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IMPACT OF PTSD ON HCV/HIV RISK-REDUCTION INTERVENTIONS AMONG INCARCERATED DRUG-USING WOMEN IN RURAL APPALACHIA

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IMPACT OF PTSD ON HCV/HIV RISK-REDUCTION INTERVENTIONS AMONG INCARCERATED DRUG-USING WOMEN IN RURAL APPALACHIA

DISSERTATION

A dissertation submitted in partial fulfillment of the
requirements for the degree of Doctor of Philosophy in the
College of Arts and Sciences
at the University of Kentucky

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ABSTRACT OF DISSERTATION

IMPACT OF PTSD ON HCV/HIV RISK-REDUCTION INTERVENTIONS AMONG INCARCERATED DRUG-USING WOMEN IN RURAL APPALACHIA

Justice-involved women in rural Appalachian Kentucky are a particularly vulnerable group in need of targeted risk-reduction interventions for hepatitis C virus (HCV) and human immunodeficiency virus (HIV). Compared to women in the general U.S. population, justice-involved women in rural Appalachia report dramatically higher rates of HCV/HIV risk behaviors (e.g., injection drug use and risky sex), interpersonal violence (IV; e.g., physical, sexual, or emotional abuse), and posttraumatic stress disorder (PTSD). IV and PTSD may exacerbate rural Appalachian women's risk for contracting and transmitting HIV/HCV, indicating a need to approach HCV/HIV risk-reduction interventions from a trauma-informed perspective.

Brief motivational interviewing and psychoeducation interventions have both demonstrated efficacy in decreasing HCV/HIV risk behaviors among incarcerated women, including those with IV histories. Yet, few studies have considered the impact of PTSD on the effectiveness of these interventions. Therefore, this study aimed to examine the impact of PTSD on the effectiveness of HCV/HIV risk-reduction interventions administered to incarcerated rural Appalachian women with IV histories.

Participants included a sample of 320 IV-exposed women who were enrolled in the Women's Intervention to Stop HIV and HCV study. Women were randomized to receive an enhanced motivational interviewing-based HCV/HIV intervention or a standard HCV/HIV psychoeducational intervention while they were incarcerated. Women were then followed at 3, 6, and 12 months after being released into the community.

Our findings indicate women's change in HCV/HIV risk behavior after being released from jail did not differ based on whether they received a brief psychoeducation alone or enhance with motivational interviewing while incarcerated. Moreover, PTSD symptoms were not associated with women's change in injection drug or sexual risk behavior after community re-entry. PTSD symptoms trended toward decreasing more during re-entry for women who received a motivational-interviewing enhanced intervention compared to women who received psychoeducation alone, although this

should be interpreted with caution. An unexpected finding was that anxiety and depressive symptoms prior to and during incarceration were associated with different trajectories of change in sexual, but not injection drug, risk behavior post-release.

Results from this study address the call for evidence-based HCV/HIV interventions to be evaluated through a trauma-informed perspective and can inform targeted prevention and intervention efforts aimed at reducing HCV/HIV risk behaviors among rural Appalachian women.

KEYWORDS: hepatitis c virus, human immunodeficiency virus, posttraumatic stress disorder, interpersonal violence, rural Appalachia, incarceration

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CHAPTER 1. INTRODUCTION

1.1 Background

Reducing the spread of hepatitis C virus (HCV) and human immunodeficiency virus (HIV) in rural Appalachian Kentucky (KY) is an urgent public health priority. Out of every 100,000 Kentuckians, currently 1,250 live with HCV and 196 live with HIV (AIDSVu, n.d.; HepVu, n.d.). Despite national and state-level public health initiatives aimed at reducing the contraction and transmission of HCV and HIV in KY, new HCV diagnoses increased by 160% in the past decade while diagnoses of HIV stagnated (Northern Kentucky Health Department, 2017; Kentucky Department for Public Health, 2019). From 2008-2015, KY had the highest rate of new HCV infections in the nation (Kentucky Department for Public Health, 2017). Fifty-four counties in KY's Appalachian region are either at risk for or are currently experiencing an HCV or HIV outbreak, which accounts for 24.5% of all at-risk counties nationwide despite representing only 1.7% of total counties in the U.S. (Van Handel et al., 2016). The high rates of injection opioid and other drug use in rural Appalachian KY increases these communities' vulnerability to the rapid spread of HCV and HIV (Moody et al., 2017; Zibbell et al., 2015).

Justice-involved women in rural Appalachian KY are a unique and particularly vulnerable group in need of targeted interventions aimed at reducing the spread of HCV and HIV. Both injection drug use and sexual activity are established risk factors for HIV (Moody et al., 2017; Perlman et al., 2015; Zibbell et al., 2015). Among KY women newly diagnosed with HIV, one-third report injection drug use and two-thirds report heterosexual contact as the route of transmission (AIDSVu, n.d.). Injection drug use is also a risk factor for HCV, yet the role of sexual activity in the spread of HCV is less clear. Although the

risk of HCV transmission between members of monogamous heterosexual couples is low, HCV risk increases for women who engage in sexual risk behaviors (e.g., sex with multiple partners, sex under the influence of alcohol and/or drugs, sex in exchange for drugs and/or money, sex with high-risk partners) and for women who are co-infected with HIV or other sexually transmitted infections (Tohme & Holmberg, 2010). Compared to women in the general U.S. population, rural Appalachian women involved with the criminal justice system report dramatically higher rates of recent injection drug use (2% vs. 60%) and sexual risk behaviors (4% vs. 80%; Lansky et al., 2014; Staton et al., 2017, 2018a, 2018b, 2018c; Women's Health USA, 2012), which exemplifies their need for targeted HCV/HIV risk-reduction interventions.

Periods of incarceration represent an underutilized intervention opportunity for rural Appalachian women—a group that represented the fastest-growing offender segment in the KY criminal justice system (Vera Institute of Justice [VIJ], 2019). Since 1980, the percent of women incarcerated in KY jails and prisons increased by 1,694% and 2,317%, respectively (VIJ, 2019). On a national scale, KY ranks second in the number of currently incarcerated women (The Sentencing Project, 2019). Although KY women are more likely to serve out their sentences in county jails rather than state prisons, county jails often provide less access to services, including healthcare and substance use treatment programs (Kentucky Legislative Research Commission, 2017). Correctional facilities in rural Appalachia house an unprecedented number of women at high risk for deleterious health outcomes, including HCV and HIV. Given that Appalachian women face multiple barriers to preventative care, including living in a remote geographical location, having limited access to health services, and lacking insurance coverage (Moody et al., 2017; Staton et al.,

2001; Staton-Tindall et al., 2007; Stephens et al., 2017), periods of incarceration represent an essential intervention opportunity.

Brief interventions administered to incarcerated women reduce HCV and HIV risk behaviors (Staton et al., 2017, 2018b). Two evidence-based approaches that have demonstrated efficacy in reducing HCV/HIV risk behaviors include *NIDA Standard HIV Education* (HIV-Ed) and *Motivational Interviewing-based HIV Risk-reduction* (HIV+MI). The HIV-Ed was developed through large, multisite cooperative agreement trials and aims to provide education on safe practices for injection drug use (e.g., identifying unsafe drug use, discussing needle and drug equipment cleaning strategies) and sexual activity (e.g., identifying unsafe sex, encouraging condom use and communication with partners; Coyle, 1998). The HIV+MI intervention is grounded in the Transtheoretical Model of Health Behavior Change, which conceptualizes the process of behavior change as taking place in stages over time (e.g., precontemplation, contemplation, preparation, action, maintenance, termination; Prochaska et al., 2008; Prochaska & Velicer, 1997). Motivational interviewing is a validated therapeutic technique that facilitates the transition through the stages of change by incorporating patient-centered counseling techniques (e.g., reflective listening) and identifying discrepancies between life goals and current behavior (Miller & Rollnick, 2002). Thus, the goal of HIV+MI is to reduce ambivalence and strengthen motivation toward behavior change and thereby reduce HCV/HIV risk behaviors. Comparative effectiveness studies show that both HIV+MI and HIV-Ed demonstrate considerable and comparable reductions in HCV/HIV risk behavior among women from rural Appalachia and women in urban settings (Staton et al., 2018b; Weir et al., 2009).

Research conducted in justice-involved rural Appalachian women highlights the need to adopt a trauma-informed perspective (Facer-Irwin et al., 2019; Levenson & Willis, 2019), which recognizes the widespread impact of trauma and its effect on potential paths for recovery (Substance Abuse and Mental Health Services Administration [SAMHSA], 2014). The lifetime prevalence of interpersonal violence (IV)—or physical, sexual, and emotional abuse (Rosenberg et al., 2006)—and posttraumatic stress disorder (PTSD; American Psychiatric Association [APA], 2013) are substantially elevated among incarcerated women in this region relative to women in the general U.S. population (IV: 80% vs. 46%; PTSD: 67% vs. 10%; Iverson et al., 2013; Mitchell et al., 2012; Staton et al., 2018b). Indeed, IV is associated with poorer perceived ability to negotiate safe sex and injection practices with partners (Mittal et al., 2013; Teitelman et al., 2008; Wagner et al., 2009), and PTSD symptoms mediate the association between IV and HCV/HIV risk behaviors (Cavanaugh et al., 2010; Plotzker et al., 2007). Additionally, individuals with PTSD demonstrate poorer outcomes in substance use treatment (Kubiak, 2004; Read et al., 2004), worse adherence to HIV antiretroviral therapy (Delahanty et al., 2004), and a need for enhanced monitoring while undergoing interferon-based therapies for HCV (Loftis et al., 2006). From a trauma-informed perspective, PTSD symptoms may exacerbate risk for HCV/HIV contraction and transmission in justice-involved rural Appalachian women. However, it is unknown to what extent brief HCV/HIV risk-reduction interventions are effective for justice-involved women with PTSD.

Symptoms of PTSD affect a large proportion of justice-involved rural women and may interfere with current efforts to reduce HCV/HIV risk behaviors. One of the defining characteristics of PTSD is avoidance of trauma reminders (APA, 2013). Individuals with

PTSD may use substances and engage in risky sexual behavior to cope with or avoid their PTSD symptoms (McCauley et al., 2012; Weiss et al., 2013). Thus, rural Appalachian women with PTSD symptoms may not benefit from brief HCV/HIV risk-reduction interventions to the same extent as women without PTSD, as these risk behaviors may be inextricably linked with their ability to cope with trauma-related distress. Yet, preliminary findings suggest that motivational interviewing attenuates risk for developing PTSD following trauma exposure (Zatzick et al., 2004), enhances PTSD treatment outcomes (Randall & McNeil, 2017), and may reduce PTSD symptoms (Battaglia et al., 2016). Since motivational interviewing is founded upon facilitating behavior change, HCV/HIV risk-reduction interventions that include a motivational interviewing component may offer more promise than standard psychoeducational interventions for IV-exposed incarcerated women with PTSD.

1.2 Study Aims

This study addresses a critical gap in efforts to reduce injection drug use and risky sexual behavior among incarcerated women from rural Appalachia—a uniquely vulnerable and disadvantaged population at high risk for deleterious health outcomes—by examining HCV/HIV risk-reduction interventions through a trauma-informed perspective (Facer-Irwin et al., 2019; Levenson & Willis, 2019; SAMHSA, 2014). More specifically, the present study addresses a significant gap in knowledge by (1) examining the effect of PTSD symptoms on evidence-based interventions that target HCV/HIV risk behavior administered to incarcerated women with IV histories and (2) evaluating the relationship between PTSD symptoms and HCV/HIV risk behavior during the community re-entry

period. The aims of the project were executed by examining secondary longitudinal data from the Women's Intervention to Stop HCV/HIV study (WISH; NCT01840722; R01DA033866). The sample included 320 women with lifetime IV randomized to receive the NIDA Standard HIV Education alone (HIV-Ed) or the NIDA Standard HIV Education plus the Motivational Interviewing-based HIV Risk-reduction intervention (HIV+MI) while incarcerated. Participants were then followed at 3-, 6-, and 12-months following release from jail.

The first aim was to examine to what extent PTSD symptoms prior to incarceration predicted HCV/HIV risk behavior following community re-entry. We expected that higher PTSD symptoms prior to incarceration would predict higher rates of injection drug and sexual risk behavior post-release (*Hypothesis 1a)*. We also hypothesized that women with higher PTSD symptoms prior to incarceration who received the enhanced HIV+MI intervention would report lower rates of injection drug use and risky sexual behavior post-release relative to women with similar levels of PTSD in the HIV-Ed condition (*Hypothesis 1b)*.

The second aim of the study was to evaluate the extent to which reductions in PTSD symptoms following community re-entry predicted reductions in HCV/HIV risk behavior. We expected that women who received the HIV+MI intervention would demonstrate greater reductions in PTSD symptoms post-release relative to women in the HIV-Ed condition (*Hypothesis 2a)*. We also hypothesized that PTSD symptom reduction would prospectively predict lower rates of injection drug use and risky sexual behavior (*Hypothesis 2b)*. Findings from this study will inform targeted prevention and intervention

efforts aimed at reducing HCV/HIV risk behaviors among justice-involved rural Appalachian women with IV histories.

CHAPTER 2. METHODS

2.1 Participants

Participants included a subsample of women who were enrolled in the WISH study who reported a lifetime history of IV during the baseline interview. Women enrolled in the parent project were incarcerated in three rural Appalachian jails. Briefly, women were eligible for the study if they endorsed moderate need for a substance use intervention and reported at least one sexual risk behavior in the three months before incarceration (full eligibility criteria are described below). Women in the subsample were, on average, 33.0 years of age (SD = 8.1), and almost all women reported their race as white (99.1%). Most women earned their high school diploma or GED (58.1%). One-third of women were married (31.3%) and most women (87.5%) had children. Demographic characteristics for the full sample are summarized elsewhere (Staton et al., 2018b).

2.2 Measures

Interviews were administered by trained personnel during incarceration (baseline) and at 3-, 6-, and 12-months following re-entry into the community (follow-up). However, it should be noted that not all measures were administered at every time point (see Table 2).

A modified version of the Risk Behavioral Assessment (RBA; Wechsberg, 1998) was used to measure injection and sexual risk behaviors. The RBA is a brief interview that determines risk levels for contracting HIV and other infectious diseases by assessing a participant's engagement in injection drug and sexual risk behaviors. Items on the modified

RBA were anchored to assess injection drug risk behavior in the year before incarceration (assessed at baseline) or since the last follow-up assessment. The modified RBA included the following items for injection drug risk behavior: (1) injected drugs; (2) used shared needle; (3) used shared works; (4) shared needles; (5) shared works; (6) shared injection equipment with sex partner; (7) did not always inject first. Items on the modified RBA measuring sexual risk behaviors include the following acts with the participant's last *main* or *casual* partner: (1) did not use condom the entire time during last vaginal sex; (2) did not use condom the entire time during last anal sex; (3) used alcohol/drugs before or during last sex; (4) last partner has history of injecting drugs; (5) traded sex for drugs, money, etc. with last *casual* partner. In prior studies on individuals who use substances, the RBA demonstrated acceptable reliability and validity (Wechsberg et al., 2004).

The Global Appraisal of Individual Needs (GAIN; Dennis et al., 2008) was used to assess PTSD and other comorbid psychiatric symptoms (i.e., anxiety and depression), as well as experiences of IV. The GAIN is a comprehensive interview that was originally developed for use by substance use treatment providers to make efficient mental health and substance use diagnoses and inform treatment placement and planning. Women were asked to what extent they experienced symptoms of PTSD, anxiety, and depression in the past 12 months at baseline or since the last assessment at the 6- and 12-month follow-up. The 12-item GAIN Traumatic Stress Scale (TSS) was used to assess PTSD symptoms. Scores on the TSS produce a total symptom count (0-12) with higher scores reflecting greater PTSD symptom severity. The total score can be dichotomized to reflect a possible diagnosis of PTSD (i.e., scores of $\geq$5 reflect "high traumatic stress" or possible PTSD). Given the notable comorbidity between PTSD, mood, and anxiety disorders (Price et al., 2019), the

12-item GAIN Anxiety and Fear Symptom Scale (AFSS) and the 9-item Depressive Symptoms Scale (DSS) were used to assess psychiatric conditions that are commonly comorbid with PTSD. The AFS and DSS produce symptom counts that range from 0-12 and 0-9, respectively. The AFS and DSS scale scores were considered for inclusions as time-invariant covariates in the primary models for Hypothesis 1a and 1b, and time-varying covariates in models for Hypothesis 2a and 2b. Four dichotomous items (Yes/No) were used to assess women's experiences of lifetime sexual, physical, or emotional abuse at baseline, and if they experienced these types of victimization since the last assessment at the 6- and 12-month follow-up. IV during the re-entry period was also considered for inclusion as a time-varying covariate in the models for Hypothesis 2a and 2b. Although the GAIN is not a formal diagnostic tool, it is a reliable and valid interview that measures IV experiences and produces provisional diagnoses of various psychiatric disorders (Dennis et al., 2008).

At baseline, participants were also asked whether this was their first period of incarceration. Women reported subsequent incarcerations at the follow-up assessments; this variable was tested as a time-varying covariate in the primary models for Hypothesis 1a, 1b, and 2b.

2.3 Procedure

All study procedures were approved by the University of Kentucky's Institutional Review Board and participants were protected under a federal Certificate of Confidentiality. Figure 1 displays an overview of study procedures and timeline relevant to the current project. Informed consent was obtained from all participants in the study.

2.3.1 *Research Location and Random Selection*

This study used an established approach for data collection with incarcerated populations recommended by the National Institute of Justice (NIJ; 2003). Of the 27 jails located in rural Appalachian KY, participating jails were selected based on geographic location, having a daily census count above 50, and having no substance use treatment programs for inmates. Based on these criteria, three jails were selected for study inclusion: Perry County, Leslie County, and Laurel County. In total, there were approximately 65 women incarcerated in these jails on a given day. From 2012-2015, recruitment in each of the three jails occurred once per month based on a randomization schedule that included all days of the week and all times of the day, consistent with recommendations from NIJ (2003). On each recruitment day, the targeted number of women inmates were randomly selected from the jail's daily census record.

2.3.2 *Preliminary Screening*

Screening and informed consent occurred in a private, confidential room in the jail and lasted approximately 20 minutes. During the informed consent procedure, women were reminded of the voluntary nature of the study. Screening measures evaluated need for substance use intervention and sexual risk behaviors in the past three months. Women were deemed eligible for study participation if they (1) endorsed at least moderate need for substance use intervention as indicated by a score of $\geq$4 for any substance measured by a modified version of the Alcohol, Smoking, and Substance Involvement Screening Test (NM-ASSIST; National Institute on Drug Abuse, 2009); (2) reported $\geq$1 self-reported sexual risk behavior (e.g., multiple sex partners, unprotected sex, sex under the influence

of alcohol or drugs) in the three months prior to incarceration as measured by three items from the RBA (Wechsberg, 1998); (3) demonstrated no evidence of cognitive impairment, active psychosis, or symptoms of physical substance withdrawal as measured by the GAIN (Dennis et al., 2008); (4) were incarcerated for at least one week following screening to complete the intervention; (5) lived in a rural Appalachian county prior to incarceration; and (6) reported a willingness to participate.

The initial recruitment phase for the WISH project occurred between 2012-2015. During this time, 900 incarcerated women were randomly selected for study screening, 688 (76.4%) completed screening, 440 (48.9%) were eligible at screening, and 400 (44.4%) completed a baseline interview. Women enrolled in the WISH study were representative of the rural Appalachian region in KY in terms of race/ethnicity. Given the association between IV experiences and PTSD symptoms (Kilpatrick et al., 2017), a subsample of women with IV histories (n = 320) will be used to examine the impact of PTSD symptoms on HCV/HIV risk behavior. Demographic information and clinical characteristics of the subsample are presented in Table 1.

2.3.3 *Baseline Interview*

On the same day as the initial screening, those who met eligibility criteria completed a confidential, face-to-face interview. Trained research personnel administered the baseline interview, which lasted approximately two hours. Jail staff were allowed to monitor entry and exit of the private visiting room but were not permitted to be present in the room for the confidential interview. Prior to the interview, women were reminded of

the components of informed consent and were compensated $25 for completing the interview.

2.3.4 *Intervention*

The aim of the parent project was to compare the effectiveness of two interventions aimed at reducing HCV/HIV risk behaviors among rural Appalachian justice-involved women (Staton et al., 2018b). Following the baseline interview, women had a 50/50 chance of being randomly assigned to one of two intervention conditions using Research Randomizer (www.randomizer.org). The *NIDA Standard HIV Education (HIV-Ed)* is a brief, single-session intervention that focuses on HIV education related to injection drug use (e.g., needle sharing, cleaning/bleaching injection equipment, disposal of hazardous waste material, stopping unsafe drug use, and benefits of drug treatment) and sexual practices (e.g., condom use, communication with sex partners, and stopping unsafe sexual practices) consistent with CDC guidelines. Women were also taught correct condom use and were given a list of local health and behavioral health services. The HIV-Ed occurred prior to HCV/HIV rapid testing and counseling. All study staff were certified HIV counselors by the Kentucky Department of Public Health.

Women randomized to receive the NIDA Standard HIV Education plus the *Motivational Interviewing-based HIV Risk-reduction* (HIV+MI) were provided the same single-session HIV Education during the baseline visit prior to HCV/HIV testing and counseling. Participants were then invited to participate in four brief motivational interviewing intervention sessions aimed at targeting motivation to change their injection drug use and risky sexual behavior. Motivational interviews were conducted prior to

release from jail. Consistent with prior research (Weir et al., 2009), the four motivational interviewing sessions focused on (1) enhancing women's ability to identify risky drug use and sexual behaviors, (2) assessing women's perceptions of risk and readiness to address risky drug use and sexual behavior, and (3) facilitating a stage-based discussion about drug use and sexual behavior change. The MI interventionist completed a 2-day training at the outset of the study and participated in on-going supervision throughout the study for quality control. Of the 166 women randomized to this condition, 111 (69.4%) completed all 4 sessions, 9 (5.6%) completed 3 sessions, 22 (13.8%) completed 1-2 sessions, 18 (11.3%) did not complete any MI sessions. More than half (59%) of women screened positive for HCV antibodies and no women screened positive for HIV.

2.3.5 *Follow-up Data Collection*

Face-to-face follow-up interviews were conducted at 3-, 6-, and 12-months post-release from jail at a location that was mutually agreed upon by the research staff and each study participant. Retention rates for the follow-up interviews ranged from 88-97%.

2.4 Data Analytic Plan

Chi-square tests and independent samples *t*-tests were used to compare whether women's engagement in HCV/HIV risk behaviors prior to incarceration and levels of PTSD, anxiety, and depression in the year before baseline differed by intervention condition.

Latent growth curve models (LGCMs) were used to examine to what extent PTSD symptoms prior to incarceration (i.e., baseline) predicted HCV/HIV risk behavior following community re-entry (***Hypotheses 1a-1b***) and to evaluate the extent to which

reductions in PTSD symptoms following community re-entry predicted reductions in HCV/HIV risk behavior (*Hypotheses 2a-2b*). This analytic approach is conceptualized in a structural equation analytic framework where initial states and change over time are depicted in the form of latent growth factors (e.g., intercept and slope; Duncan & Duncan, 2009). The growth factors are latent in that they are not directly observed but are hypothesized to cause the observed outcomes over time. LCGMs are appropriate for longitudinal designs with repeated correlated observations and are robust to missing data, differing numbers of observations across participants, and unequally spaced time intervals (Curran et al., 2010). More specifically, LGCM can account for missing data using full information maximum likelihood (FIML) estimation. FIML estimates a likelihood function for each individual based on the variables that are present so that all available data are used.

All LGCMs were conducted using Mplus Version 7.4 (Muthén & Muthén, 2015). Models were tested using a stepped approach. First, unconditional models—or models without predictors beyond the latent intercept and slope factors—were estimated to examine the best form of change in the outcome variable (HCV/HIV risk behavior, PTSD) from incarceration to community release. In other words, if participants changed on a given outcome during re-entry, the LGCM attempts to represent the best form or rate of change over time. Second, conditional models were tested with time-invariant and time-varying covariates that, based on prior research and theoretical rationale, were relevant to evaluating the primary hypotheses. TICs directly predict the latent growth factors, whereas TVCs directly predict the repeated measure of risk behavior while controlling for the influence of the latent growth factors (Curran et al., 2010). The deviance statistic (-2LL) was used to test the fit of nested models when adding time-invariant and time-varying

covariates (Schreiber et al., 2006). A significant *p*-value of the Chi-square deviance test indicates that the model with smaller deviance value fits better than the model with the larger deviance value, whereas a non-significant *p*-value indicates that the model with the larger deviance value fits better (Lee et al., 2018). The conditional LGCMs allow for estimation of between-person characteristics (interindividual differences) that predict individual variability (intraindividual variance) in the initial states and rate of change over time. Accounting for intraindividual variance in longitudinal designs decreases the probability of Type I errors (Gibbons et al., 2010). To aid in conceptualization of the LGCMs, Figure 2.2 depicts the associations among the latent growth factors of HCV/HIV risk behaviors, time invariant covariates, and time varying covariates.

2.4.1 *Hypothesis 1a and 1b*

After summing responses to the individual items on the RBA that measure injection drug and sexual risk behavior, a latent variable transformation was then used to transform the observed ordinal indicators from the summed scores into continuous latent variables (Lee et al., 2018). This transformation assumes that the observed ordinal indicators (summed scores) are discretized forms of a continuous underlying latent variable. Using a probit link function, the discretized continuum is defined by thresholds (i.e., cut points) that represent the distance between ordinal categories. Thresholds are calculated as the z-scores associated with the proportion of the standard normal that is equal to the proportion of the sample endorsing a particular level on the ordinal scale. Thresholds are fixed to be equal across time points to meet the longitudinal threshold assumption and ensure measurement of the same construct over time (Masyn et al., 2013). In the LGCM with repeated ordinal observed variables, the initial level growth factor mean (intercept) reflects

the expected proportion of participants who engaged in the HCV/HIV risk behavior (i.e., their summed scores were greater than 0). The latent slope represents change in the propensity to engage in the risk behavior over time.

Using a stepped approach, unconditional models were first estimated to examine change in injection drug and sexual risk behavior in the year prior to incarceration (baseline) to community release (months 3, 6, and 12). The conditional LGCMs were then tested with time-invariant and time-varying covariates. Baseline PTSD symptoms were entered as a time-invariant covariate in order to evaluate to what extent higher symptoms were associated with a greater propensity for injection drug and sexual risk behavior post-release (*Hypothesis 1a).* An interaction term between baseline PTSD symptoms and intervention condition was also entered as a time-invariant covariate to examine if women with higher PTSD symptoms prior to incarceration who received the enhanced HIV+MI intervention would report lower rates of injection drug use and risky sexual behavior post-release relative to those women with higher PTSD symptoms in the HIV-Ed condition (*Hypothesis 1b)*. Anxiety and depressive symptoms assessed at baseline were included as time-invariant covariates to evaluate whether PTSD symptoms at baseline predicted post-release HCV/HIV risk behavior above-and-beyond other commonly comorbid psychiatric symptoms. HCV seropositive status was also tested as a time-invariant covariate to evaluate the effect of the interventions above-and-beyond women's HCV status at baseline. Time-varying covariates included incarceration (months 3, 6, 12) and IV (months 6 and 12) since both recidivism and re-victimization may impact the extent to which participants engage in post-release HCV/HIV risk behavior.

2.4.2 *Hypothesis 2a and 2b*

The first step in the analyses for ***Hypothesis 2a***—testing whether women who received the HIV+MI intervention would demonstrate greater reductions in PTSD symptoms post-release relative to women in the HIV-Ed condition—was to specify a measurement model and examine factorial invariance of PTSD symptoms over time. Briefly, testing measurement invariance is important so that changes in mean levels of the construct reflect actual changes in the construct, rather than in how the construct was measured (Little, 2013). The 12 items from the GAIN TSS were used as measured indicators of PTSD symptoms assessed at baseline, month 6, and month 12. The benefit of conducting a measurement model (rather than using a sum) is that this method accounts for measurement error and correlated residuals between measured indicators (Little, 2013). A mean- and variance-adjusted weighted least squares (WLSMV) estimation was used in the measurement model and the comparative fit index (CFI), Tucker-Lewis index (TLI), and root mean square error of approximation (RMSEA) were used to evaluate model fit. CFI and TLI Values of $\geq$ .95 and RMSEA values of < .06 to .08 indicate acceptable model fit (Schreiber et al., 2006). Due to convergence issues, FIML (described above) was used when estimating conditional PTSD models during the re-entry period.

The second step involved adding latent growth factors to the measurement model. The intercept mean and variance were fixed to 0. Since PTSD was only assessed at three time points (baseline, month 6, and month 12), a latent linear slope was used to estimate change in PTSD over time. After adding the latent growth factors, the third step was to conduct conditional models that included time-invariant and time-varying covariates. Intervention condition was included as a time-invariant covariate. Depression and anxiety

assessed at baseline, month 6, and month 12, as well as IV and incarceration assessed at months 6 and 12 were included as time-varying covariates to examine the effect of intervention condition above and beyond other factors that may impact PTSD symptoms during the re-entry period.

To examine whether changes in PTSD prospectively predict HCV/HIV risk behaviors during the re-entry period (*Hypothesis 2b*), we calculated a difference score by subtracting the latent factor of PTSD at baseline from the latent factor of PTSD at month 6 (negative scores indicate a decrease in symptoms between these time points). This difference score was then used to predict injection drug and sexual risk behavior at month 12, while controlling for the latent factor score of PTSD symptoms at the same time point and including relevant time-invariant and time-varying covariates, as specified below. The structure of these models is similar to what has already been described for Hypothesis 1a and 1b, with the exception that the intercept was set to 0 at month 12, rather than at baseline.

2.5 Sample Size Justification

Since the current study is a secondary data analysis with a fixed sample size, a sensitivity analysis was performed to determine the smallest effect size that could be detected, referred to as the minimum detectable effect size (MDES). The power calculation was computed for the most stringent analytical model—the two-way interaction between intervention condition and PTSD presented in Aim 1. To calculate the MDES for the main effect of PTSD and the interaction between PTSD and intervention condition (HIV-Ed/HIV+MI) on the slope of change over time, as specified in the first aim, a Monte Carlo simulation with 100,000 replications was performed. For *Hypothesis 1a*, a sample size of

320 women in which 70% had probable PTSD, 80% of the time a difference in slopes of $B = 0.15$ was detected at $\alpha = .05$. This difference in slopes corresponds to a small-medium effect (Cohen, 1969). For ***Hypothesis 1b***, where the interest is in the interaction between PTSD and intervention condition, 80% of the time a difference in slopes of $B = .35$ was detected at $\alpha = .05$. This difference corresponds to a medium-large effect (Cohen, 1969).

Table 2.1. Study Variables by Assessment Period

Measures	Baseline (Jail)	Month 3	Month 6	Month 12
Demographics				
Age, race/ethnicity, education, marital status, parental status	x			
Risk Behavioral Assessment - Women (RBA)				
Injection drug risk behavior (in year before incarceration or since last assessment)	x	x	x	x
Sexual risk behavior with last main and/or casual partner	x	x	x	x
Global Appraisal of Individual Needs (GAIN)				
Interpersonal violence exposure (lifetime or since last assessment)	x		x	x
PTSD, anxiety, depression (in past year or since last assessment)	x		x	x
Justice-involvement				
Incarceration status		x	x	x

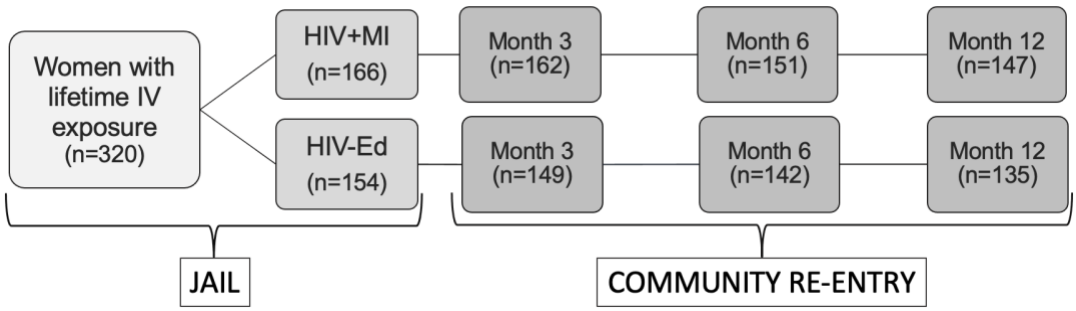

Figure 2.1. Study Timeline

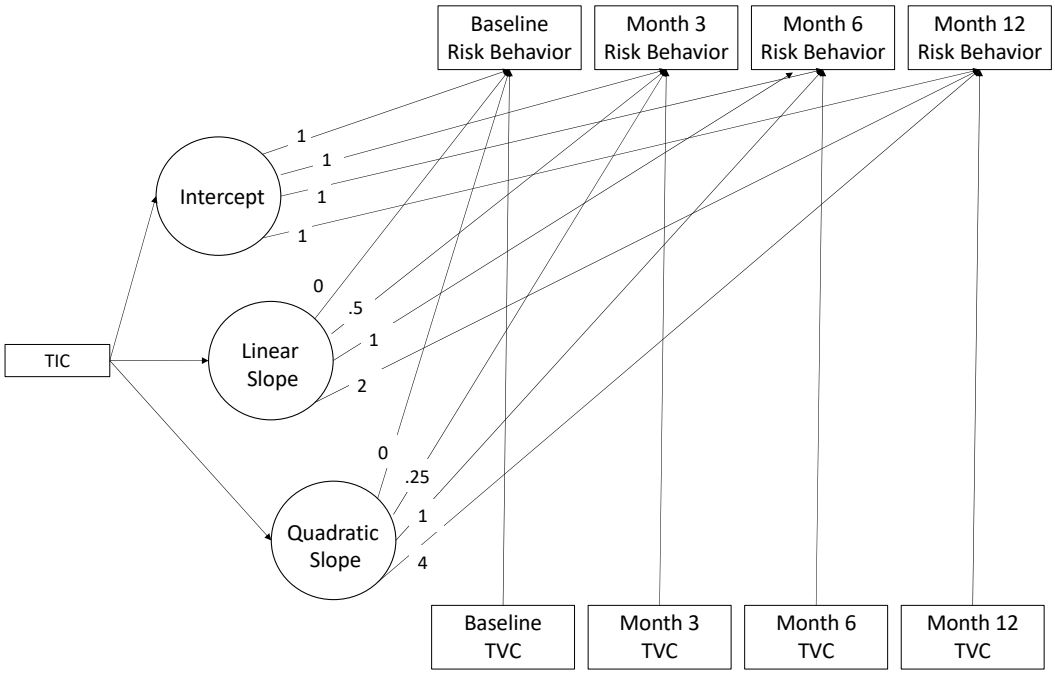

Figure 2.2. Example LGCM Estimating Change in HCV/HIV Risk Behavior during the Community Re-entry

Note: TIC = Time-invariant covariate; TVC = time-varying covariate. The numbers beside the latent growth factors reflect factor loadings for the latent intercept and slopes.

CHAPTER 3. RESULTS

3.1 Descriptive Statistics

The percentages of injection drug and sexual risk behavior and incarceration status, as well as mean psychiatric symptom scores measured at baseline and follow-up are reported in Table 3.1. Consistent with prior studies using the WISH sample (Staton et al., 2018b), women's engagement in injection drug and sexual risk behaviors in the year before incarceration did not significantly differ by intervention condition (injection drug risk behavior *p*s = .58 - .94; sexual risk behavior *p*s = .07 - .97). Women in the HIV+MI and HIV-Ed conditions reported similar rates of lifetime exposure to physical, sexual, and emotional abuse (*p*s = .07 - .74). Women's PTSD (p = .06), anxiety (p = .44), and depressive symptoms (p = .36) at baseline also did not significantly differ by intervention condition. Overall, women's engagement in HCV/HIV risk behaviors and their psychiatric symptoms decreased from pre-incarceration (baseline) to community re-entry (follow-up). Pearson correlations between PTSD, anxiety, and depressive symptoms at each time point are presented in Table 3.2. Except for the non-significant relations between PTSD at baseline and PTSD at month 6, PTSD at month 12, and anxiety at month 6, all other correlations between PTSD, anxiety, and depression were positively associated.

3.2 Development of the LGCMs

We compared unconditional models using latent linear and quadratic slopes to best estimate participants' patterns of change in HCV/HIV risk behaviors over time (*Hypothesis 1a and 1b*). In the models with a linear slope, factor loadings were set to 0, .5, 1, and 2 to

reflect change in 6-month increments and account for unequally spaced assessments. The quadratic slope models included the linear slope plus a quadratic slope term with factor loadings of 0, .25, 1, and 4. As shown in Table 3.3, models with linear and quadratic slopes demonstrated better fit than models with only linear slopes. Thus, models with linear and quadratic slopes were retained for use in further analyses. For the models examining PTSD change from baseline to month 6 as a predictor of HCV/HIV risk behavior at month 12 (*Hypothesis 2b*), the factor loadings for the linear and quadratic slopes were re-coded to -2, -1.5, -1, 0 and 4, 2.25, 1, 0 to set the intercept at the last assessment period.

When specifying the measurement model for PTSD (*Hypothesis 2a*), we tested factorial invariance to evaluate whether the properties of the PTSD assessment were stable across time points (Elsworth et al., 2015). Compared to a model with configural invariance, imposing weak and strong invariance restrictions significantly worsened model fit (weak: $\chi^2_{(22)} = 38.22$, $p = .02$; strong: $\chi^2_{(24)} = 196.85$, $p < .001$). We retained the unrestricted model because it was a good fit to the data ($\chi^2_{(637)} = 1362.27$, $p < .001$; RMSEA = .06; CFI/TLI = .98/.98) and the factor loadings of each indicator were consistent across time. We can interpret change in PTSD across time as actual change in the construct rather than how the construct was measured. Figure 3.1 displays the standardized parameter estimates from fitting the measurement model. Including the latent intercept and slope resulted in a model with good fit ($\chi^2_{(614)} = 668.09$, $p = .06$; RMSEA = .02; CFI/TLI = .99/.99).

3.3 Primary Aims

3.3.1 *Aim 1: Examine to what extent PTSD symptoms prior to incarceration predict HCV/HIV risk behavior following community re-entry.*

3.3.1.1 Unconditional Model for Injection Drug Risk Behavior

Results of the unconditional model are presented first to summarize the latent growth factors for injection drug risk behavior during the re-entry period. The model-implied observed proportions for each response category (0 to 7 injection risk behaviors) by time point are displayed in Figure 3.2. As shown in Table 3.4, the estimated intercept mean was significant indicating that more than 50% of women reported at least one injection drug risk behavior (i.e., fell above the first threshold). Propensity to engage in injection drug risk behavior significantly decreased from pre-incarceration across the re-entry period (negative linear slope) and this decrease slowed across time (positive quadratic slope). There was significant unexplained variance person-to-person in women's propensity to engage in injection drug risk behavior prior to incarceration, as well as their trajectory of change in risk behavior during the re-entry period (positive linear and quadratic slope variances).

3.3.1.2 Unconditional Model for Sexual Risk Behavior

The model-implied observed proportions for each response category (0 to 5 sexual risk behaviors) by time point are displayed in Figure 3.2. As shown in table 3.4, the estimated intercept mean was significant suggesting that more than 50% of women

reported at least one sexual risk behavior (i.e., fell above the first threshold). Propensity to engage in sexual risk behavior significantly decreased from pre-incarceration across the re-entry period (negative linear slope) and this decrease slowed across time (positive quadratic slope). There was significant unexplained variance person-to-person in women's propensity to engage in sexual risk behavior prior to incarceration and their trajectory of change in risk behavior during the re-entry period (positive linear and quadratic slope variances).

3.3.1.3 Conditional Models for Injection Drug and Sexual Risk Behavior

In the conditional LGCMs for injection drug and sexual risk behavior, each time-invariant and time-varying covariate was entered independently, and fit statistics were compared against the unconditional quadratic slope models (see Table 3.3). Model fit significantly worsened after adding HCV seropositive status at baseline as a time-invariant covariate, as well as both incarceration and IV experiences during the follow-up period as time-varying covariates. Thus, the final conditional models for ***Hypothesis 1a and 1b*** included the following time-invariant covariates: intervention condition; symptoms of PTSD, anxiety, and depression; and the interaction between intervention condition and PTSD symptoms (injection drug risk: -2LL = -1227.03; FP = 30; AIC = 2514.06; BIC = 2627.11; sexual risk: -2LL = -1672.44; FP = 28; AIC = 3400.88; BIC = 3506.40).

Table 3.4 reports the parameter estimates for the conditional LGCMs estimating injection drug and sexual risk behavior during the re-entry period. For ease of visual interpretation, the probabilities depicted in Figures 3.3 through 3.6 represent dichotomized HCV/HIV risk behavior, where 0 = denied and 1 = endorsed. Figures 3.3

and 3.4 show the non-significant effect of intervention condition on change in injection drug and sexual risk behavior during re-entry. Although none of the time-invariant covariates were significantly associated with the growth factors in the model estimating injection drug risk behavior, anxiety and depression at baseline were related to sexual risk behavior. As shown in Figure 3.5, higher baseline levels of anxiety were associated with a greater propensity of engaging in sexual risk behavior at baseline (positive intercept coefficient) and a steeper decline in sexual risk behavior across the re-entry period (negative linear slope coefficient). Additionally, women with higher anxiety severity at baseline experienced a steeper reduction in sexual risk behavior soon after release from jail, whereas sexual risk behavior declined more steadily across the re-entry period among those with lower anxiety symptom severity (positive quadratic slope). The opposite pattern was found for depression (Figure 3.6): women with lower depression severity at baseline experienced a steeper reduction in sexual risk behavior soon after being released, whereas sexual risk-taking declined more steadily during re-entry for women with higher anxiety symptoms (negative quadratic slope). No other time-invariant covariates were significantly associated with the intercept or growth factors for sexual risk behavior. Neither anxiety (B = 0.07, SE = 0.04, p = .08), nor depression (B = -0.06, SE = 0.05, p = .23) were significantly associated with sexual risk behavior at month 12, suggesting the effect of anxiety and depression on sexual risk-taking may dissipate as women are farther out from periods of incarceration.

3.3.2 Aim 2: *Evaluate the extent to which reductions in PTSD symptoms following community re-entry predict reductions in HCV/HIV risk behavior.*

3.3.2.1 Unconditional and Conditional Models for PTSD

After establishing good fit using WLSMV in the PTSD measurement model, FIML was used in the unconditional and conditional models estimating change in PTSD over time. In the unconditional model, PTSD symptoms significantly decreased (B = -1.50, SE = 0.25, $p < .001$). There was significant unexplained variance person-to-person in women's rate of change in PTSD symptoms during the re-entry period (B = 2.23, SE = 0.74, p = .003).

For the conditional LGCMs for PTSD, each time-invariant and time-varying covariate was entered independently, and fit statistics were compared against the unconditional linear slope model (see Table 3.5). Model fit significantly worsened after adding HCV seropositive status as a time-invariant covariate, as well as anxiety and depression, IV experiences, and incarceration status as time-varying covariates. Thus, the final conditional models for ***Hypothesis 2a*** only included the intervention condition as a time-invariant covariate (AIC = 6868.26; BIC = 6973.78). The effect of intervention condition significantly predicted the baseline centered intercept of PTSD (B = 0.88, SE = 0.34, p = .01) which suggests that women in the HIV+MI condition had higher model estimated PTSD symptoms in the year prior to baseline compared to women in the HIV-Ed condition. The effect of intervention condition on change in PTSD across the re-entry period approached significance (B = -0.66, SE = 0.34, p = .052). As depicted in Figure 3.7, women's PTSD symptoms decreased -0.66 units in the HIV+MI condition than in the HIV-Ed condition. Additional models were run with the intercept set at each follow-up

assessment, and results suggest women's PTSD symptoms did not differ by intervention condition at month 6 (B = 0.37, SE = 0.31, p = .23) or month 12 (B = -0.12, SE = 0.41, p = .77).

3.3.2.2 Conditional Model for Change in PTSD Predicting Change in HCV/HIV Risk Behavior

When adding the difference in factor scores between baseline PTSD and month 6 PTSD, as well as the factor score of PTSD at month 12, the model fit for both injection drug (-2LL, FP = -1883.22, 22; $\chi 2$(df) = 645.94 (7), $p < .001$) and sexual risk behavior (-2LL, FP = -2333.20, 20; $\chi 2$(df) = 642.97 (7), $p < .001$) was significantly worse compared with the unconditional model. Change in the PTSD factor scores from baseline to month 6 did not significantly predict injection drug (B = -0.14, SE = 0.09, p = .14) or sexual risk behavior (B = -0.06, SE = 0.08, p = .42) at month 12. However, higher PTSD factor scores at month 12 were positively associated with a greater propensity to engage in injection drug (B = 0.36, SE = 0.15, p = .02) and sexual risk behavior (B = .43, SE = 0.12, $p < .001$) at the same time point. The PTSD factor scores at month 12 were positively associated with the PTSD difference score (B = 0.06, SE = 0.03, p = .01) in both models. Additional time-invariant and time-varying covariates were not added to the model, as this worsened model fit.

Table 3.1 Sample Characteristic at Baseline and Follow-up by Intervention Condition

		Baseline		Month 3		Month 6		Month 12	
	Overall (*N*=320)	HIV-Ed (*n*=154)	HIV+MI (*n*=166)	HIV-Ed (*n*=149)	HIV+MI (*n*=162)	HIV-Ed (*n*=142)	HIV+MI (*n*=151)	HIV-Ed (*n*=135)	HIV+MI (*n*=147)
Incarceration (%)									
First incarceration	7.0	8.5	5.5						
Recent incarceration				19.5	17.9	31.7	21.9	43.0	33.0
Injection Drug Risk Behavior (%)									
Lifetime injection drug use	77.2	76.0	78.3						
Injection drug use	61.3	61.7	60.8	18.8	18.5	22.5	25.2	18.5	24.5
Used shared needle	50.9	49.4	52.4	14.8	13.6	20.4	19.2	17.0	21.8
Used shared works	45.9	46.1	45.8	14.1	10.5	16.9	17.2	14.8	17.0
Shared needles	47.2	47.4	47.0	10.7	9.9	14.1	13.9	8.9	15.0
Shared works	44.4	44.2	44.6	10.7	9.9	14.1	13.2	8.9	13.6
Shared equipment with partner	40.6	41.6	39.8	8.7	7.4	12.0	9.3	8.9	11.6
Did not always inject first	37.8	38.3	37.3	1.3	0.6	12.7	12.6	8.1	15.0
Sexual Risk Behavior (%)									
Unprotected vaginal sex	89.7	89.6	89.8	59.7	54.3	67.6	62.3	65.2	61.9
Unprotected anal sex	11.6	14.9	8.4	4.7	1.9	2.8	2.6	2.2	2.0
Used alcohol/drugs before sex	84.4	83.8	84.9	26.8	21.6	32.4	23.2	31.9	29.3
Last sex partner injected drugs	57.8	59.7	56.0	36.2	33.3	38.7	32.5	39.3	36.1
Traded sex for drugs/money/etc.	18.1	16.9	19.3	2.0	1.9	4.2	2.6	5.2	4.1

Table 3.1 (continued) Sample Characteristic at Baseline and Follow-up by Intervention Condition

		Baseline		Month 6		Month 12	
	Overall (*N*=320)	HIV-Ed (*n*=154)	HIV-Ed (*n*=142)	HIV+MI (*n*=151)	HIV-Ed (*n*=135)	HIV+MI (*n*=147)	HIV-Ed (*n*=142)
Interpersonal Violence (%)							
Sexual abuse	56.6	51.3	61.4	1.4	1.3	0.7	2.7
Physical abuse	85.0	89.0	94.0	9.2	6.0	8.9	5.4
Emotional abuse	91.6	85.1	84.9	14.1	12.6	16.3	13.6
Sexual, physical, emotional abuse	100.0	100.0	100.0	16.2	12.6	17.8	14.3
Psychiatric Symptoms (M, [SD])							
Possible PTSD diagnosis (%)	69.7%	63.6%	75.3%	32.4%	41.7%	37.0%	31.3%
PTSD symptoms (range 0-12)	7.14 (4.74)	6.62 (4.96)	7.63 (4.48)	3.40 (4.61)	4.17 (4.61)	3.82 (4.46)	3.29 (4.54)
Anxiety symptoms (range 0-12)	5.58 (3.66)	5.42 (3.70)	5.73 (3.63)	2.00 (2.93)	2.35 (3.26)	1.98 (2.72)	1.88 (3.07)
Depressive symptoms (range 0-9)	6.11 (2.87)	5.95 (3.00)	6.25 (2.75)	3.11 (3.12)	3.53 (3.14)	3.50 (3.00)	3.38 (3.12)

Note: HIV-Ed = NIDA Standard HIV Education; HIV+MI = Motivational Interviewing-based HIV Risk-reduction.

Table 3.2 Correlations Between PTSD, Anxiety, and Depression at Baseline and Follow-up

	BL PTSD	M6 PTSD	M12 PTSD	BL Anxiety	M6 Anxiety	M12 Anxiety	BL Depression	M6 Depression	M12 Depression
BL PTSD									
M6 PTSD	.02								
M12 PTSD	.10	.29***							
BL Anxiety	.37***	.12*	.23***						
M6 Anxiety	.08	.45***	.31***	.17**					
M12 Anxiety	.16**	.26***	.60***	.22***	.42***				
BL Depression	.37***	.16**	.25***	.74***	.19**	.24***			
M6 Depression	.12*	.38***	.27***	.14*	.74***	.31***	.16**		
M12 Depression	.23**	.22***	.54***	.23***	.32***	.63***	.23***	.38***	

Note: BL = baseline; M6 = Month 6; M12 = Month 12.

*p < .05. **p < .01. ***p <.001.

3.3 Deviance Tests for Unconditional and Conditional Injection Drug and Sexual Risk Behavior Models

	Injection Drug Risk Behavior		Sexual Risk Behavior	
	-2LL, FP	χ^2(df), *p*	-2LL, FP	χ^2(df), *p*
Slope				
Linear	-1282.94, 11		-1787.14, 9	
Quadratic	-1237.28, 15	**46.66 (4), *p* < .001**	-1690.23, 13	**96.91 (4), *p* < .001**
Time-invariant covariates				
Intervention condition	-1235.78, 18	1.50 (3), *p* = .68	-1689.08, 16	1.15 (3), *p* = .77
PTSD	-1230.39, 18	6.89 (3), *p* = .08	-1684.15, 16	6.08 (3), *p* = .11
Anxiety and depression	-1233.03, 21	4.25 (6), *p* = .64	-1682.46, 19	7.76 (6), *p* = .26
HCV seropositive status	-1433.49, 20	**196.21 (5), *p* < .001**	-1891.28, 18	**201.06 (5), *p* < .001**
Time-varying covariates				
Incarceration	-1657.70, 33	**432.31 (18), *p* < .001**	-2112.05, 34	**421.82 (21), *p* < .001**
Interpersonal violence	-1418.94, 28	**181.66 (13), *p* < .001**	-1874.23, 26	**184.66 (13), *p* < .001**

Note: -2LL = loglikelihood; FP = free parameters; df = degrees of freedom. Nested model comparisons (chi-square deviance tests) were used to test fit of the linear slope against the quadratic slope, as well as each time-invariant and time-varying covariate against fit of the quadratic slope.

Table 3.4 Unconditional and Conditional Latent Growth Curve Model Estimates for the Effect of Baseline PTSD and Intervention Condition on Injection Drug and Sexual Risk Behavior

	Injection Drug Risk Behavior		Sexual Risk Behavior	
	Unconditional LGCM	Conditional LGCM	Unconditional LGCM	Conditional LGCM
Means and Variances				
I mean	**0.37 (0.09), *p* < .001**	0.03 (0.21), *p* = .90	**1.94 (0.14), *p* < .001**	**1.66 (0.24), *p* <.001**
I variance	0.81 (0.42), *p* = .055	0.44 (0.33), *p* = .18	**0.82 (0.26), *p* = .002**	**0.74 (0.25), *p* = .003**
LS mean	**-4.17 (0.55), *p* < .001**	**-4.93 (1.40), *p* < .001**	**-3.11 (0.27), *p* < .001**	**-3.29 (0.63), *p* <.001**
LS variance	**10.18 (3.73), *p* = .006**	**8.14 (4.13), *p* = .049**	**5.69 (1.82), *p* = .002**	**5.34 (1.76), *p* = .002**
QS mean	**1.56 (0.27), *p* < .001**	**1.93 (0.71), *p* = .006**	**1.21 (0.12), *p* < .001**	**1.29 (0.29), *p* < .001**
QS variance	**2.34 (0.84), *p* = .005**	**1.88 (0.88), *p* = .03**	**1.17 (0.38), *p* = .002**	**1.08 (0.37), *p* = .003**
Covariance				
I with LS	-0.05 (0.75), *p* = .95	0.03 (0.21), *p* = .56	-0.52 (0.46), *p* = .25	-0.44 (0.44), *p* = .32
I with QS	0.16 (0.36), *p* = .66	0.00 (0.30), *p* = .99	0.23 (0.20), *p* = .24	0.19 (0.19), *p* = .30
LS with QS	**-4.76 (1.73), *p* = .006**	**-3.84 (1.87), *p* = .04**	**-2.55 (0.82), *p* = .002**	**-2.36 (0.79), *p* = .003**
Time-invariant Covariates				
PTSD → I		0.03 (0.02), *p* = .25		0.04 (0.02), *p* = .09
Intervention → I		-0.32 (0.27), *p* = .25		-0.23 (0.28), *p* = .41
PTSD by Intervention → I		0.03 (0.03), *p* = .36		0.01 (0.03), *p* = .73
Anxiety → I		0.03 (0.03), *p* = .41		**0.07 (0.03), *p* = .03**
Depression → I		0.01 (0.04), *p* = .87		-0.05 (0.04), *p* = .20

Table 3.4 (continued) Unconditional and Conditional Latent Growth Curve Model Estimates for the Effect of Baseline PTSD and Intervention Condition on Injection Drug and Sexual Risk Behavior

	Injection Drug Risk Behavior		Sexual Risk Behavior	
	Unconditional LGCM	Conditional LGCM	Unconditional LGCM	Conditional LGCM
Time-invariant Covariates				
PTSD → LS		0.11 (0.10), p = .25		0.07 (0.06), p = .25
Intervention → LS		0.87 (1.25), p = .49		0.76 (0.76), p = .31
PTSD by Intervention → LS		-0.09 (0.14), p = .49		-0.15 (0.09), p = .08
Anxiety → LS		-0.06 (0.13), p = .67		**-0.25 (0.09), p = .003**
Depression → LS		0.06 (0.17), p = .75		0.21 (0.11), p = .06
PTSD → QS		-0.07 (0.05), p = .18		-0.04 (0.03), p = .24
Intervention → QS		-0.26 (0.63), p = .68		-0.19 (0.35), p = .60
PTSD by Intervention → QS		0.04 (0.07), p = .53		0.05 (0.04), p = .21
Anxiety → QS		0.05 (0.06), p = .46		**0.13 (0.04), p = .002**
Depression → QS		-0.04 (0.09), p = .64		**-0.11 (0.05), p = .04**

Note: I = intercept; LS = linear slope; QS = quadratic slope. Unstandardized estimates are shown with standard errors in parentheses.

3.5 Deviance Tests for Unconditional and Conditional PTSD Models

	-2LL, FP	χ^2(df), *p*
Slope		
Linear	-3409.39, 26	
Time-invariant covariates		
Intervention condition	-3406.13, 28	3.26 (2), *p* = .20
HCV seropositive status	-3619.65, 30	**210.26 (4), *p* < .001**
Time-varying covariates		
Anxiety and depression	-7495.06, 71	**4085.67 (54), *p* < .001**
Incarceration	-3764.07, 37	**354.68 (11), *p* < .001**
Interpersonal violence	-3581.60, 37	**172.21 (11), *p* < .001**

Note: -2LL = loglikelihood; FP = free parameters; df = degrees of freedom. Nested model comparisons (chi-square deviance tests) were used to test fit of each time-invariant and time-varying covariate against the fit of the unconditional linear slope model.

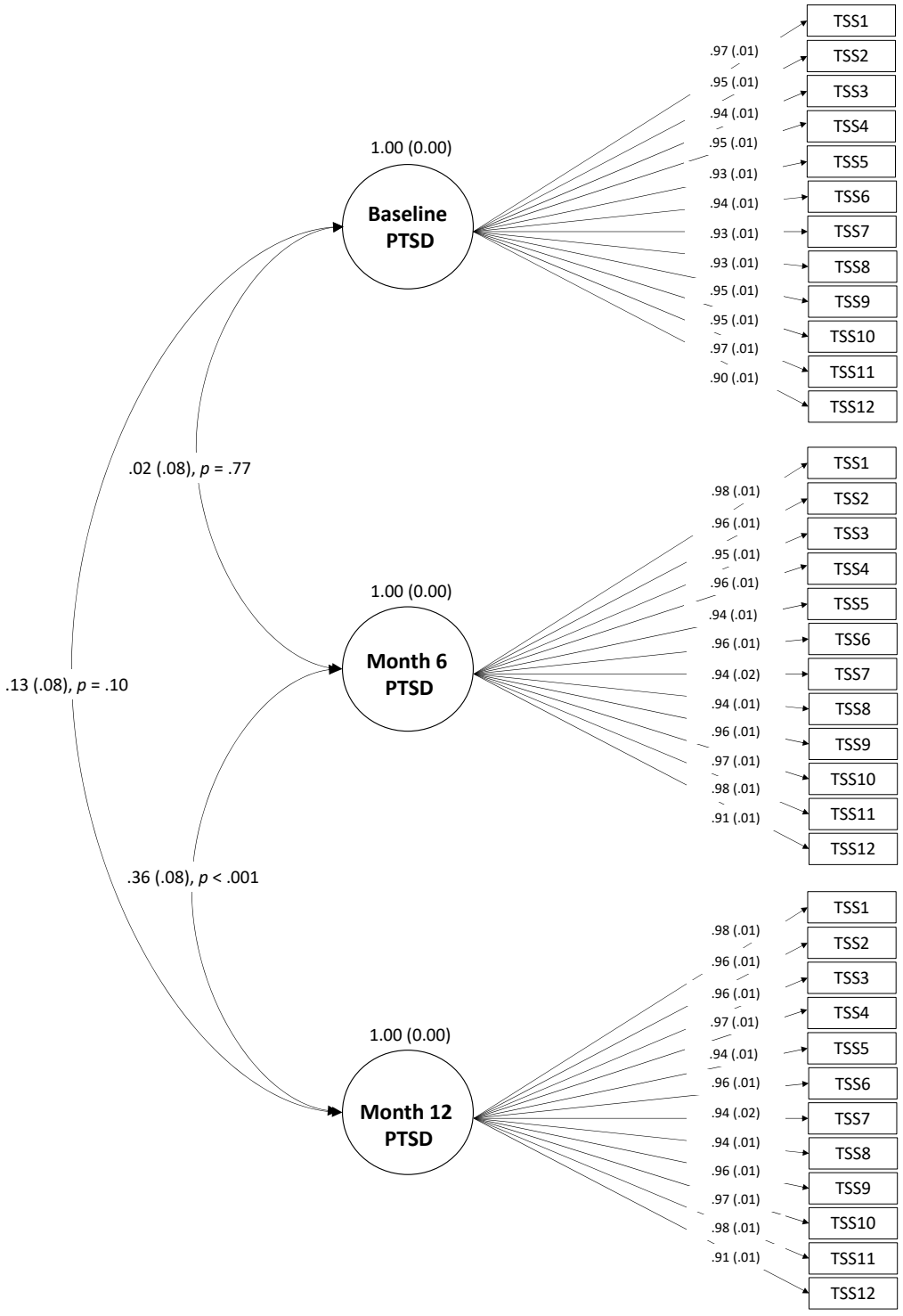

Figure 3.1 Measurement Model for Latent PTSD Symptoms at Baseline, Month 6, and Month 12

Note: Standardized estimates are shown with standard errors in parentheses.

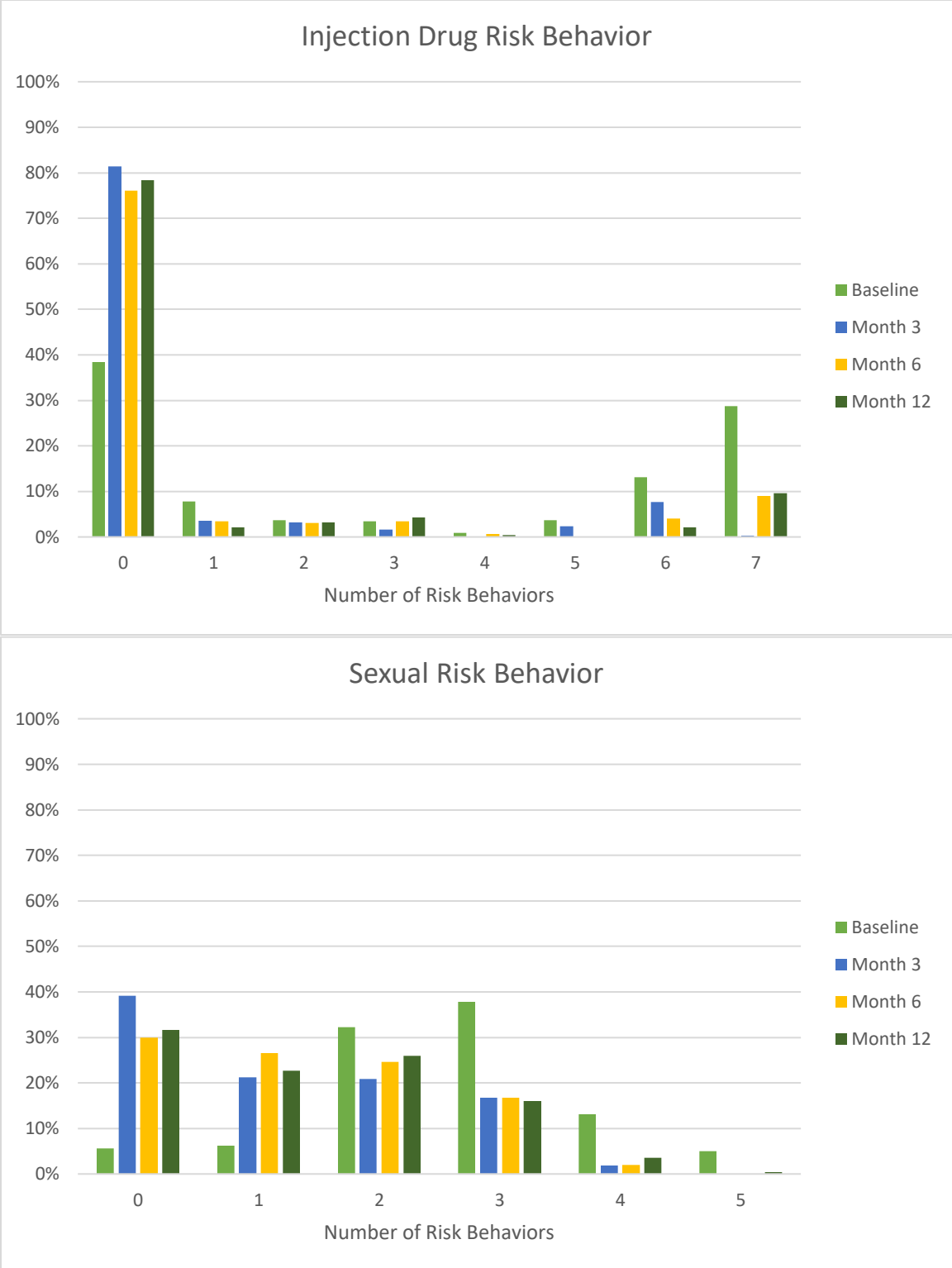

Figure 3.2. Observed Proportions for Injection Drug and Sexual Risk Behavior Response Categories

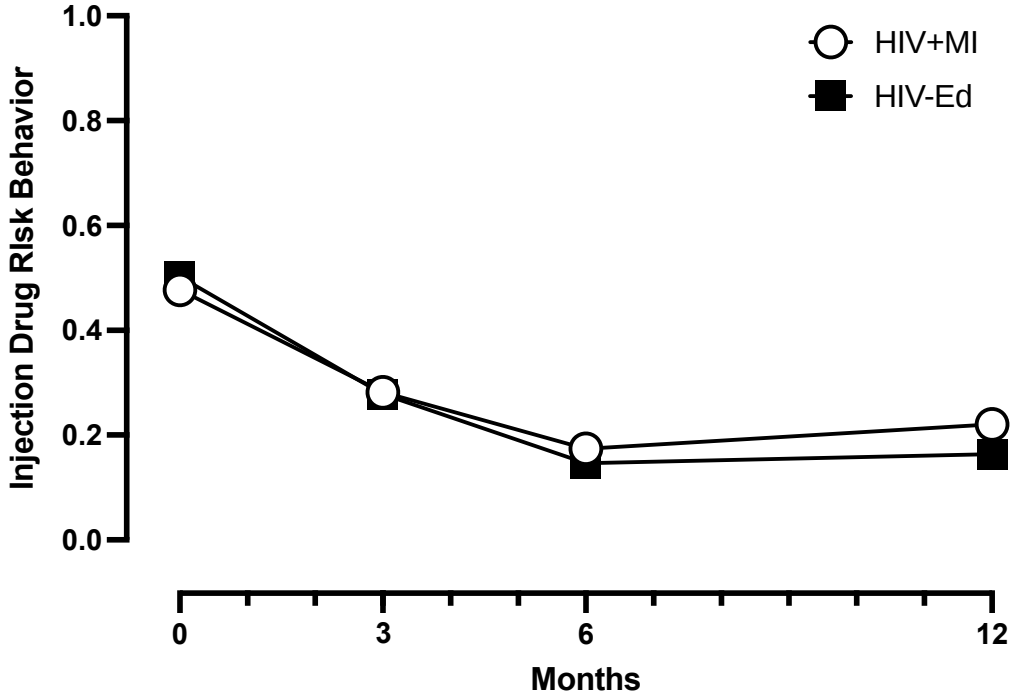

Figure 3.3. Probability of Injection Drug Risk Behavior from Pre-incarceration to Community Release by Intervention Condition

Note: The time-invariant covariates in this model include PTSD, anxiety and depression, intervention condition, and a PTSD by intervention condition interaction term.

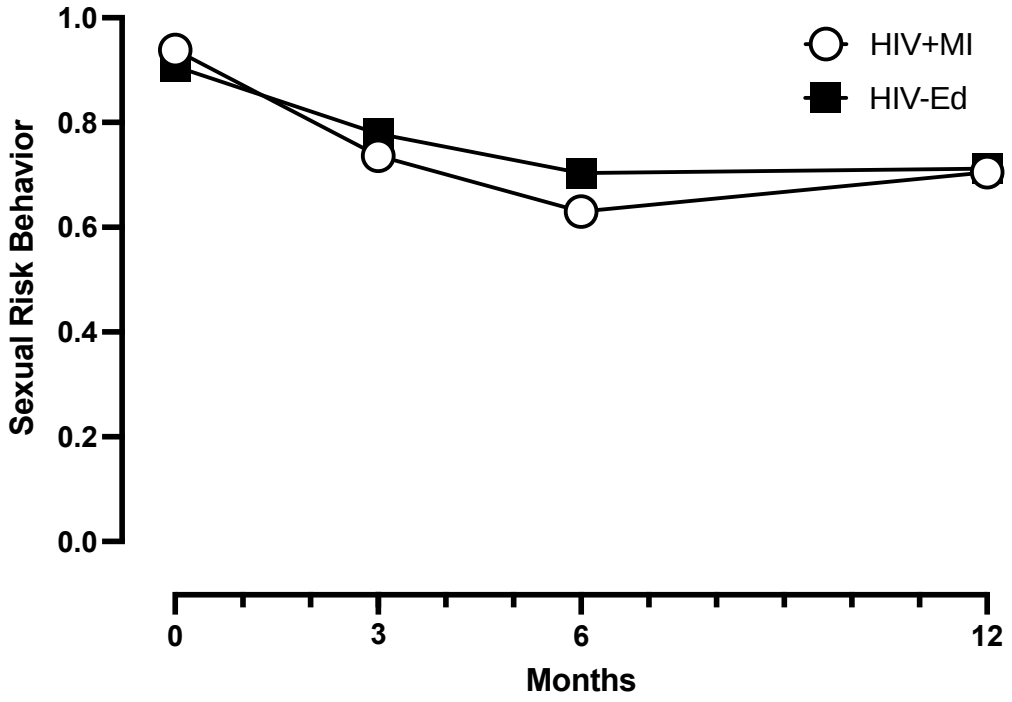

Figure 3.4. Probability of Sexual Risk Behavior from Pre-incarceration to Community Release by Intervention Condition

Note: The time-invariant covariates in this model include PTSD, anxiety and depression, intervention condition, and a PTSD by intervention condition interaction term.

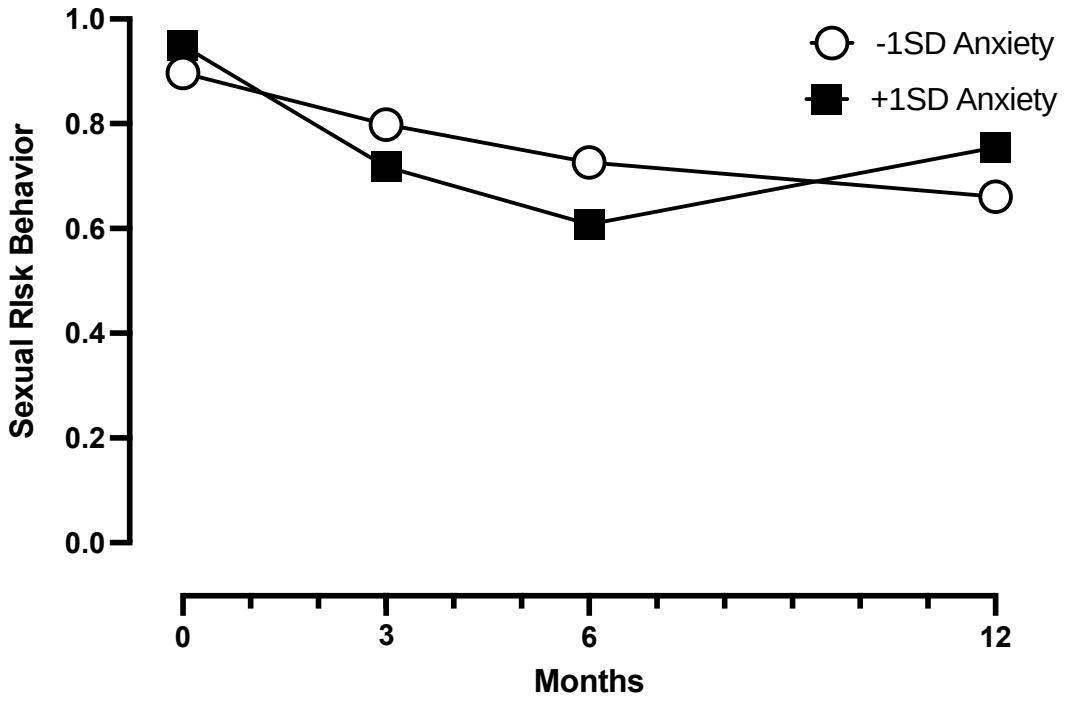

Figure 3.5. Probability of Sexual Risk Behavior from Pre-incarceration to Community Release by +/-1 Standard Deviation in Anxiety Symptoms

Note: The time-invariant covariates in this model include PTSD, anxiety and depression, intervention condition, and a PTSD by intervention condition interaction term.

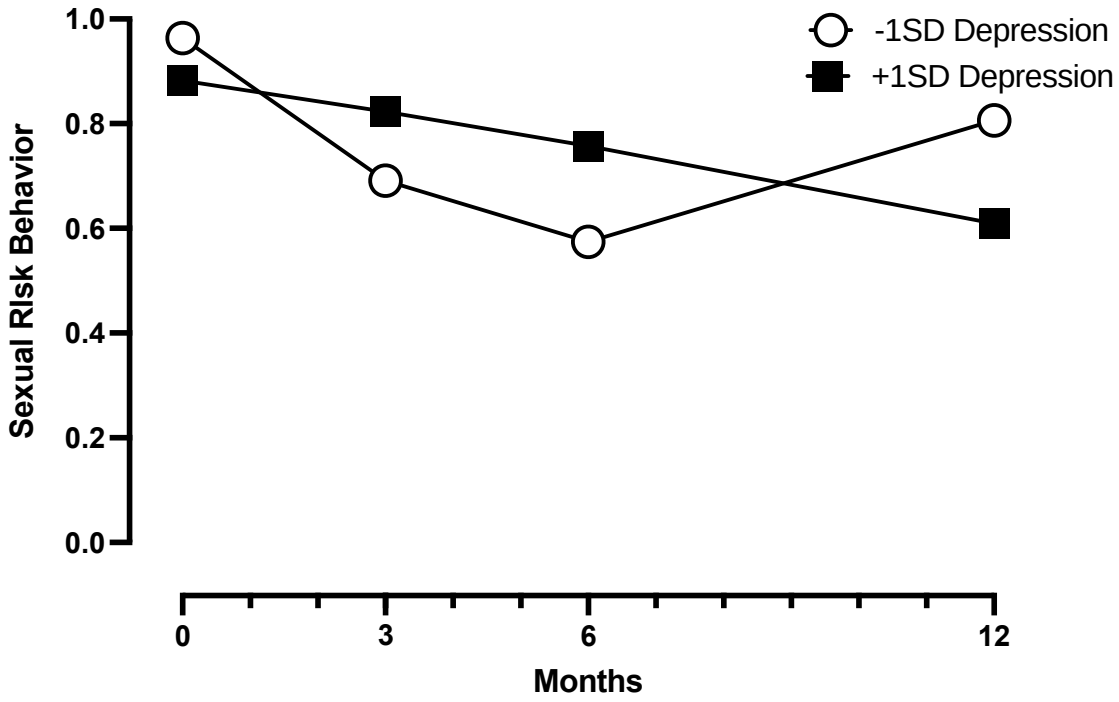

Figure 3.6. Probability of Sexual Risk Behavior from Pre-incarceration to Community Release by +/-1 Standard Deviation in Depressive Symptoms

Note: The time-invariant covariates in this model include PTSD, anxiety and depression, intervention condition, and a PTSD by intervention condition interaction term.

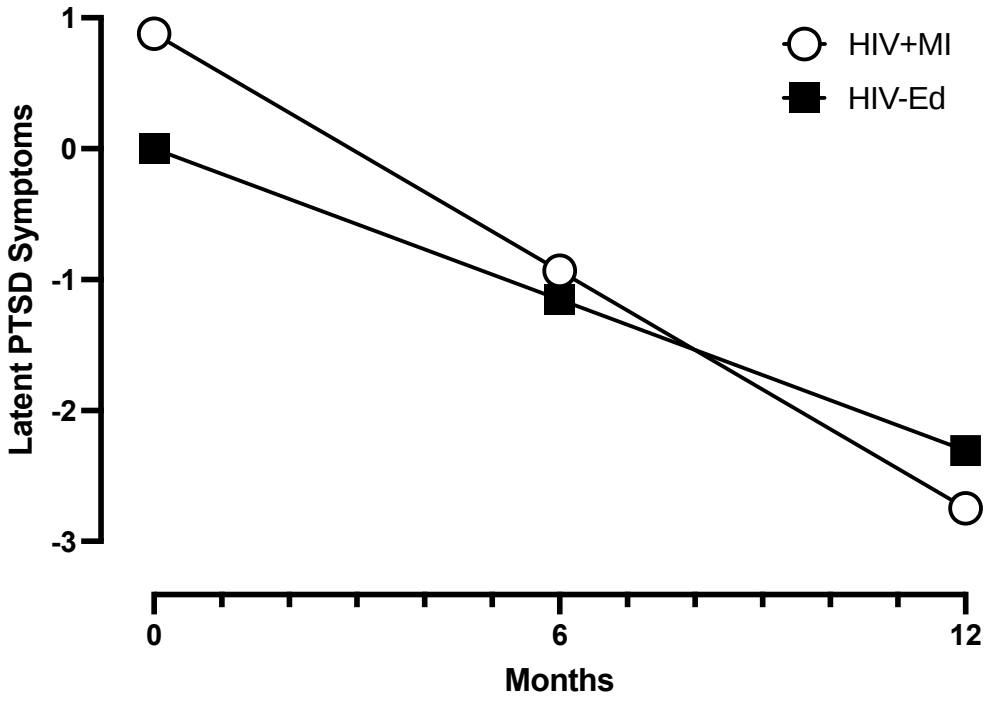

Figure 3.7. Change in PTSD from Incarceration to Community Release by Intervention Condition

CHAPTER 4. DISCUSSION

Rural Appalachian women with substance use histories are a unique and particularly vulnerable group in need of targeted interventions aimed at reducing the spread of HCV/HIV. Symptoms of PTSD affect a large proportion of justice-involved rural women and may interfere with current efforts to reduce HCV/HIV risk behaviors (Staton et al., 2017, 2018b; Weir et al., 2009). Thus, the purpose of this study was to examine HCV/HIV risk-reduction interventions administered to incarcerated women from rural Appalachia through a trauma-informed perspective (Facer-Irwin et al., 2019; Levenson & Willis, 2019; SAMHSA, 2014).

4.1 Discussion of Primary Study Aims

The first aim of this study evaluated to what extent PTSD symptoms before and during incarceration predicted HCV/HIV risk behavior following community re-entry. Overall, women's propensity to engage in injection drug and sexual risk behavior decreased after being released from jail, and their rate of change slowed across time. Additionally, women within the sample differed in their propensity to engage in HCV/HIV risk behavior before incarceration, and they displayed heterogeneous trajectories of risk behavior following community re-entry, supporting efforts to identify predictors of how risk behavior differs across incarcerated women. Consistent with and extending upon prior research conducted with women enrolled in the WISH study (Staton et al., 2018b), change in HCV/HIV risk behavior across the re-entry period (i.e., at months 3, 6, and 12) did not differ by intervention condition. Other studies have also found similar levels of risk reduction among substance users when comparing the effectiveness of HIV-Ed to enhanced interventions

involving additional counseling or culturally-informed content (Booth et al., 1998; Dushay et al., 2001). Both the HIV+MI and HIV-Ed interventions are feasible for use in jails. A single session of psychoeducation may be an efficient and cost-effective way to reduce HCV/HIV risk behaviors among rural Appalachian justice-involved women.

Although prior cross-sectional research suggests higher PTSD symptoms are associated with greater engagement in HCV/HIV risk behaviors among IV-exposed individuals (Cavanaugh et al., 2010; Plotzker et al., 2007), our findings indicate PTSD symptom severity leading up to and during incarceration was not associated with women's change in injection drug or sexual risk behavior post-release from jail (*Hypothesis 1a*). Additionally, the interaction between baseline PTSD symptoms and intervention condition was not significant (*Hypothesis 1b*)*;* having higher PTSD symptoms in the year before the baseline assessment was not associated with differences in how women responded to the HIV+MI or HIV-Ed interventions despite there being significant variability in their rate of change in HCV/HIV risk behavior during re-entry. Past research indicates individuals with PTSD have poorer outcomes in substance use treatment (Kubiak, 2004; Read et al., 2004) and benefit from enhanced monitoring while undergoing medical services for infectious diseases (Delahanty et al., 2004; Loftis et al., 2006). Yet, our results suggest PTSD symptoms leading up to and during incarceration may not influence the effectiveness of brief HCV/HIV risk reduction interventions administered to IV-exposed women in rural Appalachian jails.

The second aim of this study examined to what extent reductions in PTSD symptom severity following community re-entry predicted subsequent reductions in HCV/HIV risk behavior. PTSD symptoms decreased overall from baseline to community

re-entry, but women's change in PTSD symptoms did not differ statistically based on which risk reduction intervention they received, although the association approached significance (p = .052). PTSD symptoms trended toward decreasing more during re-entry for women in the HIV+MI condition compared to women who received HIV-Ed. Past research supports the use of motivational interviewing to attenuate risk for developing PTSD following traumatic injury (Zatzick et al., 2004) and to enhance trauma-focused treatment outcomes and potentially reduce PTSD symptoms among veterans (Battaglia et al., 2016; Randall & McNeil, 2017). Although the present study's findings did not corroborate our prediction for ***Hypothesis 2a***, the results provide preliminary support suggesting further research should be conducted to specifically examine whether HCV/HIV risk-reduction interventions that include a motivational interviewing component may offer more promise at reducing PTSD symptoms than standard psychoeducational interventions for IV-exposed incarcerated women. However, this finding should be interpreted with caution since women in the HIV+MI condition started the study with more severe PTSD symptoms than women in the HIV-Ed condition, indicating randomization failed to yield equivalent groups at baseline on this variable. It is unclear whether the trending effect of intervention condition on post-incarceration PTSD symptoms was due to differences in intervention effectiveness or because women with higher PTSD severity at baseline experienced greater symptom improvements during re-entry. We did not conduct a sensitivity analysis for Aim 2, and it is possible the analytic methods we employed were underpowered to assess the effect of intervention condition on change in PTSD symptoms over the re-entry period. Future studies should ideally be designed to include sample sizes that provide enough power to detect small but potentially meaningful effects of

intervention condition and allow for robust comparisons among IV-exposed incarcerated women with high, low, and absent PTSD symptoms.

Our results also failed to demonstrate that reductions in PTSD from baseline to month 6 would prospectively predict lower engagement in HCV/HIV risk behavior (*Hypothesis 2b*). Past research indicates individuals with PTSD often self-medicate their symptoms by using substances or taking sexual risks (McCauley et al., 2012; Weiss et al., 2013). The self-medication hypothesis informed our prediction that decreases in PTSD would predict subsequent lower rates of HCV/HIV risk behavior since these behaviors may be inextricably linked with women's ability to cope with trauma-related distress. However, change in PTSD post-release was not associated with subsequent HCV/HIV risk behavior, suggesting that patterns of change in PTSD symptoms and HCV/HIV risk behavior may unfold separately across the re-entry period for IV-exposed women. Women's self-medication of trauma-related symptoms may play a role during initiation or initial exacerbation of substance use and sexual risk-taking, whereas other processes may be more relevant when these behavioral patterns are well established (Berenz et al., 2019). For example, symptoms of physiological withdrawal or dependence may be more likely to maintain or promote injection drug risk behavior than self-medicating when trauma reminders arise for IV-exposed women with long histories of substance use. Sexual risk-taking may serve as a way for vulnerable women to earn financial support, obtain substances, or to maintain safety in their sexual relationships (Mittal et al., 2013; Noska et al., 2016; Teitelman et al., 2008), despite past research suggesting these behaviors may also self-medicate trauma-related distress (Weiss et al., 2013). This study provides a snapshot of rural women's trajectories prior to and following periods of incarceration.

Future research should include additional assessments before, during, and following periods of incarceration to better understand how patterns of PTSD and HCV/HIV risk behavior unfold as women interact with the justice system.

Null findings for the primary aims may be a function of the unique sample and methods included in this study, which were not initially designed to test the research questions herein. The face-to-face interview used to evaluate psychiatric symptoms—the GAIN—was originally developed for substance use treatment providers to efficiently evaluate mental health and substance use problems to inform treatment placement and planning (Dennis et al., 2008), and was appropriate for the needs of the parent study. However, the GAIN does not comprehensively evaluate psychiatric disorders per criteria defined in the *Diagnostic and Statistical Manual of Mental Disorders* (DSM; APA, 2013). To measure PTSD symptomology, The GAIN TSS includes 12 items that assess several important aspects of responses to "past events", including nightmares and sleep problems, emotional arousal and numbing, risk-taking and urges, anger and irritability, feelings of disconnection from others, and self-blame. However, these items do not directly map on to the PTSD symptom criteria defined in the DSM. More specifically, the GAIN TSS does not include an assessment of trauma-related avoidance, memory and concentration problems, exaggerated negative beliefs about other people or the world, and hypervigilance or startle responses. Additionally, the GAIN TSS items are not anchored to a specific traumatic event (or events) that involved exposure to actual or threatened death, serious injury, or sexual violence (i.e., satisfy the definition of a Criterion A trauma in the DSM). Thus, the GAIN TSS may not comprehensively capture IV-exposed women's PTSD symptomology as they transition in to and out of periods of incarceration; instead, this measure may reflect general

distress in response to a range of significant life stressors. Future research could improve upon these methodological limitations by including a measure that captures the frequency and severity of potentially traumatic events (e.g., the Life Events Checklist or the Trauma History Questionnaire; Hooper et al., 2011; Weathers et al., 2013), as well as a clinician-administered or self-report assessment of PTSD symptoms that better reflect DSM-5 diagnostic criteria (e.g., the Clinician-Administered PTSD Scale or the PTSD Checklist for DSM-5; Blevins et al., 2015; Weathers et al., 2018).

Another factor to consider is the distribution of baseline PTSD symptoms in the present sample of 320 IV-exposed women, who reflect a subset of all women enrolled in the WISH study (N = 400). Most women met criteria for "high traumatic stress" or possible PTSD (69.7%; $\geq$5 on the GAIN TSS) at the first assessment. However, PTSD symptom scores at baseline were bimodally distributed such that nearly half of women either reported 0 (25.0%) or all twelve symptoms (23.4%). Additionally, very few IV-exposed women had a score between 1-4 on the GAIN TSS (5.4%). We purposefully selected IV-exposed women to be included in the present analyses given the association between victimization and HCV/HIV risk behavior (Mittal et al., 2013; Teitelman et al., 2008; Wagner et al., 2009). Extending the sample to include women with other forms of trauma exposure may yield a distribution of PTSD that better reflects the spectrum of symptom severity.

Also important to note, the time frame in which PTSD symptoms were assessed may have been too broad to capture women's responses to traumatic events and how they relate to or predict HCV/HIV risk behavior. Women were asked about their PTSD symptoms in the 12 months leading up to the baseline assessment or since the last interview at the month 6 and 12 follow-ups. It is possible that the spacing between PTSD assessments may account

for the lack of associations between PTSD symptom severity scores at baseline and follow-ups. An alternative possibility is that women's PTSD symptoms may have been exacerbated leading up to and during incarceration. Their change in PTSD during re-entry may represent a return to normative levels, indicating that PTSD symptoms during incarceration may not be reflective of women's experiences of PTSD during re-entry. Longitudinal studies are needed that include assessments of PTSD symptoms at multiple time points prior to, during, and following periods of incarceration to understand patterns of change in PTSD symptoms and how these patterns relate to HCV/HIV risk behavior among IV-exposed justice-involved rural women. Additionally, future research could expand upon the current study by comparing the trajectories of PTSD and HCV/HIV risk behavior among IV-exposed rural women with histories of substance use and sexual risk-taking who do and do not undergo periods of incarceration to understand the role that being in jail plays on the association between PTSD and HCV/HIV risk behavior.

4.2 Exploratory Findings

In contrast with the null findings for PTSD symptoms on HCV/HIV risk behavior, higher levels of general anxiety leading up to and during incarceration were correlated with a higher propensity to have engaged in sexual risk behavior before incarceration and predicted a steeper decrease in sexual risk behavior across the re-entry period. Moreover, women with higher anxiety symptom severity at baseline experienced a more rapid decrease in sexual risk behavior soon after release from jail, whereas sexual risk behavior declined more steadily across the re-entry period among those with lower anxiety symptom severity. The opposite pattern was found for depression: women with lower depressive

symptoms at baseline experienced a steeper decrease in sexual risk behavior soon after release from jail, and post-incarceration sexual risk-taking declined more steadily for those with higher depressive symptoms. For women with higher anxiety or lower depressive symptoms, sexual risk behavior initially decreased from baseline to month 6 and subsequently increased from month 6 to month 12, resulting in no effect of anxiety or depressive symptoms on sexual risk-taking at the last assessment. Notably, these results were specific to sexual risk behavior, as both anxiety and depressive symptoms at baseline were not associated with injection drug risk behavior.

Some prior studies report a positive association between sexual risk behavior and symptoms of anxiety or depression among women (Coyle et al., 2019; Pettes et al., 2015; Staton-Tindall et a., 2015a), whereas others report no association (Crepaz and Marks, 2001). In the present study, baseline levels of anxiety, PTSD, and depression showed strong positive correlations indicating that general psychiatric distress was elevated leading up to or during incarceration. However, only anxiety was associated with IV-exposed women's sexual risk-taking at baseline, and both anxiety and depression were related to sexual risk behavior post-release. Anxiety symptoms may have contributed to sexual risk behavior prior to incarceration (above and beyond PTSD and depression) and may have also led to greater decreases in sexual risk-taking during the early stages of community re-entry. Although this finding may seem counterintuitive, it is possible that anxiety symptoms impaired women's judgment and facilitated impulsive sexual decisions before incarceration (Erez et al., 2014; Khan et al., 2009) and also prompted women to engage in safer sex practices post-incarceration out of concern, worry, or fear of future consequences related to their sexual behavior, particularly if said behavior was associated with the reason

for incarceration. Anxiety symptoms are generally considered to be future-oriented, whereas PTSD symptoms (as measured by the GAIN TSS) are characterized by to what extent individuals are bothered by past traumatic events. Thus, symptoms of anxiety—but not PTSD—may relate to change in sexual risk behavior since they promote concern about future events or consequences. Continued research is needed to characterize the nature of women's anxiety symptoms since the measurement tool used to assess anxiety symptoms (The GAIN AFS) provides a broad assessment of multiple anxiety-related diagnostic categories, including generalized anxiety, panic, phobias, obsessions and compulsions, anger, and paranoia. It is possible that worrying or concern about the future, the possibility of being arrested again or contracting and transmitting infectious diseases, or about their own health or the health of their partners, may be protective (i.e., associated with reductions in sexual risk behaviors) or maladaptive (i.e., increases or has no association with sexual risk-taking). Additionally, future longitudinal research is needed to examine whether sexual risk behavior among women with low anxiety symptoms continues to decrease and whether women with high anxiety symptoms experience an increase in sexual risk-taking past the one-year mark of having re-entered into the community.

Given the unexpected association between anxiety and sexual risk behavior, we conducted an exploratory analysis and found that intervention condition did not lead to different associations between anxiety and post-release sexual risk behavior trajectories (see appendix). All study participants received psychoeducation on safe sex practices, which may have prompted women with higher anxiety symptoms to reflect on the consequences of their sexual behavior, facilitating a short-term decrease in post-release sexual risk-taking. However, as mentioned above, it is unclear whether the significant post-

release decrease in sexual risk-taking among all participants is due to being incarcerated, receiving an HCV/HIV risk reduction intervention, or a naturalistic pattern of behavior change over time. Our results suggest that psychiatric symptoms, and specifically anxiety and depression, may be more closely related to post-incarceration sexual risk behaviors than injection drug risk behaviors. Women were enrolled in the study if they had a history of using substances and were (at least) in moderate need of a substance use intervention. Prevention and treatment strategies aimed at reducing sexual risk behaviors among vulnerable justice-involved women with substance use histories may benefit from integrating evidence-based strategies that address anxiety symptoms, whereas interventions for injection drug risk behavior may focus on addressing symptoms of addiction (e.g., tolerance, withdrawal, physiological dependence). Our results also highlight the need to explore alternative or additional interventions, such as anxiety-focused treatments or booster sessions during re-entry, particularly for women with high anxiety symptoms before and during incarceration.

4.3 Implications, Limitations, and Directions for Future Research

The present study's findings have important implications for providing mental and behavioral healthcare to incarcerated rural Appalachian women with histories of substance use, sexual risk behavior, and IV. As described above, women's overall engagement in HCV/HIV risk behavior and PTSD symptoms decreased following release from jail. However, the study design precludes our ability to state whether change in risk behavior and PTSD symptoms is due to the brief HCV/HIV risk reduction interventions women received or to periods of or release from incarceration. Despite the overall decrease in risk

behavior, many women engaged in at least one form of injection drug (18-24%) or sexual risk behavior (54-67%) after re-entering into the community. Additionally, 31-41% of women continued to meet criteria for possible PTSD (≥5 symptoms on TSS) post-incarceration, a rate that is substantially higher than estimates from the general U.S. population (10%; Mitchell et al., 2012). Rural Appalachian women who engage in HCV/HIV risk behaviors or experience PTSD symptoms post-release may benefit from psychosocial support or treatments beyond what was provided in the WISH study while in jail or following community re-entry.

Establishing predictors of intervention response is an important area of research and can help providers make informed decisions regarding which intervention is appropriate at what dose and for whom. Some IV-exposed women may benefit from brief behavioral risk reduction interventions offered during incarceration, whereas others may require more intensive interventions, including evidence-based trauma-informed interventions or PTSD-specific treatments. Trauma-informed interventions promote awareness of the impact trauma exposure has on the individual and typically include strength-based approaches that promote recovery, resilience, and overall wellness by teaching cognitive and behavioral skills. Several trauma-informed interventions have been successfully administered in jails and prisons and demonstrate reductions in PTSD symptoms, substance use, and sexual risk-taking (Hien et al., 2010; see King, 2017 for a review). However, to the authors' knowledge, the effectiveness of "gold standard" psychological treatments that specifically target PTSD symptoms has yet to be tested among currently incarcerated or imprisoned populations (Harner et al., 2015). One study examining the effect of a group-based PTSD-specific treatment (e.g., Cognitive Processing Therapy) among imprisoned men and

women has recently completed data collection, and results are forthcoming (Koenigs, 2019). PTSD-specific treatments require clinicians to receive specialized training and are typically offered over the course of 12-16 weeks (Lancaster et al., 2016). Although possible, these factors make the widespread implementation of PTSD-specific treatments in jail settings improbable due to the transient nature of the population and limited resources available. Important future directions are to identify who will benefit from brief behavioral interventions, who needs (or would prefer) additional or alternative trauma-focused care, and when is the optimal time to administer the interventions.

Future research should investigate rural Appalachian women's uptake of behavioral and medical healthcare after being released from jail. Past research by Dushay and colleagues (2001) suggests that although there was no difference in HCV/HIV risk reduction between the HIV-Ed and an enhanced culturally-informed intervention administered to substance users in the community, individuals who enrolled in substance use treatment services in the six months following the interventions demonstrated greater reductions in risk behavior at follow-up than those who did not. Women in the present sample were not seeking mental or behavioral health treatment when they enrolled in the study but were given a list of local health services in rural Appalachia as part of psychoeducation. Unlike treatment-seeking samples, women in the current study may have presented with varying levels of motivation to change their injection drug and sexual risk behaviors or engage in services during community re-entry. Examining the uptake of mental and behavioral health treatment after women are released from jail may help to elucidate factors that explain the variability in women's propensity to engage in HCV/HIV risk behaviors during re-entry, especially considering the geographic barriers to health care

services and stigma against help-seeking that Appalachian women face. Other notable factors to consider are women's perceptions of HCV/HIV risk behaviors, their ability to obtain stable housing and employment, as well as the quality of their social support networks and level of caretaking responsibilities following release from jail (Clone et al., 2014; Staton-Tindall et al., 2015b; Visher & Bakken, 2014).

Although findings from this study are not generalizable to men, women of color, and individuals outside of rural Appalachia or without justice involvement, this study focuses on a population—justice-involved rural Appalachian women with IV histories—that is at risk for deleterious health consequences and, until recently, has not been a focus of HCV/HIV prevention efforts. Experiences of physical, sexual, and emotional abuse are ubiquitous among rural Appalachian women who use substances (Shannon et al., 2016; Staton et al., 2018b) and may be perceived by these women as normal or unavoidable. Since IV-exposed women may have a poorer perceived ability to negotiate safe injection and sex practices with their intimate partners (Mittal et al., 2013; Teitelman et al., 2008; Wagner et al., 2009), it is possible that women who transition back into relationships with partners that perpetrate IV may be at increased risk for HCV/HIV following release from jail. Designing strength-based HCV/HIV risk reduction interventions that explicitly target the cultural values of self-reliance and resiliency promoted by Appalachian communities (Helton & Keller, 2010) may foster women's empowerment in their romantic relationships and increase their perceived ability to safely engage in HCV/HIV behaviors.

In addition to the aforementioned ways future research can expand upon the methodological limitations of the present study, several other improvements should be considered. First, PTSD symptoms were only measured at three time points, which

precluded our ability to model non-linear change, as well as to conduct a more nuanced analysis evaluating how reductions in PTSD symptoms predict reductions in HCV/HIV risk behavior following release from jail. Increasing the number of assessments could boost statistical power for advanced analyses modeling the parallel process of change in PTSD and HCV/HIV risk behavior over time (Little, 2013). Additionally, longitudinal studies with multiple assessments of PTSD symptoms prior to, during, and following periods of incarceration could elucidate patterns of change in PTSD symptoms among IV-exposed justice-involved rural women with substance use histories. Second, the interview used to assess PTSD, anxiety, and depression—the GAIN—was based on the fourth edition of the DSM but was not a formal diagnostic assessment. Future research evaluating psychiatric conditions among justice-involved women may consider using clinician-administered assessments or self-report measures that are based on criteria in the updated fifth edition of the DSM to increase diagnostic precision. However, increasing the number of assessments and including formal diagnostic measures should be carefully weighed against the added participant burden. Third, the present study did not have a control condition, which precludes our ability to draw definitive conclusions regarding the impact of brief HCV/HIV risk reduction interventions above and beyond periods of or release from incarceration. Additionally, we are not able to discern whether women in the sample benefited from HCV/HIV interventions specifically or whether they would have benefited from any intervention at all. Future research could explore to what extent periods of incarceration alone may facilitate changes in HCV/HIV risk behaviors, given that individuals in jail are often separated from environments where injection and sexual risk behaviors occur. However, excluding a control condition is a common practice when testing efficacious

interventions in real-world settings (Buchanan et al., 2007), given the ethical concerns for withholding interventions that may be beneficial to at-risk or vulnerable individuals.

4.4 Conclusions

This study addresses a critical gap in efforts to reduce injection drug and sexual risk behavior among IV-exposed rural Appalachian women with substance use histories—a uniquely vulnerable and disadvantaged population at high risk for deleterious health outcomes—by examining brief HCV/HIV interventions through a trauma-informed perspective. Our findings indicate PTSD symptoms were not associated with women's change in injection drug or sexual risk behavior after community re-entry. Moreover, women's change in HCV/HIV risk behavior after being released from jail did not differ based on whether they received brief psychoeducation or a motivational interviewing-based intervention while incarcerated. PTSD symptoms trended toward decreasing more during re-entry for women who received a motivational-interviewing enhanced intervention compared to women who received psychoeducation alone, although this should be interpreted with caution. An unexpected finding was that anxiety and depressive symptoms prior to and during incarceration were associated with different trajectories of change in sexual, but not injection drug, risk behavior post-release. The results of this study add to a growing literature aimed at developing targeted prevention and intervention efforts for reducing HCV/HIV risk behaviors among justice-involved rural Appalachian women.

APPENDIX

Supplemental Table. Conditional Latent Growth Curve Model Estimates for the Effect of Baseline Anxiety and Intervention Condition on Sexual Risk Behavior

	Sexual Risk Behavior
	Conditional LGCM
Means and Variances	
I mean	**1.72 (0.25), *p* < .001**
I variance	**0.74 (0.25), *p* = .003**
LS mean	**-3.08 (0.63), *p* < .001**
LS variance	**5.40 (1.77), *p* = .002**
QS mean	**1.21 (0.29), *p* < .001**
QS variance	**1.09 (0.37), *p* = .003**
Covariance	
I with LS	-0.43 (0.44), *p* = .33
I with QS	0.19 (0.19), *p* = .30
LS with QS	**-2.40 (0.79), *p* = .002**
Time-invariant Covariates	
PTSD → I	**0.05 (0.02), *p* = .008**
Intervention → I	-0.36 (0.28), *p* = .19
Anxiety by Intervention → I	0.05 (0.04), *p* = .35
Anxiety → I	0.05 (0.04), *p* = .25
Depression → I	-0.05 (0.04), *p* = .24
PTSD → LS	-.003 (0.05), *p* = .95
Intervention → LS	025 (0.76), *p* = .74
Anxiety by Intervention → LS	-0.11 (0.12), *p* = .35
Anxiety → LS	-0.18 (0.11), *p* = .09
Depression → LS	0.20 (0.11), *p* = .08
PTSD → QS	-0.01 (0.22), *p* = .67
Intervention → QS	0.02 (0.35), *p* = .97
Anxiety by Intervention → QS	0.03 (0.05), *p* = .56
Anxiety → QS	**0.11 (0.05), *p* = .04**
Depression → QS	**-0.10 (0.05), *p* = .05**

Note: I = intercept; LS = linear slope; QS = quadratic slope. Unstandardized estimates are shown with standard errors in parentheses.

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VITA

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EDUCATION

2021-2022 **Predoctoral Internship, Clinical Psychology**
Traumatic Stress Track, The Charleston Consortium
Medical University of South Carolina/Ralph H. Johnson VA Medical Center, Charleston, SC

2016-2019 **Master of Science, Clinical Psychology**
University of Kentucky, Lexington, KY (APA- and PCSAS-accredited)

2010-2014 **Bachelor of Science, Psychology**
Minors: Women's and Gender Studies, Religious Studies
College of Charleston, Charleston, SC

PROFESSIONAL POSITIONS

2019-2021 **Affiliate Graduate Research Assistant** - Supervisor: Dr. Shannon Sauer-Zavala, Treatment Innovation for Psychological Services, Department of Psychology, University of Kentucky

2018-2021 **Treatment Co-Developer, Study Therapist, Peer Supervisor** - Supervisors: Dr. Shannon Sauer-Zavala, Dr. Christal Badour, Dr. Thomas G. Adams, Clinic for Emotional Health, Department of Psychology, University of Kentucky

2017-2018 **Graduate Research Assistant** – Supervisor: Dr. Diane Follingstad, Center for Research on Violence Against Women, University of Kentucky

2016-2021 **Graduate Research Assistant** – Supervisor: Dr. Christal Badour, Stress, Trauma, and Recovery Research Collaborative, Department of Psychology, University of Kentucky

2013-2016 **Statistical and Research Analyst** – Supervisor: Dr. Matthew Carpenter, Department of Psychiatry & Behavioral Sciences and Hollings Cancer Center, Medical University of South Carolina

2013-2014 **Undergraduate Research Assistant** – Supervisor: Dr. Laura Arnstein Carpenter, Department of Developmental Pediatrics, Medical University of South Carolina

2013-2014 **Undergraduate Research Assistant** – Supervisor: Dr. Lisa Thomson Ross, Department of Psychology, College of Charleston

PEER-REVIEWED PUBLICATIONS

14. Sauer-Zavala, S., Southward, M.W., **Hood, C.O.**, Elhusseini, S., Fruhbauerova, M., Stumpp, N.E., & Semcho, S.A. (In press). Conceptual development and case data for a modular, personality-based treatment for borderline personality disorder. *Personality Disorders: Theory, Research, and Treatment.* DOI: 10.31234/osf.io/mu3ez

13. Jones, A.C., Lim, S., **Hood, C.O.**, Brake, C.A., & Badour, C.L. (In press). Affective lability moderates the associations between negative and positive urgency and posttraumatic stress. Epub online ahead of print. *Traumatology*. DOI: 10.1037/trm0000270

12. Flores, J., Brake, C.A., **Hood, C.O.,** & Badour, C.L. (In press). Posttraumatic stress and risky sex in trauma-exposed college students: The role of personality dispositions toward impulsive behavior. Epub online ahead of print. *Journal of American College Health*. PMCID: PMC8086839 DOI: 10.1080/07448481.2020.1819289

11. **Hood, C.O.**, Southward, M.W., Bugher, C., Sauer-Zavala, S. A preliminary evaluation of the Unified Protocol among trauma-exposed adults with and without PTSD. *International Journal of Environmental Research and Public Health, 18*(21), 1-13. DOI: 10.3390/ijerph182111729

10. **Hood, C.O.**, Jones, A.C., Flores, J., Badour, C.L., & Feldner, M.T. (2020). Distress tolerance interacts with peritraumatic emotions to predict posttraumatic stress symptoms following sexual victimization. *Traumatology*, *26*(4), 396-404. PMCID: PMC7992979
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9. **Hood, C.O.**, Ross, L.T., & Wills, N. (2020). Family factors and depression among college students: Understanding the role of self-compassion. *Journal of American College Health, 68*(7), 683-687. PMCID: PMC7085279 DOI: 10.1080/07448481.2019.1596920

8. **Hood, C.O.** & Badour, C.L. (2020). The effects of posttraumatic stress and trauma-focused disclosure on experimental pain sensitivity among trauma-exposed women. *Journal of Traumatic Stress*, *33*(6), 1071-1081. PMCID: PMC7725999 DOI: 10.1002/jts.22571

7. **Hood, C.O.**, Tomko, R.L., Baker, N.L., Tuck, B., Flanagan, J.C., Carpenter, M.J., Saladin, M., Gray, K.M., & McClure, E.A. (2020). Examining sex, adverse childhood experiences, and oxytocin on neuroendocrine reactivity in smokers. *Psychoneuroendocrinology*, *120*, 1-5.
PMCID: PMC7502468 DOI: 10.1016/j.psyneuen.2020.104752

6. McClure, E.A., Baker, N.L., **Hood, C.O.**, Tomko, R.L. Squeglia, L.M., Flanagan, J.C., Carpenter, M.J. & Gray, K.M. (2020). Cannabis and alcohol co-use in a smoking cessation pharmacotherapy trial for adolescents and emerging adults. *Nicotine & Tobacco Research, 22*(8), 1374-1382. PMCID: PMC7364825 DOI: 10.1093/ntr/ntz170

5. McClure, E.A., Baker, N.L., Gray, K.M., **Hood, C.O.**, Tomko, R.L., Carpenter, M.J., Ramakrishnan, V.R., Buchanan C.J. & Saladin, M.E. (2020). The influence of gender and oxytocin on stress reactivity, cigarette craving, and smoking in a randomized, placebo-controlled laboratory relapse paradigm. *Psychopharmacology*, *237*, 543-555.
PMCID: PMC7024045 DOI: 10.1007/s00213-019-05392-z

4. Tomko, R.L., Baker, N.L., **Hood, C.O.**, Gilmore, A.K., McClure, E.A., Squeglia, L.M., McRae-Clark, A.L., Sonne, S.C., & Gray, K.M. (2020). Depressive symptoms and cannabis use in a placebo-controlled trial of n-acetylcysteine for adult cannabis use disorder. *Psychopharmacology*, *237*, 479-490. PMCID: PMC7024037 DOI: 10.1007/s00213-019-05384-z

3. Brake, C.A., Adams, T.G., **Hood, C.O.**, & Badour, C.L. (2019). Posttraumatic mental contamination and the interpersonal theory of suicide: Effects via DSM-5 PTSD symptoms clusters. *Cognitive Therapy and Research*, *43*(1), 259-271. PMCID: PMC6615747 DOI: 10.1007/s10608-018-9959-9

2. Jones, A.C., Badour, C.L., Brake, C.A., **Hood, C.O.**, & Feldner, M.T. (2018). Facets of emotion regulation and posttraumatic stress: Indirect effect of peritraumatic dissociation. *Cognitive Therapy and Research*, *42*(4), 497-509. PMCID: PMC7500485 DOI: 10.1007/s10608-018-9899-4

1. Ross, L.T., **Hood, C.O.**, Short, S.D. (2016). Unpredictability and symptoms of depression and anxiety. *Journal of Social and Clinical Psychology*, *35*(5), 371-385. DOI: 10.1521/jscp.2016.35.5.371

HONORS AND AWARDS

2021	Jesse G. Harris, Jr. Dissertation Research Award
2021	University of Kentucky Graduate Student Congress Travel Award
2019	National Institute on Drug Abuse Director's CPDD Travel Award
2018	Education Abroad New Horizons Scholarship Recipient
2014	Psi Chi Southeastern Regional Travel Grant Recipient
2014	Graduated with Honors, Magna Cum Laude
2011-2014	College of Charleston Dean's List, Highly Distinguished Student
2010-2014	South Carolina Palmetto Fellows Scholarship Recipient
2010-2014	College of Charleston Edgar Cato Scholarship Recipient
2010-2014	College of Charleston Foundation Scholarship Recipient