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Behavioral Risk Assessment for Infectious Diseases (BRAID): Self-report Instrument To Assess Injection and Noninjection Risk Behaviors in Substance Users*

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Abstract

Background—Infectious diseases such as Human Immunodeficiency Virus and Hepatitis C are a significant problem among substance abusers. Current risk behavior measures [e.g., HIV Risk Taking Behavior Scale (HRBS) and Risk Assessment Battery (RAB)] were developed for injection drug users and do not include newly identified risks or noninjection drug use behaviors. This study developed and provided initial, internal validation of the Behavioral Risk Assessment for Infectious Diseases (BRAID) to assess infectious disease risk behaviors among alcohol and other drug users.

Methods—A self-report measure was developed from literature regarding risk behaviors. Participants (total N=998) with alcohol/substance use disorder completed the measure in 2 phases to establish initial psychometric validity.

Results—Phase 1 (N=270) completed 65 self-report questions; factor analysis revealed a 12-item solution with 5 factors (Unprotected Sex with Risky Partners, Injection Use, Sex on Cocaine/Crack, Condom Availability, and Intranasal Drug Use). Infectious disease history was positively associated with Injection Use (Sample 1) and Unprotected Sex with Risky Partners (Sample 2) and

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negatively associated with Intranasal Drug Use (Samples 1 and 2). Phase 2 (N=728) added additional injection-related items and confirmed the factor structure of the existing BRAID.

Conclusions—The BRAID is a 5-factor, 14-item self-report measure of past 6 month risk behaviors that is composed of noninjection and injection risk behaviors and was psychometrically confirmed. Though additional external (convergent/divergent) validation is needed, this report provides preliminary support for the use of the BRAID to assess infectious disease risk in substance users.

Keywords

HIV; BRAID; drug use disorder; noninjection; injection

1. INTRODUCTION

Infectious diseases, such as Human Immunodeficiency Virus (HIV), Hepatitis C (HCV), chlamydia, syphilis, and gonorrhea, are a significant problem among alcohol and other drug users. Between 2012 and 2013, more than 47,000 and 29,000 people were newly diagnosed with HIV and HCV in the United States, respectively (Centers for Disease Control and Prevention (CDC), 2013), and HIV and HCV account for more than 30,000 annual deaths (CDC, 2013). The incidence of chlamydia, syphilis, and gonorrhea has also recently increased in the US for the first time since 2006 (National Center for HIV/AIDS, Viral Hepatitis, STD, and TB Prevention, 2015). Infectious diseases are generally blood-borne illnesses that can be transmitted through sexual behaviors and injection drug use (CDC, 2013; National Center for HIV/AIDS, Viral Hepatitis, STD, and TB Prevention, 2015), though a growing body of research has implicated noninjection drug use (such as prescription drug and noninjection stimulant use) as additional robust risk factors for disease acquisition (Strathdee and Sherman, 2003; Neaigus et al., 2007; Scheinmann et al., 2007; Cicero et al., 2007; Substance Abuse and Mental Health Services Association, 2014).

Research regarding the acquisition of infectious diseases among substance users has largely focused on HIV and the specific contribution that drug injection and drug-related sexual risk behaviors (e.g., the use of sex to procure drugs or money for drugs) have on transmission. Two risk assessments, the HIV Risk-taking Behaviour Scale (HRBS) (Darke et al., 1991) and the Risk Assessment Battery (RAB) (Navaline et al., 1994), were created in the early 1990's to quantify the incidence and frequency of HIV risk behaviors among intravenous drug users. These scales helped to guide prevention, intervention, and research efforts, and continue to be the most widely-reported scales for measuring infectious disease risk behaviors among substance users. Yet they are limited by a lack of rigorous psychometric evaluation. For instance, the HRBS was originally developed (Darke et al., 1990) and validated (Darke et al., 1991) for injection drug users and its reliability has only been subsequently evaluated in a single study of 84 substance users (Petry, 2001). No published studies have psychometrically validated the RAB. In addition, the risky sexual behaviors assessed by the HRBS and RAB are not equated with unprotected sex. Thus, endorsement of sexual risk behaviors on these scales can represent condom-protected and unprotected sex, which incur substantially different levels of risk.

Since the development of the HRBS and RAB, several additional transmission and "proxy" risk behaviors have been identified within substance users that have been repeatedly associated with increased disease risk. These include noninjection risks such as sharing intranasal drug use equipment (Koblin et al., 2003) and binge drug use (Miller et al., 2006), and injection behaviors that incur heightened risk, such as transitioning between noninjection and injection drug use (Griffiths et al., 1992; Strang et al., 1992; Griffiths et al., 1994; Darke et al., 1994a, 1994b; Crofts et al., 1996; Irwin et al., 1996; Fuller et al., 2002; Abelson et al., 2006), assisting someone with injections or being a new intravenous drug user (Hagan et al., 2001; Vidal-Trecan et al., 2002; Wood et al., 2003; Roy et al., 2004; O'Connell et al., 2005; Fairbairn et al., 2006), and being a former but not current intravenous drug user (Friedman et al., 1995; Neaigus et al., 2001b). Additional sexual risk behaviors have also been identified, including the frequency of anal and vaginal sexual intercourse and whether the act was insertive or receptive (Benotsch et al., 1999; Hoffman et al., 2000), sex with other drug users (Neaigus et al., 2001a; Bravo et al., 2003; Roy et al., 2004; Purcell et al., 2006), having sex while under the influence of drugs (Celentano et al., 2006), having sex for an extended duration of time (Semple et al., 2009), having a lifetime history of a sexually transmitted disease (Hwang et al., 2000; Kalichman et al., 2005), and being sexually active following an HIV diagnosis (Campsmith et al., 2000; Aidala et al., 2006; Carrieri et al., 2006; Niccolai et al., 2006; Brewer et al., 2007). Finally, risks specific to the drug class being abused, including alcohol (Fitterling et al., 1993; Rasch et al., 2000; Stein et al., 2000; Rees et al., 2001; Kalichman et al., 2005; Raj et al., 2006), stimulants (Booth et al., 2000; Logan and Leukefeld, 2000; McCoy et al., 2004; Edwards et al., 2006; Volkow et al., 2007), and opioids (Sanchez et al., 2002; El-Bassel et al., 2003; Conrad et al., 2015) have also been associated with increased disease risk. Since all of these risks were identified after the development of the HRBS and RAB, they were not included in those assessments and are therefore not systematically queried or reliably used to determine infectious disease risk profiles for patients.

The current study aimed to develop and conduct initial validation studies on an updated measure of noninjection and injection risk behaviors for infectious disease among alcohol and other drug users. The Behavioral Risk Assessment for Infectious Diseases (BRAID) incorporates a broader and more up-to-date range of risk behaviors, including the aforementioned noninjection drug use and unprotected sexual risk factors, to permit a more thorough characterization of infectious disease risk behaviors, and was developed within the context of a large and diverse sample of alcohol and other drug users to increase overall generalizability.

2. METHODS

2.1 Study Phases

This study was conducted in two phases. Phase 1 consisted of initial scale development and Phase 2 consisted of scale extension and confirmation. Phase 1 and Phase 2 were conducted in independent and diverse samples of substance users (described below and meant to represent both alcohol and other drug users; Table 1). Collapsed across samples, participants (N=998) reported regular abuse of alcohol (51.9% of participants); cocaine/crack (42.2%);

prescription stimulants (31.0%), opioids (25.7%), and sedatives (24.0%); heroin (19.8%); and amphetamine/methamphetamine (11.5%). A total of 25.5% of participants reported ever injecting a drug. Overall, participants had a lifetime diagnosis of chlamydia (16.8%), gonorrhea (16.1%), HCV (11.8%), human papillomavirus (HPV) (5.7%), trichomoniasis (5.4%), genital herpes (4.9%), syphilis (4.8%), and HIV (3.3%). The Johns Hopkins University, University of Pennsylvania, and University of Vermont Institutional Review Boards (IRBs) all approved this study and all subjects provided informed consent to participate.

2.2. Study Measures

2.2.1. Demographic Questionnaire—Participants in both study phases completed a brief demographic and drug use questionnaire (Table 1). Due to the nature of the study samples and need for brevity, demographic questions varied slightly across the phases and therefore do not allow for direct comparison for some items.

2.2.2. Initial BRAID Questionnaire—A questionnaire was developed based upon risk behaviors associated with the acquisition of infectious diseases in substance users that were identified through an extensive literature review. Independent experts in infectious disease risk then reviewed the items and provided qualitative recommendations, and modifications were made accordingly. This first version contained 65 questions and assessed risk behaviors over the preceding 6-month period. At this time, the BRAID was conceptualized as a method of assessing noninjection infectious risk behaviors; as a result, the questions were focused heavily on noninjection drug use and sexual risk behaviors.

2.2.3. Infectious Disease History Questionnaire—Participants were asked to identify (yes/no) whether they had ever been diagnosed with chlamydia, genital warts, gonorrhea, Hepatitis B, HCV, herpes, HIV or AIDS, HPV, syphilis, or trichomoniasis.

2.3 Phase 1: Initial Scale Development

2.3.1. Phase 1 Participants—Participants for Phase 1 were recruited from multiple injection and noninjection substance-using populations and included stimulant users (n=73), patients maintained on methadone (n=50), patients with alcohol use disorder (n=70), and opioid/cocaine-using outpatients (n=77). Recruitment occurred in Burlington, VT (1 site; n=45), Baltimore, MD (3 sites; n=155), and Philadelphia, PA (1 site; n=70), for a total of 270 participants. Participants were approached by a staff member or responded to a flyer to participate in a brief, self-report questionnaire study. Eligibility criteria were being 18 or older, being a known substance user, and being fluent in English. Participants were compensated up to $10 for participation. Demographics, drug use characteristics, and infectious disease history are presented in Table 1.

2.3.2. Phase 1 Selection of BRAID Items—The thirty items with the highest rates of responding and the least content overlap with other items were selected from the 65-item BRAID and submitted to exploratory factor analysis. This process was subjective and designed to maximize the diversity of questions. Items that relied upon endorsement of others (e.g., item 38: does being high from crack or cocaine increase, decrease, or have no

effects on how long your sex lasts; item 39: by how many minutes) were excluded from the analyses in favor of the primary items. Items that were similar in content were prioritized for analysis based upon the level of risk they incurred and/or the rate at which they were endorsed. A complete list of all items queried during Phase 1 is available as Supplemental Material[1].

2.3.3. Exploratory Factor Analysis—Items were dichotomized and submitted to polychoric correlation using the *mixed.cor* function in the *psych* toolbox (Revelle, 2015) in R (R Core Team, 2013). Variables with missing data were correlated using a "pairwise-complete" algorithm. Generalized weighted least square factor extraction, which is robust against non-normality, was used due to the non-normality of dichotomized BRAID items. Parallel analysis, assessed using the *fa.parallel* function in the *psych* package in R, was used to identify the initial number of factors to extract in the exploratory factor anlaysis. Latent variables assumed in the BRAID model might reasonably be expected to co-vary, so an oblique factor rotation (*oblimin)* was chosen over an orthogonal rotation. Items were eliminated from the model if they loaded poorly (< .40) on their intended primary factor (Floyd and Widaman, 1995), if they exhibited poor item-total correlation (< .30), or if their removal increased scale score reliability (estimated using Cronbach's alpha). Once the initial factor structure of the BRAID was established, remaining items were evaluated by adding them to the model one at a time and applying the above-mentioned exclusion criteria.

2.3.4. Confirmatory Factor Analysis—Confirmatory factor analysis was conducted using the *lavaan* package (Rosseel, 2012) in R with the robust weighted least squares estimator. The model allowed each variable to load onto its primary intended factor, with all other factor loadings set to 0. Factors were identified by fixing them to unit variance. This confirmatory factor model is a more conservative test of fit of the model identified by the exploratory factor analytic solution. Model fit was evaluated using the comparative fit index (CFI), the standardized root mean square residual (SRMR) (Bentler, 1995; Hu and Bentler, 1999), and root mean square error of approximation (RMSEA). Consideration of a combination of fit indexes, with "acceptable fit" values of SRMR < 0.09, CLI > 0.90, and RMSEA < 0.06, has been shown to minimize both type I and type II error, even in models of small samples (n ≤ 250) (Hu and Bentler, 1999).

2.3.5 Phase 1 Results—Exploratory factor analysis in Phase 1 revealed a 13-item solution with 5 unique factors: Unprotected Sex with Risky Partners (5 items), Injection Use (2 items), Sex on Cocaine/Crack (2 items), Condom Availability (2 items), and Intranasal Drug Use (2 items). Following removal of one poorly-performing item from the Unprotected Sex with Risky Partners factor, confirmatory factor analysis of data collected from Sample 1 indicated excellent model fit (RMSEA =.050 [90% CI: .000–.083], SRMR = .061, CFI = .937).

[1]Supplementary material can be found by accessing the online version of this paper at http://dx.doi.org and by entering doi:...

2.4 Phase 2: BRAID Scale Confirmation

2.4.1 Phase 2 Participants—Participants for Phase 2 were recruited using the online crowd-sourcing technology Amazon Mechanical Turk (MTurk), an emerging platform for participant recruitment (Buhrmester et al., 2011). Through this technology, researchers ("requesters") post advertisements ("HITs") for online studies in which participants ("workers") can elect to participate. The survey was restricted to participants residing within the United States who had ≥80% approval rate from completion of previous assignments through MTurk. Participants were required to complete a brief introductory survey to assess their eligibility for the primary survey. The population being targeted was concealed to prevent individuals from misrepresenting themselves to be eligible for the study. Eligibility criteria were being 18 or older, being fluent in English, and reporting current heavy drinking (e.g., ≥3 and ≥4 drinks per day for women and men, respectively) or using of heroin, cocaine/crack, methamphetamine, or prescription opioids, sedative, or stimulants that were not prescribed to them with the intention of getting high, three times a week or more for the past year. A total of 7,730 individuals completed the eligibility survey, and 728 (9.4% of those who completed the eligibility survey) met the inclusion criteria and completed the study, for which they received $2. Participant demographics, drug use characteristics, and infectious disease history are presented in Table 1.

2.4.2 Phase 2 Selection of BRAID Items—Twenty-seven of the items from Phase 1 were administered to participants in Phase 2; 3 items were removed because they were dependent upon answering another item (e.g., "If sex with crack or cocaine increases or decreases length of sex, by how many minutes is it increased or decreased?"). The BRAID as confirmed in Phase 1 contained an "Injection/Opioid Use" factor, however the scale at that time was focused on noninjection transmission risks and did not include items related to sharing needles or drug works, which are conventionally assessed and highly predictive risk factors for infectious disease transmission. In an effort to make the BRAID relevant to both injection and noninjection drug-using groups, three additional injection risk items were presented to participants ("sharing needles", "sharing any cookers, cottons/works, or injection water", and "injected someone with a needle").

2.4.3 Phase 2 Analysis—Between-group confirmatory factor analysis was used to test for factorial invariance between the 12-item BRAID ratings collected in Phase 1 and Phase 2, to determine whether the BRAID had similar measurement properties across the samples. Group factor analysis was conducted using the *lavaan* package in R, with the robust weighted least squares estimator. Model fit in factorial invariance models was assessed using a combination of change in the CFI, SRMR, and RMSEA. Simulation indicates these fit indices are sensitive to measurement invariance and lack of measurement invariance at the levels (factor loadings, intercepts, and residuals, or weak, strong, and strict invariance) tested within this sample (Chen, 2007). Group sizes differed between samples 1 (N=270) and 2 (N=728). In small (< 300) or unequal sample sizes, decreases in CFI > 0.005, increases in RMSEA > 0.010, and increases in SRMR > 0.025 indicate nonvariance when modeling weak factorial invariance, and decreases in CFI > 0.005, increases in RMSEA > 0.010, and increases of SRMR > 0.005 indicate noninvariance when modeling strong and strict invariance (Chen, 2007). Responses to the three new injection risk items were then added to

a confirmatory factor analysis model for Phase 2 data, with these new injection risk items loading only onto the previously titled “Injection/Opioid Use” factor, and fixed to zero loading on all other factors.

2.4.4 Phase 2 Results—Strict factorial invariance was demonstrated between responses to the 12-item BRAID in Phase 1 and Phase 2 (Table 2), which indicates the BRAID displays nearly identical psychometric properties in both samples. Addition of the three new injection risk items to the confirmatory factor analysis of the 12-item BRAID in Phase 2 data yielded poor model fit (RMSEA = .059 [90% CI: .051–.066], SRMR = .061, CFI = .825). Removing the worst-performing item from the Injection Use factor (“Have you used an opioid like heroin, OxyContin, or Vicodin?”) improved model fit (RMSEA = .052 [90% CO: .044–.060], SRMR = .046, CFI = .874), yielding a 14-item BRAID with a simple overall factor structure (Table 3) and a more clearly focused Injection Drug Use factor.

2.5 Phase 2 Comparisons of Outcomes to Infectious Disease History

2.5.1 Data Analysis—Endorsement of BRAID risk factors from Samples 1 and 2 (excluding the Injection Risk factor, which presented different items to the two samples) were compared using Fisher’s exact tests, and lifetime history of infectious disease was computed for each participant as a dichotomous measure (yes/no) and regressed on BRAID factor scores with structural equation modeling using the *sem* function of the *lavaan* toolbox in R.

2.5.2 Results of Comparisons—Table 4 presents the prevalence of risk behaviors identified by BRAID items. Samples 1 and 2 differed significantly on their endorsement of unprotected sex with drug users and paid partners, sexual behaviors related to crack or cocaine, and condom carrying. As shown in Table 5, the Injection Use factor was significantly positively associated with the number of infectious diseases with which an individual had been diagnosed in Sample 1 ($B = 0.201$, $z = 2.51$, $p = 0.012$), Unprotected Sex with Risky Partners was significantly positively associated with the number of infectious diseases diagnosed in Sample 2 ($B = 0.22$, $z = 2.16$, $p = 0.031$), and endorsement of Intranasal Drug was significantly negatively associated with number of infectious diseases diagnosed in both Sample 1 ($B = -0.21$, $z = -3.02$, $p = 0.003$) and Sample 2 ($B = -0.16$, $z = -2.36$, $p = 0.018$).

3. RESULTS

This manuscript describes the initial development of the Behavioral Risk Assessment for Infectious Diseases (BRAID), a self-report measure of infectious disease risk behaviors in substance users. The BRAID has the potential to update and expand previous risk assessments like the HRBS and RAB by querying a broader and more contemporary array of risk behaviors, by explicitly defining risky sexual behavior as unprotected, and by deriving the items through sampling a large and diverse group of injection and noninjection substance users. Confirmatory factor analysis revealed a 5-scale, 14-item, self-report measure that asks participants to identify specific risk behaviors in which they have engaged (yes/no) over the preceding 6-month period. Preliminary results suggest the BRAID has promise to be an

updated assessment of risk behaviors for infectious diseases among alcohol and other drug users.

The two participant samples in this study varied across geographic regions, along many clinically-relevant variables, and were predominately noninjection drug users. That the factor structure remained robust across both samples, despite pronounced differences in group demographics, drug use, and infectious disease characteristics, provides strong support for the validity of this scale. A primary goal of this scale was to identify specific noninjection substance use and sexual risk behaviors that should be more frequently queried as part of behavioral risk assessments, to extend previous scales that had been developed specifically for injection drug users. The final BRAID items address numerous unprotected sexual risk behaviors, as well as intranasal drug use behaviors and condom availability, that are not included in prior risk assessments.

Participant responses on the BRAID revealed relatively high levels of many risk behaviors, with more than 20% of the overall sample endorsing past 6-month unprotected sex or sex with an alcohol or other drug user. Conversely, 41% and 58% of respondents reported having been provided with a condom and having a condom available right now, respectively. The Condom Availability subscale represents a potential protective factor against infectious disease transmission and may provide a novel method for detecting improvement in risk behaviors over time. In clinical settings, lack of endorsement of these items could also signal a clear target for immediate intervention. Significant associations were observed between a history of infectious disease and the Injection Use factor (Sample 1) and Unprotected Sex with Risky Partners factor (Samples 1 and 2). Endorsement of the Intranasal Drug Use factor also appeared to be protective against infectious disease history. These results are likely explained by the fact that injection drug users are unlikely to simultaneously be intranasal users, though more research is warranted to fully explore this association. Although the BRAID factor structure was retained in these samples, it will be important to replicate these results within a larger sample of participants who have been diagnosed with an infectious disease.

4. DISCUSSION

Strengths of this study include the reliance upon empirical literature to develop the questionnaire items, sampling from a large and diverse group of alcohol and other drug users, systematic psychometric evaluation of the subscales, inclusion of both injection and noninjection drug use behaviors, and an emphasis on unprotected sexual behaviors. Limitations include the fact that items were self-report and were not delivered via Audio-CASI, a well-known method for asking about HIV risk behaviors during interviews (Des Jarlais et al., 1999) that could have biased participant responding. In addition, items were selected for analysis during Phase 1 based upon qualitative decisions and not firm response thresholds. One final potential limitation is that Sample 2 was collected via the MTurk crowdsourcing platform. Crowdsourcing is an emerging form of participant recruitment (Buhrmester et al., 2011) that has value for recruiting individuals who may not be enrolled and/or attending treatment but are using drugs (arguably making them higher risk individuals), and who reside across wide geographic regions, which reduces the likelihood

that responses are region-specific. Comparisons of data collected via crowdsourcing and in-person reveal consistent response patterns that validate the use of crowdsourcing (Boynton and Richman, 2014; Bartneck et al., 2015). It is noteworthy that only 9.4% of the individuals who attempted to participate in Phase 2 were considered eligible, which supports the fidelity of the screening system that was employed. Though this recruitment style does prevent verification of participant substance use, the consistency in factor structure across the two samples is promising and supports the continued evaluation of the BRAID for assessment of infectious disease risk behaviors.

This study developed and conducted initial validations of the Behavioral Risk Assessment for Infectious Diseases (BRAID) as a self-report measure with 5 independent and complementary subscales that assess injection and noninjection risk behaviors. Preliminary evidence from these initial studies suggest the BRAID has the potential to contribute an updated measure to research on infectious disease risk among alcohol and other drug users. Additional research is needed to evaluate the convergent, divergent, and construct validity of the BRAID with existing measures such as the HRBS and RAB, and to examine its psychometric properties in other patient populations such as those with infectious disease history. Evaluations of the BRAID's test-retest reliability and predictive validity will also be critical to support its use in both research and clinical settings. Overall, these data provide preliminary support for further evaluation of the BRAID to assess a diverse array of infectious disease risk behaviors among alcohol and other drug users.

Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

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References

Abelson J, Treloar C, Crawford J, Kippax S, van Beek I, Howard J. Some characteristics of early-onset injection drug users prior to and at the time of their first injection. Addiction. 2006; 101:548–555. [PubMed: 16548934]

Aidala AA, Lee G, Howard JM, Caban M, Abramson D, Messeri P. HIV-positive men sexually active with women: sexual behaviors and sexual risks. J Urban Health. 2006; 83:637–655. [PubMed: 16770702]

Bartneck C, Duenser A, Moltchanova E, Zawieska K. Comparing the similarity of responses received from studies in Amazon's Mechanical Turk to studies conducted online and with direct recruitment. PLoS One. 2015; 10:e0121595. [PubMed: 25876027]

Benotsch EG, Kalichman SC, Kelly JA. Sexual compulsivity and substance use in HIV-seropositive men who have sex with men: prevalence and predictors of high-risk behaviors. Addict Behav. 1999; 24:857–868. [PubMed: 10628518]

Bentler, PM. EQS, Structural Equations Program Manual. Multivariate Software; Encino, CA: 1995.

Booth RE, Kwiatkowski CF, Chitwood DD. Sex related HIV risk behaviors: differential risks among injection drug users, crack smokers, and injection drug users who smoke crack. Drug Alcohol Depend. 2000; 58:219–226. [PubMed: 10759032]

Boynton MH, Richman LS. An online daily diary study of alcohol use using Amazon's Mechanical Turk. Drug Alcohol Rev. 2014; 33:456–461. [PubMed: 24893885]

Bravo MJ, Barrio G, de la Fuente L, Royuela L, Domingo L, Silva T. Reasons for selecting an initial route of heroin administration and for subsequent transitions during a severe HIV epidemic. Addiction. 2003; 98:749–760. [PubMed: 12780363]

Brewer TH, Zhao W, Metsch LR, Coltes A, Zenilman J. High-risk behaviors in women who use crack: knowledge of HIV serostatus and risk behavior. Ann Epidemiol. 2007; 17:533–539. [PubMed: 17407822]

Buhrmester M, Kwang T, Gosling SD. Amazon's Mechanical Turk: a new source of inexpensive, yet high-quality, data? Perspect. Psychol Sci. 2011; 6:3–5.

Campsmith ML, Nakashima AK, Jones JL. Association between crack cocaine use and high-risk sexual behaviors after HIV diagnosis. J Acquir Immune Defic Syndr. 2000; 25:192–198. [PubMed: 11103051]

Carrieri MP, Rey D, Serraino D, Tremolieres F, Mechali D, Moatti JP, Spire B. Manif 2000 Study Group. Oral contraception and unprotected sex with occasional partners of women HIV-infected through injection drug use. AIDS Care. 2006; 18:795–800. [PubMed: 16971290]

Celentano DD, Valleroy LA, Sifakis F, MacKellar DA, Hylton J, Thiede H, McFarland W, Shehan DA, Stoyanoff SR, LaLota M, Koblin BA, Katz MH, Torian LV. for the Young Men's Survey Study Group. Associations between substance use and sexual risk among very young men who have sex with men. Sex Transm Dis. 2006; 33:265–271. [PubMed: 16434886]

Centers for Disease Control Prevention (CDC). [Last accessed July 25, 2016] HIV Surveillance Report: Diagnosis of HIV Infection and AIDS in the United States and Dependent Areas. 2013. Available at http://www.cdc.gov/hiv/library/reports/surveillance/

Centers for Disease Control and Prevention (CDC). [Last accessed July 25, 2016] Viral Hepatitis-Statistics and Surveillance. Surveillance for Viral Hepatitis - United States, 2013. 2013. Available at http://www.cdc.gov/hepatitis/statistics/2013surveillance/

Chen FF. Sensitivity of goodness of fit indexes to lack of measurement invariance. Struct Equat Model. 2007; 14:464–504.

Cicero TJ, Surratt H, Inciardi JA, Munoz A. Relationship between therapeutic use and abuse of opioid analgesics in rural, suburban, and urban locations in the United States. Pharmacoepidemiol Drug Saf. 2007; 16:827–840. [PubMed: 17636553]

Conrad C, Bradley HM, Broz D, Buddha S, Chapman EL, Galang RR, Hillman D, Hon J, Hoover KW, Patel MR, Perez A, Peters PJ, Pontones P, Roseberry JC, Sandoval M, Shields J, Walthall J, Waterhouse D, Weidle PJ, Wu H, Duwve JM. Centers for Disease Control and Prevention (CDC). Community outbreak of hiv infection linked to injection drug use of oxymorphone--Indiana, 2015. MMWR. 2015; 64:443–444. [PubMed: 25928470]

Crofts N, Louie R, Rosenthal D, Jolley D. The first hit: circumstances surrounding initiation into injecting. Addiction. 1996; 91:1187–1196. [PubMed: 8828246]

Darke S, Cohen J, Ross J, Hando J, Hall W. Transitions between routes of administration of regular amphetamine users. Addiction. 1994a; 89:1077–1083. [PubMed: 7987184]

Darke S, Hall W, Carless J. Drug use, injecting practices and sexual behaviour of opioid users in Sydney, Australia. Br J Addict. 1990; 85:1603–1609. [PubMed: 2289060]

Darke S, Hall W, Heather N, Ward J, Wodak A. The reliability and validity of a scale to measure HIV risk-taking behaviour among intravenous drug users. AIDS. 1991; 5:181–185. [PubMed: 2031690]

Darke S, Swift W, Hall W, Ross M. Predictors of injecting and injecting risk-taking behaviour among methadone-maintenance clients. Addiction. 1994b; 89:311–316. [PubMed: 8173500]

Des Jarlais DC, Paone D, Milliken J, Turner CF, Miller H, Gribble J, Shi Q, Hagan H, Friedman SR. Audio-computer interviewing to measure risk behaviour for HIV among injecting drug users: a quasi-randomised trial. Lancet. 1999; 353:1657–1661. [PubMed: 10335785]

Edwards JM, Halpern CT, Wechsberg WM. Correlates of exchanging sex for drugs or money among women who use crack cocaine. AIDS Educ Prev. 2006; 18:420–429. [PubMed: 17067253]

El-Bassel N, Gilbert L, Rajah V. The relationship between drug abuse and sexual performance among women on methadone. Heightening the risk of sexual intimate violence and HIV. Addict Behav. 2003; 28:1385–1403. [PubMed: 14512062]

Fairbairn N, Wood E, Small W, Stoltz JA, Li K, Kerr T. Risk profile of individuals who provide assistance with illicit drug injections. Drug Alcohol Depend. 2006; 82:41–46. [PubMed: 16150556]

Fitterling JM, Matens PB, Scotti JR, Allen JS Jr. AIDS risk behaviors and knowledge among heterosexual alcoholics and non-injecting drug users. Addiction. 1993; 88:1257–1265. [PubMed: 8241925]

Floyd FJ, Widaman KF. Factor analysis in the development and refinement of clinical assessment instruments. Psychol Assess. 1995; 7:286–299.

Friedman SR, Jose B, Deren S, Des Jarlais DC, Neaigus A. Risk factors for human immunodeficiency virus seroconversion among out-of-treatment drug injectors in high and low seroprevalence cities. The National AIDS Research Consortium. Am J Epidemiol. 1995; 142:864–874. [PubMed: 7572963]

Fuller CM, Vlahov D, Ompad DC, Shah N, Arria A, Strathdee SA. High-risk behaviors associated with transition from illicit non-injection to injection drug use among adolescent and young adult drug users: a case-control study. Drug Alcohol Depend. 2002; 66:189–198. [PubMed: 11906806]

Griffiths P, Gossop M, Powis B, Strang J. Extent and nature of transitions of route among heroin addicts in treatment--preliminary data from the Drug Transitions Study. Br J Addict. 1992; 87:485–491. [PubMed: 1559047]

Griffiths P, Gossop M, Powis B, Strang J. Transitions in patterns of heroin administration: a study of heroin chasers and heroin injectors. Addiction. 1994; 89:301–309. [PubMed: 8173499]

Hagan H, Thiede H, Weiss NS, Hopkins SG, Duchin JS, Alexander ER. Sharing of drug preparation equipment as a risk factor for hepatitis C. Am J Public Health. 2001; 91:42–46. [PubMed: 11189822]

Hoffman JA, Klein H, Eber M, Crosby H. Frequency and intensity of crack use as predictors of women's involvement in HIV-related sexual risk behaviors. Drug Alcohol Depend. 2000; 58:227–236. [PubMed: 10759033]

Hu L, Bentler PM. Cutoff criteria for fit indexes in covariance structure analysis: conventional criteria versus new alternatives. Struct Equat Model. 1999; 6:1–55.

Hwang LY, Ross MW, Zack C, Bull L, Rickman K, Holleman M. Prevalence of sexually transmitted infections and associated risk factors among populations of drug abusers. Clin Infect Dis. 2000; 31:920–926. [PubMed: 11049771]

Irwin KL, Edlin BR, Faruque S, McCoy HV, Word C, Serrano Y, Inciardi J, Bowser B, Holmberg SD. Crack cocaine smokers who turn to drug injection: characteristics, factors associated with injection, and implications for HIV transmission. The Multicenter Crack Cocaine and HIV Infection Study Team. Drug Alcohol Depend. 1996; 42:85–92. [PubMed: 8889407]

Kalichman SC, Cain D, Knetch J, Hill J. Patterns of sexual risk behavior change among sexually transmitted infection clinic patients. Arch Sex Behav. 2005; 34:307–319. [PubMed: 15971013]

Koblin BA, Factor SH, Wu Y, Vlahov D. Hepatitis C virus infection among noninjecting drug users in New York City. J Med Virol. 2003; 70:387–390. [PubMed: 12767001]

Logan TK, Leukefeld C. Sexual and drug use behaviors among female crack users: a multi-site sample. Drug Alcohol Depend. 2000; 58:237–245. [PubMed: 10759034]

McCoy CB, Lai S, Metsch LR, Messiah SE, Zhao W. Injection drug use and crack cocaine smoking: independent and dual risk behaviors for HIV infection. Ann Epidemiol. 2004; 14:535–542. [PubMed: 15350952]

Miller CL, Kerr T, Frankish JC, Spittal PM, Li K, Schechter MT, Wood E. Binge drug use independently predicts HIV seroconversion among injection drug users: implications for public health strategies. Subst Use Misuse. 2006; 41:199–210. [PubMed: 16393742]

National Center for HIV/AIDS, Viral Hepatitis, STD, and TB Prevention. Reported Cases of Sexually Transmitted Diseases on the Rise, some at an Alarming Rate. Centers for Disease Control and Prevention; Atlanta: 2015.

Navaline HA, Snider EC, Petro CJ, Tobin D, Metzger D, Alterman AI, Woody GE. Preparations for AIDS vaccine trials. An automated version of the Risk Assessment Battery (RAB): enhancing the assessment of risk behaviors. AIDS Res Hum Retroviruses. 1994; 10(Suppl 2):S281–283. [PubMed: 7865319]

Neaigus A, Gyarmathy VA, Zhao M, Miller M, Friedman SR, Des Jarlais DC. Sexual and other noninjection risks for HBV and HCV seroconversions among noninjecting heroin users. J Infect Dis. 2007; 195:1052–1061. [PubMed: 17330797]

Neaigus A, Miller M, Friedman SR, Des Jarlais DC. Sexual transmission risk among noninjecting heroin users infected with human immunodeficiency virus or hepatitis C virus. J Infect Dis. 2001a; 184:359–363. [PubMed: 11443564]

Neaigus A, Miller M, Friedman SR, Hagen DL, Sifaneck SJ, Ildefonso G, des Jarlais DC. Potential risk factors for the transition to injecting among non-injecting heroin users: a comparison of former injectors and never injectors. Addiction. 2001b; 96:847–860. [PubMed: 11399216]

Niccolai LM, D'Entremont D, Pritchett EN, Wagner K. Unprotected intercourse among people living with HIV/AIDS: the importance of partnership characteristics. AIDS Care. 2006; 18:801–807. [PubMed: 16971291]

O'Connell JM, Kerr T, Li K, Tyndall MW, Hogg RS, Montaner JS, Wood E. Requiring help injecting independently predicts incident HIV infection among injection drug users. J Acquir Immune Defic Syndr. 2005; 40:83–88. [PubMed: 16123687]

Petry NM. Reliability of drug users' self-reported HIV risk behaviors using a brief, 11-item scale. Subst Use Misuse. 2001; 36:1731–1747. [PubMed: 11758820]

Purcell DW, Mizuno Y, Metsch LR, Garfein R, Tobin K, Knight K, Latka MH. Unprotected sexual behavior among heterosexual HIV-positive injection drug using men: associations by partner type and partner serostatus. J Urban Health. 2006; 83:656–668. [PubMed: 16736116]

R Core Team. The R Foundation for Statistical Computing. Vienna, Austria: 2013. R: A language and environment for statistical computing. Available at http://www.R-project.org/ [Last accessed on July 25, 2016]

Raj A, Cheng DM, Levison R, Meli S, Samet JH. Sex trade, sexual risk, and nondisclosure of HIV serostatus: findings from HIV-infected persons with a history of alcohol problems. AIDS Behav. 2006; 10:149–157. [PubMed: 16482406]

Rasch RF, Weisen CA, MacDonald B, Wechsberg WM, Perritt R, Dennis ML. Patterns of HIV risk and alcohol use among African-American crack abusers. Drug Alcohol Depend. 2000; 58:259–266. [PubMed: 10759036]

Rees V, Saitz R, Horton NJ, Samet J. Association of alcohol consumption with HIV sex- and drug-risk behaviors among drug users. J Subst Abuse Treat. 2001; 21:129–134. [PubMed: 11728786]

Revelle, W. psych: Procedures for Personality and Psychological Research. Northwestern University; Evanston IL: 2015. Available at http://CRAN.R-project.org/package=psych [Last accessed on July 25, 2016]

Rosseel Y. Iavaan: An R package for structural equation modeling. J Stat Softw. 2012; 48:1–36.

Roy KM, Goldberg DJ, Hutchinson S, Cameron SO, Wilson K, MacDonald L. Hepatitis C virus among self declared non-injecting sexual partners of injecting drug users. J Med Virol. 2004; 74:62–66. [PubMed: 15258969]

Sanchez J, Comerford M, Chitwood DD, Fernandez MI, McCoy CB. High risk sexual behaviours among heroin sniffers who have no history of injection drug use: implications for HIV risk reduction. AIDS Care. 2002; 14:391–398. [PubMed: 12042084]

Scheinmann R, Hagan H, Lelutiu-Weinberger C, Stern R, Des Jarlais DC, Flom PL, Strauss S. Non-injection drug use and Hepatitis C Virus: a systematic review. Drug Alcohol Depend. 2007; 89:1–12. [PubMed: 17174481]

Semple SJ, Zians J, Strathdee SA, Patterson TL. Sexual marathons and methamphetamine use among HIV-positive men who have sex with men. Arch Sex Behav. 2009; 38:583–590. [PubMed: 18185990]

Stein MD, Hanna L, Natarajan R, Clarke J, Marisi M, Sobota M, Rich J. Alcohol use patterns predict high-risk HIV behaviors among active injection drug users. J Subst Abuse Treat. 2000; 18:359–363. [PubMed: 10812309]

Strang J, Des Jarlais DC, Griffiths P, Gossop M. The study of transitions in the route of drug use: the route from one route to another. Br J Addict. 1992; 87:473–483. [PubMed: 1559046]

Strathdee SA, Sherman SG. The role of sexual transmission of HIV infection among injection and non-injection drug users. J Urban Health. 2003; 80:iii7–14. [PubMed: 14713667]

Substance Abuse and Mental Health Services Association. Results from the 2013 National Survey on Drug use and Health: Summary of National Findings. Substance Abuse and Mental Health Services Administration; Rockville, MD: 2014.

Vidal-Trecan GM, Varescon-Pousson I, Boissonnas A. Injection risk behaviors at the first and at the most recent injections among drug users. Drug Alcohol Depend. 2002; 66:107–109. [PubMed: 11906797]

Volkow ND, Wang GJ, Fowler JS, Telang F, Jayne M, Wong C. Stimulant-induced enhanced sexual desire as a potential contributing factor in HIV transmission. Am J Psychiatry. 2007; 164:157–160. [PubMed: 17202559]

Wood E, Spittal PM, Kerr T, Small W, Tyndall MW, O'Shaughnessy MV, Schechter MT. Requiring help injecting as a risk factor for HIV infection in the Vancouver epidemic: implications for HIV prevention. Can J Public Health. 2003; 94:355–359. [PubMed: 14577743]

Highlights

- Risk assessments for infectious disease in substance users do not include contemporary risks
- The Behavioral Risk Assessment for Infectious Diseases (BRAID) is a 14-item self-report, dichotomous measure of past 6 months risk behaviors
- The BRAID has been initially psychometrically validated in injection and noninjection users

Table 1

Demographic, Drug Use, and Infectious Disease Characteristics

	Phase 1 (N = 270)	Phase 2 (N = 728)
Demographics		
Age in years (%)		
18–29	13	53
30–39	20	32
40–49	40	11
50–59	31	4
60 or older	6	2
Male (%)	62	52
Race (%)		
African American	63	6
Caucasian	34	81
Other	3	5
Hispanic (%)	8	7
Heterosexual (%)	93	84
Married (%)	12	29
Substance Use (% of participants)	**Past 30 day**	**Used ≥3 week past year**
Amphetamine/Methamphetamine	9	14
Alcohol	52	52
Cocaine/Crack	76	8
Heroin	31	9
Prescription Opioids[a]	12	39
Prescription Benzodiazepines/Sedatives[a]	7	41
Prescription Stimulants[a]	N/A[b]	31
Ever injected a drug (%)	39	12
In opioid maintenance treatment (%)	37	N/A[b]
Enrolled in drug treatment (%)	47	N/A[b]
History of Infectious Disease Diagnosis (% participants)		
Chlamydia	17	N/A[b]
Genital Herpes	3	7
Gonorrhea	27	5
Hepatitis C (HCV)	21	2
Human Immunodeficiency Virus (HIV)	6	1
Human Papillomavirus (HPV)	4	8
Syphilis	7	2
Trichomoniasis	6	5

[a] Values represent illicit or non-prescribed use of prescription medication with a goal of getting high

[b] Item not queried

Table 2

Phases 1 and 2: Factorial Invariance

Level	CFI	RMSEA [95% CI]	SRMR
Loadings	0.924	0.053 [0.043–0.064]	0.047
Weak	0.928	0.049 [0.039–0.058]	0.052
Strong	0.932	0.046 [0.036–0.055]	0.052
Strict	0.948	0.038 [0.028–0.048]	0.052

Table 3

Phase 2: Confirmatory Factor Analysis

Factor	Item	Factor loading estimate	Std.err	Z-value	P(>|z|)
Unprotected Sex with Risky Partners	Unprotected one-night stand(s)	0.543	0.047	11.46	<0.0001
	Unprotected paid partner(s)	0.487	0.082	5.91	<0.0001
	Unprotected sex with drug user(s)	0.833	0.050	16.60	<0.0001
	Unprotected sex with alcohol user(s)	0.463	0.036	12.98	<0.0001
Injection Use	Injection drug use	0.845	0.064	13.21	<0.0001
	Shared an injection needle	0.638	0.106	6.04	<0.0001
	Shared any cookers, cottons/filters, or injection water	0.703	0.088	7.96	<0.0001
	Injected someone else with a drug	0.754	0.084	8.97	<0.0001
Sex on Cocaine/Crack	Unprotected sex on cocaine/crack	0.895	0.040	22.33	<0.0001
	Marathon sex on cocaine/crack	0.804	0.049	16.48	<0.0001
Condom Availability	Provided with condoms	0.825	0.119	6.95	<0.0001
	Have condoms right now	0.611	0.092	6.67	<0.0001
Intranasal Drug Use	Use drugs intranasally	0.796	0.039	20.26	<0.0001
	Share straw(s)	0.808	0.049	16.38	<0.0001

Table 4

Prevalence of Risk Behaviors

Factor	Item	Overall (%) (N=998)	Phase 1 (%) (N = 270)	Phase 2 (%) (N = 728)
Unprotected Sex with Risky Partners	Unprotected one-night stand(s)	20	23	19
	Unprotected paid partner(s)	8	15	5
	Unprotected sex with drug user(s)	24	46	16
	Unprotected sex with alcohol user(s)	38	42	36
Injection Use	Injection drug use	15	24	11
	Opioid use	37	32	39
	Shared an injection needle	4	Not Assessed	4
	Shared any cookers, cottons/filters, or injection water	8	Not Assessed	8
	Injected someone else with a drug	7	Not Assessed	7
Sex on Cocaine/Crack	Unprotected sex on cocaine/crack	23	35	19
	Marathon sex on cocaine/crack	20	33	15
Condom Availability	Provided with condoms	41	49	38
	Have condoms right now	58	65	56
Intranasal Drug Use	Use drugs intranasally	25	25	25
	Share straw(s)	16	15	16

Values represent % participants

Table 5

Associations Between BRAID Factors and History of Infectious Diseases

	Estimate	Std.err	Z-value	P(>|z|)
Sample 1 (N=270)				
Factor				
Unprotected Sex with Risky Partners	0.25	0.14	1.83	0.068
Injection Use	0.20	0.08	2.51	**0.012**
Sex on Cocaine/Crack	0.04	0.12	0.33	0.744
Condom Availability	0.00	0.10	−0.03	0.974
Intranasal Drug Use	−0.21	0.07	−3.02	**0.003**
Sample 2 (N=728)				
Factor				
Unprotected Sex with Risky Partners	0.22	0.10	2.16	**0.031**
Injection Use	0.06	0.07	0.83	0.405
Sex on Cocaine/Crack	0.06	0.07	0.88	0.378
Condom Availability	0.00	0.05	−0.04	0.971
Intranasal Drug Use	−0.16	0.07	−2.36	**0.018**