2016).

For education, higher attainment is associated with lower rates of substance use in adulthood and later sexual debut (Merline, O'Malley, Schulenberg, Bachman, & Johnson, 2004; Spriggs & Halpern, 2008). High school dropouts have higher rates of binge drinking and marijuana use (Maynard, Salas-Wright, & Vaughn, 2015). In comparison to non-adjudicated populations, probationers and parolees tend to have significantly higher prevalence rates of alcohol, illicit drugs, and marijuana use (Fearn et al., 2016).

Last, few studies of differences in drug and sexual risk among lesbian and gay incarcerated women have been conducted (Otis, Oser, & Staton-Tindall, 2016). One study of rural incarcerated lesbian and gay women found similar rates of opioid, hallucinogen, and stimulant use in comparison to heterosexual women; however, rates of IDU, needle sharing, and evidence of substance use disorders were more prevalent. In studies of the general population, in comparison to lesbians, bisexual women have higher rates of risky drug and sexual behavior (Hequembourg, Livingston, & Parks, 2013; McCabe, Hughes, Bostwick, & Boyd, 2005). Bisexual women also engage in riskier sexual practices than lesbian women (Hequembourg, Livingston, & Parks, 2013).

The literature suggests that sociodemographic factors are strong correlates of substance abuse. However, these factors have not been extensively studied among rural, incarcerated, White women. More research on the relationship between sociodemographic factors and risky behaviors is needed especially for understudied and vulnerable populations.

The Present Study

The purpose of this exploratory study is to examine the extent to which both HIV knowledge and HCV knowledge were related to risky sex behaviors and risky drug behaviors. Second, the role of sociodemographic factors (i.e., age, family income, education, and sexual orientation) on both risk outcomes will be examined. The first hypothesis is that HIV and HCV knowledge independently would be significant predictors of risky sexual and drug behaviors. The second hypothesis is that sociodemographic factors would predict risky sex and drug behaviors. The third hypothesis is that the path between HIV knowledge and risky sexual behavior would be moderated by HCV knowledge and that the same pattern would follow for drug risk. The study broadens the extant literature in an exploratory examination of moderators to delineate the evidence on the relationship between HIV knowledge,

HCV knowledge, sociodemographic factors and risky drug and sexual behaviors among incarcerated, rural, substance abusing, White women to inform prevention and intervention strategies.

Method

Participants

This study is a secondary analysis of a federally funded intervention grant. In the larger trial, participants were randomly selected from three local rural jails and screened for substance use using the NIDA-modified Alcohol, Smoking, and Substance Involved Screening Test (National Institute on Drug Abuse [NIDA] ASSIST, 2009). For the larger study, a total of 900 rural women were randomly selected for screening. Of the 688 who participated in the screening session, 440 were eligible to participate. Forty were released early for a final sample of 400. Thirteen participants had incomplete data on the baseline measures and were excluded from the analysis.

Procedure

The study was approved by the university institutional review board and a federal Certificate of Confidentiality was obtained to further ensure privacy of data for this incarcerated sample. Study recruitment took place at each of the three jails each month using a random selection design, described in the parent study. Participants randomly selected for screening were provided informed consent by trained interviewers who were from the same rural areas. Participants were allowed to ask questions about the study and assured of confidentiality. The NIDA-modified ASSIST screening form took approximately 20 minutes to complete along with five questions to ascertain risky sexual behavior and questions to ascertain interest in the study. Baseline interviews were conducted face-to-face in a private room in each of the jails. Participants were asked to respond to questions about drug use, risky sexual practices, and HIV/HCV knowledge prior to entering the jail using laptops outfitted with Computer Assisted Personal Interview (CAPI) software. No jail staff was present for interviews. Participants were paid $25 for their time and offered HIV/HCV testing with certified counselors.

Measures

Measurement strategy.—To measure the risky drug behavior, risky sex, HIV knowledge, and HCV knowledge constructs, a pool of items were selected from the baseline survey. Using an empirical process and confirmatory factor analysis (CFA), the validity of creating a single score for each construct from the item pool was evaluated. This process is described in detail by Carle and Weech-Maldonado (2012). Output factor scores were generated for each construct and used in the analyses (Bock & Aiken, 1981). Factor scores are a more precise estimate of the underlying construct of interest than a summary score that would include greater amounts of measurement error, and conflate levels of the general factor and any specific factors in the score. Space constraints prevent a detailed description of the modeling process and are available upon request. All factor analyses were conducted using Mplus 7.1 (Muthén & Muthén, 1999-2012).

Dependent variables.

Risky sex behaviors.: Several items from the Risk Behavioral Assessment (Weshberg, 1998) were used to measure risky sex. A sample item asked whether or not participants had had a specific STI ("yes"/"no"). Other sex risk items addressed sexual behaviors (e.g., trading sex for things like money or drugs, how often do you use condoms, etc.). To comprise the final risky sex behavior construct, factor scores were used. Higher scores indicate more risky behaviors.

Risky drug behaviors.: The original survey included modified items from the Addiction Severity Index (ASI), 5th edition (McLellan, Luborsky, O'Brien, & Woody, 1980). Items were selected that addressed current year and lifetime drug abuse. For example, the current use item asked, "In the past year, what drugs did you inject?" Participants then endorsed or denied use from a list of drugs read by the interviewer. Factor scores from the CFA on risky drug behaviors were used in the analysis. Again, higher scores indicate engaging in more risky drug behaviors.

Independent variables.

HIV knowledge.: Items from The Brief 18-item HIV-Knowledge Questionnaire (HIV-KQ-18; Carey & Schroder, 2002) were assessed in a CFA to measure HIV knowledge. A sample question included "A person will not get HIV if taking antibiotics." Participants responded "true" or "false." Items were recoded for consistent directionality, with a higher score indicating greater HIV knowledge (range 0-18). The CFA excluded one item for measurement issues, which resulted in a 17-factor model that was used in the analyses.

Hepatitis C knowledge.: From Carey and colleagues (2005) questionnaire on Hepatitis A, B, and C, CFA was conducted on seven items. Participants responded "yes" or "no" to questions such as "Is there a treatment for hepatitis C?" Items were reverse coded so that high scores indicated high knowledge (range 0-7). All seven items remained after the CFA and were used in the models.

Sociodemographics.: Age (participant's age in years at baseline interview), family income (i.e., "During the 6 months before incarceration, what was your total income from all sources?"), education (i.e., "What is the last grade or year that you completed in school?), and sexual orientation (i.e., "Which of the following best fits how you would describe your sexual orientation") were used. For sexual orientation, those who self-identified as lesbian, gay, bisexual, or questioning (LGBQ) were compared to heterosexuals.

Analytic strategy.—Using Mplus 7.1 (Muthén & Muthén, 1999-2012), frequencies were calculated for categorical variables, whereas means and standard deviations were calculated for the continuous variables. A series of bivariate logistic regressions and Pearson's correlations were used to examine associations between the predictor and outcome constructs (i.e., risky sex and drug behaviors; see Table 1). The independent variables were centered and interaction terms created using multiplication (Aiken & West, 1991).

Two multiple regression models were run. Model 1 measured the sex risk outcome with HIV knowledge, HCV knowledge, sociodemographic factors, and the interaction (see Table 2). Model 2 included the same predictors with drug risk as the outcome (see Table 3). For all multiple regression models, regression diagnostics were conducted using methods described by Cohen, Cohen, West, and Aiken (2003). Diagnostics included examining regression assumptions, multicollinearity, outliers, leverage, and influence using numerical and graphical methods. When these methods identified potentially problematic observations, analyses were conducted with and without these observations and compared results across models. Because the models resulted in a similar size, pattern, and significance of findings, the results of model that included all observations are presented.

Results

Descriptive Analyses

The majority of women identified as White (99%) and ranged in age from 18 to 69 years (M = 32.8). Approximately 30% of the participants had a 12th grade education. The mean annual family income prior to incarceration was $8,467. Two-thirds ($n$ = 309) reported being unemployed/disabled in the six months prior to incarceration. About 20 % (n = 81) self-identified as LGBQ and the majority identified as bisexual (n = 70).

The participants scored high on HIV knowledge (M = 16.02 [range 7-18 prior to CFA]) and HCV knowledge (M = 4.8 [range 3-7 prior to CFA]) and high on risky drug and sexual behaviors (e.g., 59.75% reported lifetime IDU; M = 33 lifetime sex partners). The correlation analyses revealed a significant robust positive correlation between HIV knowledge and HCV knowledge as well as between drug risk and sexual risk. In addition, there was a significant inverse correlation between HIV knowledge and education, income, and drug risk. Likewise, HCV knowledge was negatively correlated with education, income, and drug risk (see Table 1).

Multiple Regressions

Using two separate multiple regression models, factors associated with sex risk and drug risk were examined. In each set, we first predicted the outcome (sex or drug risk) from HIV, then again from HCV, and, last, the interaction of HIV and HCV knowledge. The two models also included the sociodemographic variables. This allowed us to examine the size and significance of the relationship between the outcomes and the primary predictors individually and then whether the size and significance changed when including both in the model.

Sex risk.—The main effects of HIV knowledge and sociodemographic variables on sex risk demonstrated that HIV knowledge was a significant predictor of decreased sexual risk behavior (see Table 2). At the average level of each of the sociodemographics, a standard deviation increase in HIV knowledge predicted a −0.22 standard deviation decrease in sex risk. We also observed statistically significant coefficients for age and sexual orientation. Older women had lower sex risk behavior scores, while bisexual women had greater sex risk behavior scores, at the average level of all other variables in the model.

Predicting sex risk from HCV knowledge and sociodemographic variables and their interactions with HCV knowledge suggested that HCV knowledge significantly and negatively associated with sex risk. At the average level of each of the sociodemographic factors, a standard deviation increase in HCV knowledge predicted a −0.15 standard deviation decrease in sex risk. There was also a statistically significant coefficient for sexual orientation. Bisexual women again had greater sex risk behavior scores, at the average level of all other variables in the model.

In the analysis with HIV knowledge, HCV knowledge, and all first order interaction effects, HIV knowledge, age, and sexual orientation all significantly predicated sex risk. HCV knowledge was no longer statistically significant, and thus, HIV knowledge was a stronger predictor (see Table 2 for sex risk coefficients).

Drug risk.—Model 2 predicted drug risk from HIV knowledge and sociodemographic variables and the interaction between HIV and HCV knowledge demonstrated that HIV knowledge significantly predicted drug risk behaviors (see Table 3). At the average level of each of the sociodemographic variables, a one standard deviation increase in HIV knowledge predicted a −0.23 standard deviation decrease in drug risk. We also observed statistically significant coefficients for age, family income, and sexual orientation. Older women had lower drug risk behavior scores, while bisexual women and women with higher family incomes had greater drug risk behavior scores, at the average level of all other variables in the model.

The analysis predicting drug risk from HCV knowledge and sociodemographic variables and their interactions with HCV knowledge suggested that HCV knowledge significantly predicted drug risk. At the average level of each of the sociodemographics, a standard deviation increase in HCV knowledge predicted a −0.17 standard deviation decrease in drug risk. There were also statistically significant coefficients for age, family income, and sexual orientation. Older women had lower drug risk behavior scores, while LGBQs and women with higher family incomes had greater drug risk behavior scores, at the average level of all other variables in the model.

In the analysis with HIV knowledge, HCV knowledge, and all first order interaction effects, HIV knowledge, age, family income, and LGBQ status all significantly predicated drug risk. HCV knowledge alone was no longer statistically significant. Thus, the interaction of HIV and HCV knowledge was significant.

Discussion

The present study assessed correlates of risky drug and sexual behaviors in a sample of incarcerated, substance abusing, rural White women. The first hypothesis was supported. Independently, both HIV knowledge and HCV knowledge were associated with lower sex and drug risk behaviors. Previous literature was inconsistent regarding the effects of HIV/HCV knowledge on behavior. In a meta-analysis of effective HIV prevention interventions for women, Mize and colleagues (2002) found overall that interventions improved HIV knowledge and self-efficacy. In a more recent study among incarcerated

men and women, Zakaria, Thompson, and Borgatta (2010) found mixed results on the relationship between HIV and HCV knowledge and behavior change. However, at the item level, inmates with specific knowledge of HIV risk due to IDU were more likely to engage in harm reduction practices such as using clean needles than inmates who were unaware of the risks. The results of the present study provide support that health knowledge is associated with lower risky behaviors in rural, incarcerated substance abusing women. Increasing health knowledge within this population may be challenging. Due to lower populations of jailed women in comparison to men, there are fewer educational and intervention programming opportunities (Program Review and Investigations Committee, 2016).

In addition, for the second hypothesis, significant findings were noted for sociodemographic variables. The findings on age were consistent with prior research suggesting that as youth enter adulthood, risky sex and drug behavior increases (CDC, 2008; SAMHSA, 2016; Sayegh, Fortenberry, Shew, & Orr, 2006; Substance Abuse and Mental Health Services Administration [SAMHSA], 2016; Van der Molen et al., 2015). Younger women had significantly higher sex and drug risk behaviors. For girls, early onset of disruptive behaviors and conduct disorders increase the risk for lower educational attainment and substance use disorders (Van der Molen et al., 2015). These findings suggest that early intervention and prevention is crucial.

Higher family income was also associated with drug risk, but not sex risk. While there is little consensus in the literature on the connection between income and drug risk (Galea, Ahern, Tracy, & Vlahov, 2007), unlike the present sample, most studies are able to differentiate between lower and upper class. The limited income distribution in this sample is consistent with previous literature indicating that rural populations are more likely to live in poverty (Eberhardt et al., 2001). No studies were identified that compared the relationship between income and substance abuse in rural samples. The findings suggest that drug risk behaviors may differ by more narrow margins among the rural, impoverished populations.

LGBQ (mostly bisexual in this sample) women in this sample had significantly higher sex and drug risk behaviors. The findings on sexual orientation align with previous research indicating that bisexual women engage in riskier substance abuse and risky sexual behaviors (Hequembourg & Dearing, 2013; Matthews, Cho, Hughes, Wilsnack, Johnson, & Martin, 2013). Differences in sexual orientation and substance abuse among female or rural inmates have rarely been studied. Rural lesbian and gay women may face distinctive challenges. For example, gender norms and strong religious beliefs may contribute to stigmatization and internalized homophobia (McCarthy, 2002).

The third hypothesis was partially supported. The path between HIV knowledge and sex risk was not influenced by HCV knowledge. This indicated that when HIV and HCV knowledge were combined, the effects are roughly the same as HIV knowledge alone. For risky drug behaviors, the path from HIV knowledge was influenced by HCV knowledge. The significant interaction indicates that, while increased HIV or HCV knowledge is associated with decreased risky drug behavior, when an individual is high on both their combined impact is less additive. If an individual is high on just HIV or HCV knowledge alone, there

is decreased risky drug behavior. However, if an individual is high on both, while there is still an overall decrease in risky drug behavior, the additive impact is tempered and less than one would expect based on the main effects alone. One qualitative study of female offenders found that HCV was perceived as very prevalent and benign and despite knowledge of risk behaviors, easily overlooked (Staton-Tindall, Webster, Oser, Havens, & Leukefeld, 2015). Perhaps in rural substance abusing women, HIV knowledge has a stronger leverage on sex and drug risk and should be prioritized in future interventions.

The findings suggest that a gap exists in the application of knowledge for this high-risk population. These findings elucidate the need for interventions to focus on behavior change. Other studies have included perception of risk, which may be useful in future research with this population. Moreover, there may be other social constructs that mitigate the translation of health knowledge into risk reduction.

Strengths and Limitations

The present study has several strengths. It adds to the limited literature on risky behavior among rural, incarcerated women. Furthermore, it makes significant contributions to our understanding of HIV and HCV knowledge and sociodemographic factors that may contribute to risky sex and drug behavior in this understudied and unique population. Despite the increased risk of HCV and HIV among injection drug users and incarcerated people (CDC, 2015b; CDC, 2016c), HCV knowledge is studied far less often. Other significant contributions include adding to the dearth of literature on risky sexual behavior incarcerated lesbian, gay, and bisexual women. Last, the parent study used random sampling for participant selection, which supports the statistical analysis and interpretation.

As with any study, there are limitations to be noted. Both high knowledge and high risk were noted in this sample, which may have limited the variability of the measures. The factor analyses may have provided stronger evidence of measurement accuracy for the HIV and HCV knowledge scales, but the scales are traditionally measured using summative scores. While the sample was randomly selected, the uniqueness of Appalachian culture may limit the generalizability of the results to other incarcerated women or other rural regions. The data used in this analysis was also cross-sectional, which limits the ability to discuss causality. As with any self-report data, the influence of social desirability should be considered when interpreting the findings though data was collected in private, non-recording rooms and confidentiality assured. Future studies may want to consider the locale of interviews and corroborate self-reports with other information such as treatment records and/or drug screens.

Implications for Practice

Health educators and clinicians (e.g., general practitioners, nurses, etc.) need to be cognizant of the changing trends in drug user profiles. In evaluation and screening, the findings suggest that it is essential to assess for confounding sociodemographic characteristics and level of health knowledge. The results of these evaluations can better inform intervention strategies. In prevention efforts, health educators may need to inform at-risk women about the additive sociodemographic risk factors and focus on increasing HIV knowledge. Additional

interventions may be necessary such as referrals and resources to address socioeconomic and educational needs. Armed with current information, these women may make more responsible choices about their drug and sexual behaviors. Last, in the public health arena, clinicians should continue to fight for parity for substance abuse services to increase the availability and broader integration of treatment. Implementing these strategies can help reduce the spread of HIV and HCV among rural, White women upon reentry into the community.

Conclusions

The results of the present study elucidate that HIV knowledge interventions should play a main role in future interventions for rural incarcerated women. While there were mixed findings on age, family income, and sexual orientation, these factors should also be considered when designing future interventions. Owczarzak et al. (2016) suggest that incorporating knowledge of local epidemiological trends and demographics may further strengthen interventions. Moreover, knowledge may be better applied if interventions are coupled with critical thinking skills, education on how science works, and the influence of small sample bias (i.e., perceived risk based on personal experiences; Cutler & Lleras-Mooney, 2006). LGBQ women may be particularly overlooked in sex health interventions. The results of this study suggest that specialized interventions for substance abusing LGBQ women are warranted. The predicative limitations of cross-sectional data suggest that longitudinal assessments of knowledge, sociodemographics, and risky behavior should be conducted. Given that the findings reveal an inconsistency between knowledge and engagement in risk behaviors, alternative intervention strategies such as pleasure-based education should be considered in mitigating risky behavior. Further research is needed to understand predictors of risky sex and drug behaviors in rural incarcerated women and to test the effectiveness of these proposed targeted interventions. These women are an inimitable risk group that warrants additional attention in research and intervention efforts to diminish the risk of HIV and HCV.

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Table 1.

Correlation Matrix with Descriptives.

Variable	1	2	3	4	5	6	7
1. HIV Knowledge	-						
2. HCV Knowledge	0.68**	-					
3. Education	−0.15**	−0.13*	-				
4. Age	0.00	0.04	−0.12*	-			
5. Income	−0.04**	−0.07**	0.08	0.06**	-		
6. Drug Risk	−0.27**	−0.21**	0.01	0.19**	0.12	-	
7. Sex Risk	−0.24	−0.17	−0.03	−0.14	0.07	0.76**	-
Mean(***S.D.)	0.12(0.70)	0.11(0.51)	11.10(2.28)	32.81(8.24)	8467.15(18558.90)	0.04(0.80)	0.04(0.68)
Minimum	−0.88	−0.41	0.00	18.00	0.00	−1.59	−1.18
Maximum	2.54	2.69	19.00	61.00	210000.00	2.34	1.94

Note. *p < .05; **p < .01***S.D. is standard deviation. HIV and HCV knowledge, drug risk, and sex risk values are based on factor scores used in the logistic regression.

Table 2.

Model 1 Regression on Sex Risk.

Main effects	**β (SE)**
HIV knowledge	−0.22 ** (0.05)
Age	−0.011 * (0.05)
Family income	0.08 (0.05)
Education	−0.08 (0.05)
LGBQ	0.16 ** (0.05)
Intercept	-
Main effects	**β (SE)**
HCV knowledge	−0.15 ** (0.05)
Age	−0.09 (.05)
Family income	0.08 (0.05)
Education	−0.07 (0.05)
LGBQ	0.18 ** (0.05)
Intercept	-
Interaction	**β (SE)**
HIV knowledge	−0.23 ** (0.07)
HCV knowledge	−0.05 (0.08)
Age	−0.11 * (0.05)
Family income	0.09 (0.05)
Education	−0.09 (0.05)
LGBQ	0.16 ** (0.05)
HIV x HCV interaction	0.09 (0.06)
Interaction	-

Note. SE = standard error; HIV = human immunodeficiency virus; HCV = hepatitis C virus; LGBQ = lesbian, gay, bisexual, or questioning.

* $p < .05$

** $p < .01$.

Table 3.

Model 2 Regression on Drug Risk.

Main effects	**β (SE)**
HIV knowledge	−0.24 ** (0.05)
Age	−0.15 ** (0.49)
Family income	0.12 ** (0.048)
Education	−0.05 (0.05)
LGBQ	0.18 ** (0.05)
Intercept	-
Main effects	**β (SE)**
HCV knowledge	−0.17 ** (0.04)
Age	−0.13 ** (0.05)
Family income	0.11 * (0.04)
Education	−0.03 (0.05)
LGBQ	0.19 ** (0.04)
Intercept	-
Interaction	**β (SE)**
HIV knowledge	−0.27 ** (0.07)
HCV knowledge	−0.11 (0.07)
Age	−0.15 ** (0.05)
Family income	0.12 * (0.05)
Education	−0.05 (0.05)
LGBQ	0.17 ** (0.05)
HIV x HCV interaction	0.19 * (0.06)
Intercept	-

Note. SE = standard error; HIV = human immunodeficiency virus; HCV = hepatitis C virus; LGBQ = lesbian, gay, bisexual, or questioning.

* p < .05

** p < .01.