Characteristics of Youth With, and At High Risk for, HIV

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Abstract

This paper examines the characteristics of 8,251 participants in 10 service demonstration projects targeted to youth living with, or at risk for HIV. Factors predicting risk behaviors and HIV status were identified. Second, exploratory and confirmatory factor analyses identified dimensions underlying HIV risk behaviors. A gender-specific three-factor model was tested, reflecting same-gender vs. opposite-gender sexual behaviors, substance abuse, and risky sex. The results permit an estimation of HIV risk from basic information available when youth present for care in community programs.

Characteristics of Youth With, and At High Risk for, HIV

Adolescents and young adults are disproportionately affected by HIV/AIDS. The Centers for Disease Control and Prevention (CDC) report that, as of December 1997, 633,000 adult and adolescent AIDS cases were reported in the United States, with 3,130 cases in the 13-19 year old age group, and 22,953 cases in the 20-24 year old age group (CDC, 1997). Due to the relatively long lag in developing symptoms of HIV infection, it is likely that many young adults became infected during adolescence. Some estimates suggest that there may be two to three times as many HIV-positive youth for each known case of AIDS (Karon, Rosenberg, McQuillan, Khare, Gwinn, & Peterson, 1996). Sexual exposures account for most reported adolescent AIDS cases, with disproportionately higher rates in African American and Hispanic adolescents and young adults (CDC, 1997).

Factors Impacting HIV Risk: A Multivariate Problem

While numerous factors can be linked to HIV risk behavior in youth, several areas have been consistently identified as particularly important areas of vulnerability in the literature.

Sexual behavior and risk taking. Sexual risk behavior associated with HIV/AIDS transmission typically is initiated by late adolescence. Rotheram-Borus, Mahler, and Rosario (1995) have shown that adolescents have not changed their behavior in response to the pandemic, although they are well informed about HIV/AIDS and hold relatively positive attitudes toward HIV/AIDS prevention. Several studies have also noted that, regardless of their reported high-risk behaviors, adolescents tend not to perceive themselves as being at risk for HIV infection (Malow, McMahaon, Cremer, Lewis, & Alferi, 1997; Reitman, St. Lawrence, Jefferson, Alleyne, Brasfield, & Shirley, 1996; Sikand, Fisher, & Friedman, 1996). High-risk behaviors tend to co-exist in the same individuals and this clustering of behavior already has developed by late adolescence (Petridou, Zavitsanos, Dessypris, & Frangakis, 1997). Thus, to

understand sexual behavior and sexual risk-taking during adolescence, it is essential to consider the various ways that young people construct a sense of themselves as sexual beings.

The use of empirical typologies to describe sexual risk behavior is a relatively common approach for attempting to understand how individuals cluster on a variety of sexual risk variables. The typology approach asks whether there are subsets of individuals who have a particular behavioral pattern of risk. Typically, for each identified behavioral type, prevalence is noted of individuals within type, and group membership within a type is linked with relevant characteristics of background other behavior. Miller, Clark, Wendell, and Levin (1997) describe a typology of adolescent heterosexual experiences with individuals being classified into one of five patterns of sexual experience: Delayers, Anticipators, One-Timers, Steadies, and Multiples. In another study, a combination of multidimensional scaling and cluster analysis was used to describe subtypes of individuals from a statewide survey of high school students' health risk behaviors. Five types of students were identified, with one of the clusters describing traditional "problem behavior" including smoking, unprotected sexual intercourse, and alcohol consumption (Basen-Engquist, Edmundson, & Parcel, 1996).

Substance use. The use of alcohol and other drugs contribute substantially to potential HIV exposure and risk for young adults (Edlin, Irwin, Faruque, McCoy, et al., 1994; Elifson, Boles, & Sweat, 1993; Hou & Basen-Engquist, 1997). Drug use increases the likelihood of teens' participation in sexual risk behaviors and reduces the likelihood of condom use (Hingson, Strunin, Berlin, et al., 1990; King, Delaronde, Dinoi, & Forsberg, 1996). Increased frequency and severity of drug use behaviors and more years of sexual intercourse are associated with an increased number of sexual partners and recent condom nonuse (Shrier, Emans, Woods, & DuRant, 1997). The use of alcohol and other drugs, to cope with having HIV, before or during sex is negatively associated with certain safer sex attitudes and practices (King, et al., 1996). Rates of injection drug use and needle sharing are especially high among youth living on the

streets, thereby putting them at particularly high risk for HIV infection (Kipke, Unger, Palmer, & Edgington, 1997). Substance abuse has been shown to be a key factor in health related risk behaviors in an investigation of Latino youth. Eight behaviors were identified as important predictors of risk: alcohol use, cigarette use, marijuana use, illicit drug use, self-violence, drunk driving, unintended pregnancy, and violence (Brindis, Wolfe, McCarter, & Ball, 1995).

Personal resources. In addition to the key risk factors of sexual behavior and substance use, other factors may contribute to an individual's HIV risk. For example, the personal resources that an individual has, as indicated by the proxy measure of whether or not that individual has had prior mental health involvement or criminal justice involvement, are important factors in understanding an adolescent's ability to navigate through risky options that present themselves during daily life. Mental health problems (e.g., depression, conduct disorder, and substance abuse) and dysfunctional social environment and context (e.g., family, peer, and neighborhood) are associated with adolescent involvement in sexual risk behaviors (Chen, Stiffman, Cheng, & Dore, 1997). In addition, protected and improved patterns of sexual risk acts are associated with low levels of anxiety, depression, and substance use and high levels of self-esteem (Rotheram-Borus, Rosario, Reid, & Koopman, 1995). Strong associations have been demonstrated between substance abuse and delinquency in a number of ethnic groups (Neumark-Sztainer, Story, French, & Cassuto, 1996), suggesting that increased HIV risk through substance abuse may be associated with mental health issues and/or criminal justice system involvement. In a study involving incarcerated adolescents, results indicated very high rates of risk behaviors for HIV infection and STDs, with more than three quarters of the youth reporting three or more sex partners, 25 percent never using condoms, and 19 percent having a current diagnosis of at least one STD. More females than males reported a history of STDs and had higher rates of current diagnoses (Canterbury, McGarvey, Sheldon-Keller, & Waite, 1995).

Social context and homelessness. The influence of peers and family context has been a critical area of research on HIV risk behaviors in youth. A study of African American adolescents examined the effects of peer problem behavior, the absence of a father or equivalent in the home, and the mother-adolescent relationship as predictors of adolescent problem behaviors (Mason, Cauce, Gonzales, & Hiraga, 1994). Older siblings influence adolescent risk behavior (D'Amico & Fromme, 1997). For youth without a home, HIV risk and the likelihood of engaging in risky behaviors is exacerbated. Currently, there are between half a million and two million homeless and runaway teenagers in the United States (Ryan & Futterman, 1997), and many homeless youth have run away from family violence and sexual abuse or have been thrown out of their homes (Busen & Beech, 1997; Ryan & Futterman, 1997; Sondheimer, 1992). Many precariously housed adolescents engage in survival sex (Friedman & Goodman, 1992; Morey & Friedman, 1993; Sondheimer, 1992). These conditions make street youth particularly vulnerable to substance abuse and HIV (Bond, Mazin, & Jiminez, 1992; Clements, Gleghorn, Garcia, Katz, & Marx, 1997). Street youth may be six times more likely to be at risk for HIV infection than non-homeless youth (Cohen, Mackenzie, & Yates, 1991). Homeless youth have particularly high seroprevalence rates (Pfeifer & Oliver, 1997), and require sensitive, youth-oriented programs to connect them to care (Goulart & Madover, 1991; Kipke et al., 1997; Melchiono & Price, 1991; Rotheram-Borus, Meyer-Bahlburg, Rosario, Koopman, Haignere, Exner, Matthieu, Henderson, & Gruen, 1992).

This investigation examines the characteristics of a large sample of adolescents and young adults who participated in a special group of projects targeted for youth with, or at high risk for, HIV. Through its Special Projects of National Significance (SPNS) Program, the Health Resources and Services Administration (HRSA) funds national demonstration projects for HIV/AIDS services. In 1993, HRSA awarded 10 grants to projects that were targeting HIV/AIDS services to adolescents and youth. These 10 projects were relatively heterogeneous

with programs ranging greatly in scope and planned outcomes. Nonetheless, the 10 projects shared target populations, specifically, adolescents and youth who were either already infected with HIV or at high risk to become so, and they shared their aim of building programs with the potential for replication throughout the United States. A cross-cutting evaluation was developed to track the characteristics of the programs and their outcomes (Huba & Melchior, 1998). As would be expected for a national services demonstration program, the HRSA SPNS Program Adolescent Care Grantees differ greatly from one another. Descriptions of the service models for the 10 projects are given in a special issue of the Journal of Adolescent Health (see Huba & Melchior, 1998; Woods, 1998). Whether or not the projects are directly providing tightly-linked systems of medical and psychosocial care, each is seeking to direct youth into such service models (Huba & Melchior, 1998). This paper examines characteristics of the youth served in these national demonstration projects and asks the major ways that they may be classified in terms of their risk behaviors and experiences. Earlier preliminary technical reports (Huba, Melchior, Panter, Brief, Lee, Hodgins, Woods, Kipke, Feudo, Vining-Bethea, Lothrop, Wallace, Sturdevant, Remafedi, Greenberg, Burch, Tenner, Singer, Brady, & Marconi, 1997a, b, c) provide basic descriptive analyses on the early portions of these data. In this paper, we present two approaches toward understanding the characteristics of the youth that are most associated with HIV risk behaviors, as well as how these risk behaviors are associated with each other. Thus, through a series of analyses, we seek to identify the major behavioral dimensions that describe the target population of youth who are HIV-positive or at high risk to become so. Because the 10 projects from whom these data derive in aggregate define a consensus service model that is both youth-focused and comprehensive (see Huba & Melchior, 1998), the analyses presented here serve to illustrate the range of issues that are prevalent among young people served by comprehensive service organizations targeting youth needing HIV-related services.

Method

Cross-Cutting Evaluation Instruments and Design

As part of their involvement as grantees, the 10 projects agreed to participate in a cross-cutting evaluation.[1] The cross-cutting evaluation includes several single-page forms used to track activities of individual clients (see Huba, Melchior, Panter, Brief, Lee, Hodgins, Woods, Kipke, Feudo, Vining-Bethea, Lothrop, Wallace, Sturdevant, Remafedi, Greenberg, Burch, Tenner, Singer, Brady, & Marconi, 1997a, b, c). These forms utilize a fax-in system that allows data to be transmitted via fax from project sites in the field to a central data computer (Huba, Brown, & Melchior, 1995; Huba & Melchior, 1995). The data presented here were collected using the Contact Form (Huba, Melchior, & the HRSA SPNS Program Adolescent Care Projects, 1994). Contact Forms document the characteristics of individuals reached by the adolescent care projects, including patterns of HIV risk behaviors. These forms have been completed in the context of outreach, program enrollment, or to change or update information previously documented for individuals served by the projects.[2] The data of this paper are those from unique individuals, so data have been aggregated across individuals (who may have had one or more contacts during the course of the project). Table 1 shows the number of unique young men and young women in the sample.

Insert Table 1 About Here

Participants

The data in these analyses were collected between December 1993 and March 1998 from 4,141 males and 4,110 females. There were 379 young men known to be HIV-positive and 3,762

who did not have HIV status identified in the data while 158 young women were known to be HIV-positive and 3,952 had unknown HIV status. Men tended to be older (mean = 19.1 years; standard deviation = 3.0 years) than women (mean = 18.4 years; standard deviation = 2.8 years), (t (8194) = 10.06; $p < .001$). Of the young men, 36.8 percent were African American, 3.3 percent were Asian American, 26.9 percent were Caucasian, 26.7 percent were Hispanic/Latino, 1.0 percent were Native American, 2.7 percent were multiracial, and 2.7 percent had an "other" or unknown ethnicity. Among young women, 32.7 percent were African American, 3.8 percent were Asian American, 28.8 percent were Caucasian, 27.2 percent were Hispanic/Latina, 1.0 percent were Native American, 3.4 percent were multiracial, and 3.2 percent had an "other" or unknown ethnicity.[3]

Data Analytic Approach

Two major types of data analyses are used. First, we ask basic questions about the background characteristics that might predict whether or not a particular HIV risk behavior was performed. Logistic regression is used. Second, we examine the underlying structure from the eight major risk variables (by gender) and ask questions about the underlying dimensions among these risk variables. Confirmatory and exploratory factor analysis is used.

Logistic regression analyses. To examine the degree to which background factors predict key dependent measures, logistic regression analyses were used. Logistic regression assesses how well predictor variables (e.g., HIV status, homelessness, runaway status) predict a dichotomous dependent measure. Analyses were conducted using SPSS for Windows, Version 8.0 (SPSS, 1998).

Factor analytic methods: exploratory approach. Exploratory factor analysis is used initially to categorize major patterns of associations among behavioral risk variables. Exploratory factor analysis was conducted on product-moment correlations using maximum likelihood extraction followed by an oblique direct oblimin factor rotation.

Because the results from the exploratory factor analyses will later be used to confirm statistical models of the types of risk behaviors in confirmatory factor analyses, and it is not generally appropriate to use the same data to explore for major trends and then test whether the model fits the data, we used a "split sample" strategy for the exploratory and confirmatory factor analyses. Specifically, the overall male sample of 4,141 cases was randomly split into a derivation sample of 2,033 cases and a cross-validation sample of 2,108 cases. The overall female sample of 4,110 cases was randomly split into a derivation sample of 2,039 cases and a cross-validation sample of 2,071 cases. Consistent with the typical practice, the derivation sample was used for the exploratory factor analyses and initial restricted (confirmatory) factor analysis solutions. Final confirmation of the restricted factor analysis models was done in the independent cross-validation samples.

Factor analytic methods: confirmatory statistical approach. Supplementing the exploratory factor analysis methods, more advanced methods of "confirmatory" or "restricted" factor analysis were used to extend results on the major typologies of risk behavior. The LISREL 8.20 program (Jöreskog & Sörbom, 1993, 1998) was used for confirmatory factor analyses. These methods allow one to specify in advance the major patterns of relationships among indicators and, therefore, the factors that should be obtained. One specifies a model by stating whether indicators are expected to load on each factor, how interrelated the factors are expected to be (if at all), and then tests to see if this proposed structure is statistically plausible for the observed empirical data. The LISREL computer program also permits us to make more appropriate assumptions about the data than does traditional exploratory factor analysis on product-moment correlations. As noted later, the major risk behavior variables modeled in this paper are coded to have either three categories (behavior not present, behavior present in the past but not currently, behavior present currently) or six categories, such as is the case for the risk variables associated with sex with males (protected or not), sex with females (protected or not),

and injection drug use (shared needles or not). In all cases, while it is possible to assume that the variables represent continuously-measured, ordered categories, it is making a stronger assumption – as is made with more traditional methods of factor analysis – to assume that the risk variables represent a quantitative scale from 1 to 3, or 1 to 6. Consequently, through using polychoric (or "latent") correlations in LISREL rather than traditional product-moment correlations, "weaker" assumptions can be made about the scaling properties of the major variables. We use these more statistically appropriate approaches when modeling confirmatory data structures in this paper.

Technically, the confirmatory factor analyses use polychoric correlation coefficients estimated from the PRELIS 2.20 computer program (Jöreskog & Sörbom, 1998) as input to the LISREL 8.20 computer program for analysis using weighted least squares estimation. Goodness-of-fit, evaluating the match between the proposed factor structure and the observed data, was assessed in multiple ways according to standard recommendations (Hoyle & Panter, 1995) including the chi-square goodness-of-fit test, the Comparative Fit Index (Bentler, 1990), and the root mean square of the discrepancy between actual and estimated correlation coefficients (or RMSEA; Steiger, 1990). An extended discussion of such methods to obtain more precise and statistically correct models of risk variables is provided by Huba and Harlow (1986, 1987).

Other analyses. For some of the sets of variables, canonical correlation analysis was used to determine if one set of variables, taken as a whole, is significantly related to another set. When individual correlations are shown in tables, their significance levels have been adjusted for the number of correlations coefficients examined at a time, using the Bonferroni correction. Thus, the significance levels shown are simultaneous confidence intervals. All exploratory factor and canonical correlation analyses were conducted in SPSS for Windows, Version 8.0 (SPSS, 1998).

Results

Prevalence of HIV-Related Behaviors Among Youth Served in These Projects

In the context of this investigation, data collected regarding HIV-related behaviors are not risk behaviors in the usual sense; that is, they are not coded in terms of risk for HIV transmission per se. In terms of these 10 adolescent-focused projects, the behaviors are used as markers for potential service interventions. For example, when service staff code a young person's level of "sex risk," they are simultaneously making an assessment of the youth's needs and triaging that person for possible enrollment into health services or other resources. Thus, these may be considered to be indicators of HIV-related service need. The following analysis of youth behaviors should be interpreted within this context.

Initial scaling of HIV-related behaviors. Eight behavioral indicators were coded from the Contact Form data. Sexual behaviors were coded into two indicators: Risky Sex with Men and Risky Sex with Women. Both indicators were derived from a combination of information as to whether and how recently the individual had engaged in sex and whether and how recently he or she had engaged in unprotected sex. For example, Risky Sex with Men was defined as a 6-level variable.[4] Risky Sex with Women was defined in a parallel way. This classification scheme was examined separately by gender and was judged to be an effective coding heuristic for risky sexual behaviors. Injection Drug Risk was coded in a similar way as a combination of information known about the individual's injection drug use and needle sharing behavior.[5, 6] Other HIV-related behaviors and markers included Sex with an Injection Drug User, Survival Sex, Sex with an HIV-Positive Partner, having a Sexually Transmitted Disease (STD), and Substance Abuse. Each of these indicators was coded as a 3-level variable.[7]

Table 2 summarizes each behavioral index by gender and known HIV status. As can be seen in Table 2, in nearly every case these indices differentiate youth who are known to be HIV-positive from those whose HIV status is unknown. However, the degree to which the variables

relate to HIV status varies considerably. For example, the current risk for substance abuse is only slightly higher for HIV-positive males, and is actually lower for HIV-positive females. In contrast, current risk for survival sex is about four times higher for HIV-positive males and females than for their counterparts for whom HIV status is unknown.

Insert Table 2 About Here

Interrelations among the risk behaviors by gender are shown in Table 3. The lower triangle of the correlation matrix for males and the lower triangle of the correlation matrix for females shows the product-moment correlations among these risk factors based on the entire sample of 4,141 males and 4,110 females. While the patterns of intercorrelations are mostly similar for males and females, there are some notable variations. For example, among males, having sex with an HIV-positive partner was correlated with risky sex with males $\underline{r} = .37$, but these two variables were uncorrelated among females ($\underline{r} = .01$). Other gender differences among these relationships appear to be largely a function of different patterns of sexual behaviors between the young males and females.[8]

Insert Table 3 About Here

Table 4 shows interrelations between four additional youth characteristics (e.g., homeless, runaway, criminal justice involved, and mental health involved) and the eight HIV-

related behavior indicators for both males and females (again using the full samples for males and females). The largest canonical correlation between the set of HIV-related behaviors and these characteristics was .38 for males (Wilks $\lambda = .80$, F (32, 15228) = 29.25, $p < .001$) and .35 for females (Wilks $\lambda = .83$, F (32, 15114) = 24.72, $p < .001$). Thus, for both males and females, a youth's status as homeless or runaway was moderately related to risky sex with men, sex with an injection drug user, survival sex, substance abuse, and injection drug risk. Involvement in the criminal justice system was also moderately related to substance abuse and injection drug risk. For both males and females, involvement in mental health services appeared to be related to risky sex with men, survival sex, sex with an HIV-positive partner, survival sex, having a sexually transmitted disease, and injection drug risk.

Insert Table 4 About Here

Predicting HIV Risk Behaviors and Predicting HIV Status: Logistic Regressions

To assess the likelihood that performing each risk behavior (yes or no) is a function of five characteristics of the youth – HIV status, being a runaway, being homeless, having involvement with the criminal justice system, and having involvement with the mental health system – and the eight risk factors were re-coded into dichotomies. These dichotomies indicated whether or not the client performed each behavior.

Predicting risk behavior. Referring to the categories for the variables listed in Table 2, risky sex with men and risky sex with women were coded as "0" if the client participated in no sex or protected sex and as "1" if the client participated in current or prior unprotected sex. For

the other behaviors, a “0” was coded if there was no known risk and a “1” was coded if there was any current or prior risk. Then, logistic regression analyses were performed with these new dichotomous risk factors as the dependent measures and HIV status, homeless status, runaway status, criminal justice system involvement, and mental health system involvement as the independent variables. Separate analyses were conducted for males and females. For each of the 16 logistic regression analyses, there was a significant overall association between the re-coded risk behavior and the dependent measure. Table 5 summarizes these analyses.

Insert Table 5 About Here

In looking at Table 5, each analysis can be interpreted in the following way. The logistic regression tests for the independent contribution of each factor in the context of the other four factors. Consider the regression to predict the first variable listed (Risky Sex with Men) among the young men in the sample. The test for the model shows that the risk behavior is significantly predicted from the five factors. The significance tests next to the Wald statistic for each factor show that Risky Sex with Men is predicted by knowing HIV status, the homelessness status of the client, and whether or not he is involved with the mental health system. Examining the odds ratio associated with this result, it appears that HIV-positive young men are about six times more likely to have engaged in this behavior than are those whose HIV status is unknown. Independent of HIV status, an individual known to be involved with the mental health system is about twice as likely to engage in Risky Sex with Men than is a young man who is not so involved. Note that there are not significant contributions of status as a runaway youth or involvement with the criminal justice system.

Next, it is informative for each regression model to compare the results for young men with those for young women, presented in the right portion of the table. Note that, while there is also a statistically significant prediction of the behavior of Risky Sex with Men for young women, the contributing factors are different. For young women, being HIV-positive is not a predictor of Risky Sex with Men, although homeless status, criminal justice system involvement, and mental health system involvement are significant predictors.

Predicting HIV status. We conducted – separately for young men and young women – logistic regression analyses in which HIV status was the outcome (dependent) measure. We used the eight risk behaviors and four additional variables (runaway status, homelessness, involvement with the criminal justice system, and involvement with the mental health system) to predict HIV status (HIV-positive or HIV-unknown). The resulting logistic regressions are significant for males ($\chi^2(12, N = 4{,}141) = 1086.92$, $p < .001$) and for females ($\chi^2(12, N = 4{,}110) = 500.37$, $p < .001$). In a prediction sense, 52.8 percent of the HIV-positive young men are correctly identified using the prediction equation (or odds ratios) implied by Table 6, and 97.7 percent of the HIV-unknown young men are correctly identified. Similarly, 36.7 percent of the HIV-positive young women are correctly identified and 99.3 percent of the HIV-unknown young women are correctly identified from the 12 factors. A weighting scheme based on the 12 characteristics used on independent variables in the analyses of Table 6 may prove to be highly useful in screening youth entering services for likely HIV status. Note that these equations are not necessarily exact because youth with HIV are not fully identified by these projects (or the service system as a whole).

Insert Table 6 About Here

The prediction results just shown are heavily weighted by asking youth about a very important risk behavior – whether a sex partner is known to have been HIV infected. For youth who are truly screened because they do not currently know their HIV status to be positive, it may be difficult to obtain this information. Consequently, we conducted the logistic regressions a second time without this indicator, obtaining results shown in the bottom half of Table 6. The regression equations remain statistically significant; for young men, $\chi^2(11, \underline{N} = 4{,}141) = 836.73$, $\underline{p} < .001$; for young women $\chi^2(11, \underline{N} = 4{,}110) = 153.33$, $\underline{p} < .001$. Note that the importance given to selected information learned in the clinic would be weighted differently in this model. Also, using these alternate prediction equations, less than half of the HIV-positive young men (42.7 percent) would be identified correctly, but nearly all of the HIV-unknown young men would be identified correctly (97.6 percent). For women, less than one percent of HIV-positive young women would be identified correctly (0.6 percent) though nearly all HIV-unknown young women would be correctly categorized (99.9 percent), as only two of the more than 4,000 women would be predicted to have HIV as determined from the equation.

Identifying Preliminary Structure Underlying the Eight Risk Behaviors: Exploratory Factor Analysis

Table 7 shows results for the exploratory factor analyses of the youth risk behavior variables obtained in the derivation samples of 2,033 males and 2,039 females. There are three major dimensions of risk factors for young men and women. The choice to retain a three-factor solution (right side of Table 7) derives from an examination of the distribution of the eigenvalues

of the correlation matrix, statistical tests of fit, and an examination of alternate solutions above and below the retained three-factor solution.

For both males and females, the first factor includes having risky sex with men, and not having risky sex with women. Thus, for both genders, the first factor appears to reflect Sexual Intercourse with Men as opposed to women. The second factor (for males) includes sex with an injection drug user, survival sex, substance abuse and injection drug risk. These three indicators plus survival sex also form the second factor for females. The second factor thus may reflect immersion in a substance abuse culture. It is important to note that same-sex sexual activity is related to the first and third factors for young men but to the second factor for young women. The different loadings for same-sex activity represent its different functional significance for those young men and young women who are recruited into programs for those youth at high-risk to become infected with HIV and seem related to the different risks at which opposite- or same-sex sexual activity puts young men and young women for HIV transmission. The third factor (for males and females) includes sex with an HIV-positive partner and having an STD, and smaller loadings for survival sex and having sex with a drug injector. This factor might be labeled High Risk Sexual Behaviors.

Insert Table 7 About Here

Describing Factor Structure Underlying the Eight Risk Behaviors: Confirmatory Factor Analysis

As just noted, we first explored the data using a derivation sample of one half of the data. In this section we further refine the dimensional analyses and then use a complete statistical confirmation of the patterns using a confirmatory factor analysis model. Thus, as a follow-up to

the initial exploratory factor analyses of risk behavior for the young men and young women, we conducted confirmatory (or restricted) factor analyses on the same data. As noted earlier, these analyses depart from traditional exploratory factor analysis in that we start with a hypothesized model and determine how well it fits the observed data using such methods. Also, instead of assuming that the variables are measured at the interval level (that is, that the values 1, 2, 3, etc. are "equally-spread" ones), the analyses here only assume that the variables are measured at the ordinal level (or that the values coded as "2" are larger than those coded as "1," the values coded as "3" are larger than those coded as "2," etc.).

To develop an initial model for the data from the young men, we started with the three-factor solution presented in the right side of Table 7, derived in our exploratory sample of 2,033 cases. From this solution, we hypothesized a first factor of same-gender versus opposite-gender sexual risk behaviors that would be expected to have strong loadings for the variables of risky sex with men, risky sex with women (but in the opposite way), and sex with an HIV-positive partner. Based on results from the exploratory analysis, we would also expect the first factor to have a negative loading for substance abuse suggesting that the factor contrasts men who have sex with men (and to some degree HIV-positive partners) with heterosexual substance abusers. A second factor of immersion in a substance abuse culture was hypothesized with loadings for injection drug use risk, substance abuse, and sex with an injection drug user. A third factor of very high-risk sex was also hypothesized including strong loadings for sex with an HIV-positive partner, sexually transmitted diseases, survival sex, sex with a drug injector, and risky sex with men, in general.

Because we wished to both explore and confirm a model in the same data set, we used a strategy of data exploration and cross-validation in the following way. We started with the model just described and fit it to the exploratory sample of one-half of the data for young men (N = 2,033) as seen by the traditional factor analysis findings from Table 7. We then used various

strategies of model fitting (see, among others, Huba & Bentler, 1982; Huba & Harlow, 1986, 1987) to add a few additional parameters to the hypothesized factor analysis model and to eliminate statistically non-significant parameters. That model has a very high degree of fit to the data as indicated by the small value of the goodness-of-fit statistical test (χ^2(13, N = 1,033) = 76.243), the small value of the RMSEA index of fit of .048, and the large value near its maximum of 1 of the comparative fit index (here estimated at .996). For every statistical parameter in the model, we show the standardized parameter value, which is analogous to the usual values obtained in an exploratory factor analysis from a correlation matrix.[9] All of the parameters in the final statistical model in the male derivation sample are statistically significant. The raw coefficients and their standard errors are given in Table 8.

In the second half of the data (or the cross-validation sample) in which the model was not originally fit, we cross-validated the pattern of significant and non-significant parameters using what might be termed a "loose cross-validation" strategy (see Huba & Bentler, 1982) appropriate for ordinally scaled variables (with a correlation structure). The resulting cross-validated model is shown in Figure 1. That model fit the data very well as indicated by the small value of the goodness-of-fit index (χ^2(13, N = 2,033) = 69.93), the small value of the RMSEA index of fit (of .046), and the large value of the comparative fit index of .997. Note that this second test is the true assessment of the fit of the model as it is tested in an independent part of the data that had not been previously explored.

Insert Table 8 About Here

Insert Figure 1 About Here

To develop an initial model for the data from the young women, we also started with the three-factor exploratory solution of Table 7 and hypothesized a first factor of opposite-gender versus same-gender sexual risk behaviors that would be expected to have loadings for the variables of risky sex with men, risky sex with women (but in a negative way), and sexually transmitted diseases such as would be caused for a woman who has frequent male partners. A second factor of immersion in a substance abuse culture was hypothesized with loadings for injection drug use risk, substance abuse, sex with an injection drug user, and survival sex as well as having risk sex with another woman. A third factor of very high risk sex was also hypothesized including loadings for sex with an HIV-positive partner, sexually transmitted diseases, survival sex, and sex with a drug injector.

As with the data for the young men, we used a strategy of data exploration and cross-validation in the following way. We started with the model just described and fit it to one-half of the data for young women (N = 2,039), which constituted the exploratory sample. We then used various strategies of model fitting to add a few additional parameters to the hypothesized factor analysis model. That model has a very high degree of fit to the data as indicated by the small value of the goodness-of-fit statistical test ($\chi^2(13, N = 2{,}039) = 67.78$), the small value of the RMSEA index of fit of .045, and the large value near its maximum of 1 of the comparative fit index (here estimated at .996). For every statistical parameter in the model, we show the standardized parameter value, which is analogous to the usual values obtained in an exploratory

factor analysis from a correlation matrix. All parameters in the final statistical model in the female derivation sample are statistically significant.

In the second half of the data (or the cross-validation sample) in which the model was not originally fit, we cross-validated the pattern of significant and non-significant parameters using what might be termed a "loose cross-validation" strategy. The resulting cross-validated model is shown in Figure 2. That model fit the data very well as indicated by the small value of the goodness-of-fit index ($\chi^2(13, N = 2{,}071) = 61.51$), the small value of the RMSEA index of fit (of .042), and the large value of the comparative fit index of .987. Parameter estimates and their standard errors for the female sample are shown in Table 9.

Insert Table 9 About Here

Insert Figure 2 About Here

As a result of the modeling, we have statistically plausible, confirmed models of the relationship of risk behaviors for men and women. Those models, shown in Figures 1 and 2 share the factors of same-gender versus opposite-gender risky sex, immersion in a substance abuse culture, and very high-risk sex. It is important to note that in comparing solutions across the derivation and cross-validation samples there are small differences between the final models for the young men and young women. This lack of difference across samples indicates, among other

things, that certain behaviors have different meanings for men and women recruited into programs because they are at high risk for HIV.[10]

Discussion

The findings from this investigation provide a number of useful ways to quantify basic risk behavior information among youth who are known to be HIV-positive, and those at very high risk to become HIV infected. The indicators employed in this work were examined in a sample of 8,251 youth (split about evenly by gender).

Two approaches were used to understand these risk behaviors. First, we examined what characteristics predicted the basic information of whether or not the youth engaged in the risk behavior (ignoring issues of behavior recency and/or current severity of risk). With these data, we used characteristics identified in the literature to examine the likelihood of performing the risky behavior. For instance, by knowing that a male youth was HIV-positive, we also knew that youth was nearly six times as likely to engage in risky sex with men, five and a half times as likely to have engaged in sex with an injection drug user, nearly six times as likely to have engaged in survival sex, 37 times as likely to have engaged in sex with an HIV-positive partner, six times as likely to have an STD, and nine and a half times as likely to have engaged in injection drug use. Similar likelihood estimates can be made in considering how HIV status, homelessness, runaway status, criminal involvement, and mental health involvement predict risky behavior in females.

The gender differences demonstrated in this study are consistent with those reported elsewhere (e.g., Rogers, Futterman, Levin, & D'Angelo, 1996) in that prediction of HIV status was stronger for young men than for young women. The clinical implication of such results is that screening for risky behaviors may be a more practical way to select boys for HIV testing than it is for girls. In addition, the gender differences in predicting HIV status were pronounced

in the logistic regression model that included the indicator of whether the youth had a known HIV-positive sex partner. When this variable was not included in the regression model, HIV status was predicted equally well for young men and women. Given that the functional significance of this behavior is different for men and women, these results are to be expected.

In considering these data, it is important to note that the sample that is being considered in this case is special in many respects. These individuals are youth who present themselves or are actively approached by organizations with programs that are targeted for youth with HIV risk. By definition, all of the findings presented in this work must be viewed in the context of the sample of service population and the youth served by the 10 adolescent projects highlighted in this work. Thus, in considering "typical levels of risk" it must be in light of the individuals in this sample who themselves are not a random sample of all youth, but rather a sample of youth known to be likely to need HIV-related services.

A second approach toward understanding the HIV risk behaviors revolved around understanding the underlying dimensions of these variables. That is, could the associations represented in these risk behaviors be described in a smaller, yet meaningful, set of dimensions? This question was approached in two ways. First, traditional exploratory factor analyses were performed and three dimensions were identified for males and females. While the factor solutions differed slightly by gender, the major indicators (risk behaviors) for each dimension were clear. The three dimensions, corresponding with opposite-gender versus same-gender sex, immersion in substance use, and high sexual risk were somewhat interrelated (as expected) and may be useful in categorizing key areas of risk behavior for youth. These factors were confirmed in an independent sample using a restricted factor analytic approach. Given the sample, the estimation methods and statistical indicators employed, these results suggest a robust set of three factors for male and female infected, and at-risk, youth.

In identifying these underlying dimensions of risk in youth, a consistent issue arises regarding how risk behaviors should be appropriately scaled. In other words, should a continuum of recency be employed to describe current risk? Alternatively, is it enough to know simply that a youth has, in the past, engaged in this risky behavior? What is the optimal way to take eight common HIV risk behaviors and combine them to understand the urgency that a particular youth may need services? The level of information afforded by these behavioral risk indicators, by design on the Contact Form, allowed more differentiated decisions about how risk could be assessed. A follow-up to these analyses presented in this paper involve a combining of the initial risk variables, as suggested by either the factor analytic approach (which focuses on variables), or the typology approach (which focuses on the youth in the sample), to derive dimensions of risk. Given that contact with an infected or highly at-risk individual may be quite limited, it is of critical importance to have a simple, quick way of understanding the level of risk of that youth. This assessment may be accomplished only by understanding these behavioral risk indicators at the level presented in this investigation on a sample of youth as diverse and broad-based as the one employed here. Of course, it may be possible to classify risk at a much finer level of detail, depending on the various types of sexual behaviors (e.g., differential transmission of risk associated with anal vs. vaginal vs. oral intercourse or for men vs. women). However, it is not always possible, or even appropriate, to obtain a detailed sexual history from a young person in an outreach setting or during an initial service encounter when rapport and trust between program staff and the client may not be established.

HIV risk behaviors were found to be moderately related to a youth being homeless or having run away from home, having a history of criminal justice involvement, or involvement with the mental health service system. This suggests a pattern of overall risk that may not necessarily be limited to HIV disease, but part of a more generalized vulnerability. Further work is planned to examine the issue of multiple health, mental health, and related problems among

these youth and the impact of those issues on service utilization and retention. The level of therapeutic burden (Brown, Huba, & Melchior, 1995) for HIV-positive and high-risk youth may be a significant predictor of treatment outcomes.

Other caveats should be considered in interpreting information provided about youth risk behaviors as presented in this study. First, the data provided on risk behaviors by the 10 adolescent care projects are based on a combination of client self-report and clinical observation as to what is known about the current level of risk for a young person. As such, it is very likely that, in general, risk will tend to be under-reported among these youth. Still, client self-report appears to be a reliable method of data collection for HIV risk behaviors (Needle, Fisher, Weatherby, Chitwood, Brown, Cesari, Booth, Williams, Watters, Andersen, & Braunstein, 1995). Second, the information about the young people's HIV serostatus is based on whether individuals were known to be HIV-positive as reported to the evaluation center's core data archive. Some of the project sites did not report information about youth HIV status consistently; thus, the prevalence of HIV disease among participants may similarly be under-reported. Even if the number of positive youth are under-counted, however, the present findings do differentiate between young people who are identified as being HIV-positive and those who are not identified as such.

Finally, it should be noted that prediction of HIV status as discussed here, reflects a cross-sectional, correlational approach. As it is not known when the youth tested positive in the present study, the temporal relationships among the risk factors and HIV status cannot be unambiguously determined. Yet it is well established that the behaviors and other factors identified here place a young person at risk for HIV infection. By identifying these relationships and the major structures underlying these indicators, we can hopefully move towards a better understanding of youth presenting at community-based services and ultimately improve our ability to identify and serve HIV-positive and at-risk youth.

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Author Note

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Footnotes

[1] The cross-cutting evaluation is coordinated by The Measurement Group and was developed in collaboration with the 10 Adolescent Care Projects and HRSA. The evaluation forms are available in various reports on these projects (Huba, Melchior, Panter, Brief, Lee, Hodgins, Woods, Kipke, Feudo, Vining-Bethea, Lothrop, Wallace, Sturdevant, Remafedi, Greenberg, Burch, Tenner, Singer, Brady, & Marconi, 1997a, b, c) and also are available on the Internet (www.themeasurementgroup.com/adolspns/adol.htm) along with full instructions for their use.

[2] Human Subjects Protection Committees at each site determined if informed consent for participation in the evaluation was required, or if the data were collected as part of the usual quality improvement process, and hence exempt. All data collection at all sites was voluntary for clients and providers and, hence, these data do have certain non-random patterns of missing observations.

[3] Note that because many outreach contacts are brief and relatively anonymous, it is not always possible for project staff to obtain unique identifier information about the youth contacted; thus, the number of unique individuals may over- or under-represent the actual number of unduplicated youth in the sample.

[4] (1) No known risk (never known to have any sex with males), (2) Prior sex, never unprotected (sex with males prior to the last 30 days but never unprotected), (3) Current sex, never unprotected (sex with males in the last 30 days but never unprotected), (4) Prior sex, prior unprotected (sex with males prior to the last 30 days and unprotected prior to the last 30 days), (5) Current sex, prior unprotected (sex with males in the last 30 days and unprotected prior to the

last 30 days), and (6) Current sex, current unprotected (sex with males in the last 30 days and unprotected in the last 30 days).

[5] (1) Never known to have any injection drug use, (2) Prior injection drug use, never shared (injection drug use prior to the last 30 days but never shared needles), (3) Current injection drug use, never shared (injection drug use in the last 30 days but never shared needles, (4) Prior injection drug use, prior shared (injection drug use prior to the last 30 days and shared needles prior to the last 30 days), (5) Current injection drug use, prior shared (injection drug use in the last 30 days and shared needles prior to the last 30 days), and (6) Current injection drug use, current shared (injection drug use in the last 30 days and shared needles in the last 30 days).

[6] The 6-level classification schemes for Risky Sex with Men, Risky Sex with Women, and Injection Drug Use were studied to ensure that the groups were ordered in the proper way. We conducted several hundred conjoint scaling analyses in which the 6-level schemes were studied in conjunction with other major variables. In virtually every case, the levels in the other variables (primarily topics discussed with the clients and services to which they were directed) were monotonic with the 6 levels. Furthermore, one-way analyses of variance and multiple comparison tests suggested that it was, considering overall analyses conducted, important to keep the 6-level distinction rather than collapsing it into fewer categories.

[7] (1) No known risk, (2) prior risk (the behavior occurred prior to the last 30 days), or (3) current risk (the behavior occurred within the last 30 days).

[8] Above the diagonal in each table are polychoric correlation coefficients, which make "weaker" assumptions about the scaling of the data (assuming only that the values are ordered categories). Again, the coefficients are sizable and highly significant. It is to be theoretically

expected that these coefficients will be a little larger than traditional product-moment correlations.

[9] The assumption for a standardized solution is that the factors are of unit length (or have a variance of 1.0). Note that because we have modeled ordinal data using a polychoric correlation matrix, the standardization also assumes that a correlation matrix has been analyzed.

[10] In particular, unprotected same-sex intercourse is a relatively very high-risk behavior for a young man while opposite-sex intercourse is a relatively high-risk behavior for a young woman. The relative roles of young men and young women in the sex trade and the drug subculture may also differ.

Table 1

Male and Female Clients Per Project

Project	Total Unique Clients	Young Men				Young Women			
		Number of HIV-Positive Young Males	Mean (SD) of Contact Forms per HIV-Positive Males	Number of HIV-Unknown Males	Mean (SD) of Contact Forms per HIV-Unknown Young Males	Number of HIV-Positive Young Females	Mean (SD) of Contact Forms per HIV-Positive Young Females	Number of HIV-Unknown Young Females	Mean (SD) of Contact Forms per HIV-Unknown Young Females
A	2,580	3	1.0 (0.0)	1,504	1.2 (0.5)	5	1.4 (0.6)	979	1.2 (0.5)
B	2,004	47	1.0 (0.2)	884	1.1 (0.4)	22	1.3 (0.5)	998	1.2 (0.6)
C	1,118	34	3.4 (3.6)	557	1.4 (0.9)	7	4.6 (4.5)	515	1.3 (0.7)
D	1,106	12	3.2 (1.6)	300	1.6 (1.3)	14	2.9 (2.1)	778	1.5 (1.1)
E	379	0	--- (---)	217	1.2 (0.5)	0	--- (---)	162	1.1 (0.4)
F	366	0	--- (---)	61	1.0 (0.1)	0	--- (---)	304	1.3 (0.8)
G	355	64	4.4 (3.4)	169	1.1 (0.3)	18	2.4 (2.0)	100	1.1 (0.4)
H	282	61	1.4 (1.2)	70	1.2 (0.6)	29	1.5 (0.9)	116	1.3 (0.9)
I	172	137	1.5 (0.6)	0	--- (---)	35	1.5 (0.6)	0	--- (---)
J	49	21	1.6 (0.7)	0	--- (---)	28	1.6 (0.7)	0	--- (---)
Total	8,411	379	2.1 (2.2)	3,762	1.2 (0.7)	158	1.9 (1.6)	3,952	1.3 (0.7)

Note. Rows are arranged in order from most to least total unique clients. Gender was unknown for a total of 160 clients, including 89 individuals at Project A, 53 at Project B, 5 at Project C, 2 at Project D, 0 at Project E, 1 at Project F, 4 at Project G, 6 at Project H, 0 at Project I, and 0 at Project J.

Table 2

Risk Behaviors by Gender and HIV Status

	Percent of Males		Percent of Females	
	HIV-Positive (N = 379)	HIV-Unknown (N = 3,762)	HIV-Positive (N = 158)	HIV-Unknown (N = 3,952)
Risky Sex with Men				
No known risk	21.1%	74.8%	12.0%	11.0%
Prior sex, never unprotected	10.3%	1.4%	3.2%	3.6%
Current sex, never unprotected	5.8%	2.6%	3.2%	5.0%
Prior sex, prior unprotected	42.7%	11.3%	53.8%	30.5%
Current sex, prior unprotected	1.3%	0.2%	0.6%	0.3%
Current sex, current unprotected	18.7%	9.7%	27.2%	49.6%
	$\chi^2(5, N=4,141)=558.47, p<.001$		$\chi^2(5, N=4,110)=43.93, p<.001$	
Risky Sex with Women				
No known risk	64.6%	17.4%	82.3%	82.4%
Prior sex, never unprotected	4.7%	4.1%	3.2%	0.8%
Current sex, never unprotected	0.3%	4.5%	1.3%	1.4%
Prior sex, prior unprotected	26.6%	31.8%	10.8%	7.9%
Current sex, prior unprotected	0.3%	0.2%	0.0%	0.0%
Current sex, current unprotected	3.4%	42.1%	2.5%	7.4%
	$\chi^2(5, N=4,141)=506.02, p<.001$		$\chi^2(5, N=4,110)=15.51, p<.05$	
Sex with Injection Drug User				
No known risk	73.9%	94.5%	72.2%	93.3%
Prior risk	18.5%	4.1%	25.3%	4.7%
Current risk	7.7%	1.4%	2.5%	2.0%
	$\chi^2(2, N=4,141)=214.82, p<.001$		$\chi^2(2, N=4,110)=124.88, p<.001$	
Survival Sex				
No known risk	71.8%	94.3%	81.0%	91.8%
Prior risk	19.3%	3.7%	13.9%	6.4%
Current risk	9.0%	2.0%	5.1%	1.8%
	$\chi^2(2, N=4,141)=245.89, p<.001$		$\chi^2(2, N=4,110)=23.26, p<.001$	
Sex with an HIV-Positive Partner				
No known risk	39.8%	96.4%	41.8%	97.9%
Prior risk	49.1%	2.5%	48.1%	1.7%
Current risk	11.1%	1.1%	10.1%	0.4%
	$\chi^2(2, N=4,141)=1,391.75, p<.001$		$\chi^2(2, N=4,110)=1,174.75, p<.001$	

(Table continues)

Table 2

Risk Behaviors by Gender and HIV Status

	Percent of Males		Percent of Females	
	HIV-Positive (N = 379)	HIV-Unknown (N = 3,762)	HIV-Positive (N = 158)	HIV-Unknown (N = 3,952)
Sexually Transmitted Diseases				
No known risk	50.1%	86.1%	46.8%	80.0%
Prior risk	44.3%	10.3%	44.9%	14.4%
Current risk	5.5%	3.6%	8.2%	5.5%
	$\chi^2(2, N=4,141)=354.13, p<.001$		$\chi^2(2, N=4,110)=113.59, p<.001$	
Substance Abuse				
No known risk	46.7%	57.6%	50.0%	66.1%
Prior risk	27.2%	18.0%	37.3%	14.5%
Current risk	26.1%	24.4%	12.7%	19.4%
	$\chi^2(2, N=4,141)=23.01, p<.001$		$\chi^2(2, N=4,110)=61.18, p<.001$	
Injection Drug Risk				
Never any injection drug use	67.5%	94.5%	79.7%	94.5%
Prior injection drug use, never shared	7.7%	1.2%	7.0%	1.1%
Current injection drug use, never shared	1.6%	0.5%	0.0%	0.3%
Prior injection drug use, prior shared	10.8%	2.4%	7.6%	2.4%
Current injection drug use, prior shared	7.7%	0.3%	1.3%	0.5%
Current injection drug use, current shared	4.7%	1.1%	4.4%	1.2%
	$\chi^2(5, N=4,141)=411.16, p<.001$		$\chi^2(5, N=4,110)=73.23, p<.001$	
Homeless				
No	82.1%	91.3%	88.0%	90.6%
Yes	17.9%	8.7%	12.0%	9.4%
	$\chi^2(1, N=4,141)=34.14, p<.001$		$\chi^2(1, N=4,110)=1.23$, n.s.	
Runaway				
No	92.3%	96.0%	94.9%	94.8%
Yes	7.7%	4.0%	5.1%	5.2%
	$\chi^2(1, N=4,141)=11.18, p<.01$		$\chi^2(1, N=4,110)=0.01$, n.s.	
Criminal Justice System Involved				
No	95.0%	89.8%	87.3%	93.6%
Yes	5.0%	10.2%	12.7%	6.4%
	$\chi^2(1, N=4,141)=10.50, p<.01$		$\chi^2(1, N=4,110)=9.70, p<.01$	

(Table continues)

Table 2

Risk Behaviors by Gender and HIV Status

	Percent of Males		Percent of Females	
	HIV-Positive (N = 379)	HIV-Unknown (N = 3,762)	HIV-Positive (N = 158)	HIV-Unknown (N = 3,952)
Mental Health System Involved				
No	81.0%	90.5%	77.8%	88.2%
Yes	19.0%	9.5%	22.2%	11.8%
	$\chi^2(1, N=4,141)=33.01, p<.001$		$\chi^2(1, N=4,110)=15.04, p<.001$	

Table 3

Interrelations among Most Recent Participant Risk Behaviors[1]

	Risky Sex with Men	Risky Sex with Women	Sex with IDU User	Survival Sex	Sex with HIV-Positive Partner	Sexually Transmitted Diseases	Substance Abuse	Injection Drug Risk
				Males				
Risky Sex with Men	---	-.54*	.40*	.61*	.64*	.26*	.08*	.39*
Risky Sex with Women	-.41*	---	.00	-.21*	-.41*	.07*	.25*	-.04*
Sex with an Injection Drug User	.20*	.01	---	.69*	.66*	.49*	.47*	.80*
Survival Sex	.34*	-.10*	.40*	---	.65*	.45*	.40*	.63*
Sex with an HIV-Positive Partner	.37*	-.20*	.40*	.38*	---	.58*	.21*	.59*
Sexually Transmitted Diseases	.16*	.05*	.25*	.22*	.32*	---	.24*	.36*
Substance Abuse	.06*	.19*	.23*	.19*	.11*	.14*	---	.60*
Injection Drug Risk	.20*	.01	.56*	.36*	.34*	.19*	.29*	---
				Females				
Risky Sex with Men	---	-.31*	.13*	.16*	.00*	.39*	.19*	.03*
Risky Sex with Women	-.21*	---	.38*	.38*	.23*	.03*	.28*	.45*
Sex with an Injection Drug User	.07*	.17*	---	.63*	.60*	.33*	.49*	.74*
Survival Sex	.08*	.19*	.34*	---	.49*	.44*	.57*	.69*
Sex with an HIV-Positive Partner	.01	.08*	.28*	.22*	---	.40*	.24*	.48*
Sexually Transmitted Diseases	.23*	.01	.14*	.20*	.16*	---	.16*	.30*
Substance Abuse	.14*	.16*	.24*	.30	.09*	.07*	---	.68*
Injection Drug Risk	.03	.20*	.45*	.41*	.20*	.13*	.32*	---

Note. N = 4,141 males and N = 4,110 females.

* Correlation is statistically significant at the 0.05 level after a Bonferroni adjustment by gender.

[1] Correlations below the diagonal are product-moment coefficients used in traditional exploratory factor analyses. Correlations above the diagonal are polychoric correlations used in confirmatory factor analyses.

Table 4

Interrelations among Most Recent Participant Characteristics and Risk Behaviors[1]

	Males				Females			
	Homeless	Runaway	Criminal Justice Involved	Mental Health Services	Homeless	Runaway	Criminal Justice Involved	Mental Health Services
Risky Sex with Men	.09*/.18*	.07*/.17*	-.04*/-.09*	.14*/.26*	.07*/.14*	.09*/.24*	.04/.06*	.09*/.19*
Risky Sex with Women	.01/.02	-.01/-.02	.10*/.16*	-.02/-.03	.08*/.20*	.01/.04	.03/.10*	.01/.03
Sex with an Injection Drug User	.30*/.58*	.04/.13*	.00/-.02	.11*/.25*	.23*/.49*	.06*/.19*	.01/.07*	.06*/.15*
Survival Sex	.21*/.45*	.10*/.29*	.00/.01	.08*/.26*	.21*/.44*	.12*/.30*	.23*/.50*	.07*/.17*
Sex with an HIV-Positive Partner	.12*/.28*	.05*/.16*	-.04/-.14*	.10*/.23*	.09*/.26*	.02/.11*	.07*/.23*	.06*/.18*
Sexually Transmitted Diseases	.14*/.29*	.07*/.18*	.06*/.16*	.10*/.21*	.07*/.16*	.08*/.21*	.14*/.32*	.11*/.22*
Substance Abuse	.20*/.38*	.05*/.14*	.14*/.28*	.06*/.12*	.15*/.30*	.07/.17*	.13*/.30*	.02/.05
Injection Drug Risk	.28*/.53*	.06*/.18*	.13*/.31*	.10*/.24*	.19*/.44*	.04/.11*	.14*/.38*	.06*/.13*

Note. N = 4,141 males and N = 4,110 females.

* Correlation is statistically significant at the 0.05 level after a Bonferroni adjustment by gender. The largest canonical correlations between the set of HIV-related behaviors and these characteristics were .38 among males and .35 among females.

[1] Correlations before the slash (/) are product-moment (point-biserial) correlations as typically calculated and presented. Correlations after the slash are polychoric correlations estimated in the PRELIS program taking into account the data coding into two, three, or six ordered categories. Note that polychoric correlations will always be larger then the corresponding Pearson correlations.

Table 5

Prediction of Re-Coded (Dichotomous) Risk Behaviors from HIV Status, Homeless Status, Runaway Status, Criminal Justice System (CJS) Involvement, and Mental Health System (MHS) Involvement

	Males				Females			
Dependent Measure	Model χ^2	Odds Ratio	95% Confidence Interval	Wald Statistic	Model χ^2	Odds Ratio	95% Confidence Interval	Wald Statistic
Risky Sex with Men	323.26***				57.81***			
HIV-Positive		5.84	4.65-7.32	234.77***		1.00	0.66-1.52	0.00
Homeless		1.45	1.15-1.85	9.42**		1.81	1.30-2.52	12.49***
Runaway		1.10	0.77-1.57	0.27		1.53	0.94-2.47	2.99
CJS-Involved		0.98	0.76-1.27	0.01		2.10	1.39-3.15	12.63***
MHS-Involved		2.00	1.59-2.51	35.45***		1.59	1.20-2.12	10.14**
Risky Sex with Women	412.57***				43.67***			
HIV-Positive		0.15	0.12-0.19	242.59***		0.78	0.49-1.26	1.04
Homeless		1.53	1.18-1.99	10.42**		2.11	1.63-2.73	32.79***
Runaway		0.80	0.55-1.16	1.36		0.78	0.52-1.17	1.46
CJS-Involved		5.67	3.87-8.32	78.95***		1.68	1.24-2.27	11.27***
MHS-Involved		0.94	0.74-1.19	0.29		1.07	0.82-1.40	0.24
Sex with Injection Drug User	376.07***				226.73***			
HIV-Positive		5.40	4.02-7.26	125.21***		5.61	3.78-8.32	73.65***
Homeless		9.23	6.96-12.24	238.73***		6.60	4.98-8.76	171.28***
Runaway		0.45	0.26-0.80	7.46**		0.95	0.60-1.51	0.05
CJS-Involved		0.83	0.52-1.33	0.60		0.95	0.60-1.50	0.05
MHS-Involved		1.93	1.37-2.74	13.80***		1.38	0.98-1.95	3.35

(Table continues)

Table 5

Prediction of Re-Coded (Dichotomous) Risk Behaviors from HIV Status, Homeless Status, Runaway Status, Criminal Justice System (CJS) Involvement, and Mental Health System (MHS) Involvement

	Males				Females			
Dependent Measure	Model χ^2	Odds Ratio	95% Confidence Interval	Wald Statistic	Model χ^2	Odds Ratio	95% Confidence Interval	Wald Statistic
Survival Sex	279.36***				285.58***			
HIV-Positive		5.78	4.38-7.62	154.59***		2.30	1.45-3.63	12.62***
Homeless		4.38	3.29-5.85	101.01***		4.61	3.46-6.14	109.39***
Runaway		1.46	0.92-2.31	2.58		1.20	0.77-1.88	0.67
CJS-Involved		1.07	0.71-1.62	0.12		6.59	4.89-8.88	153.00***
MHS-Involved		1.44	1.02-2.03	4.29*		1.13	0.80-1.60	0.51
Sex with HIV-Positive Partner	810.25***				461.99***			
HIV-Positive		37.26	28.43-48.85	686.52***		69.07	46.20-103.27	425.87***
Homeless		2.11	1.45-3.07	15.15***		3.35	2.06-5.46	23.76***
Runaway		0.98	0.54-1.76	0.01		1.17	0.57-2.41	0.18
CJS-Involved		0.66	0.38-1.14	2.21		2.05	1.16-3.63	6.14*
MHS-Involved		1.67	1.14-2.44	6.89***		1.20	0.72-2.00	0.50
Sexually Transmitted Disease	335.80***				209.15***			
HIV-Positive		6.03	4.80-7.58	237.65***		4.26	3.06-5.94	73.62***
Homeless		2.36	1.84-3.03	45.79***		1.52	1.19-1.95	11.06***
Runaway		0.93	0.62-1.38	0.14		1.38	0.99-1.93	3.63
CJS-Involved		2.07	1.61-2.67	31.55***		3.07	2.36-3.98	70.64***
MHS-Involved		1.59	1.23-2.07	12.30***		1.62	1.30-2.03	17.86***

(Table continues)

Table 5

Prediction of Re-Coded (Dichotomous) Risk Behaviors from HIV Status, Homeless Status, Runaway Status, Criminal Justice System (CJS) Involvement, and Mental Health System (MHS) Involvement

	Males				Females			
Dependent Measure	Model χ^2	Odds Ratio	95% Confidence Interval	Wald Statistic	Model χ^2	Odds Ratio	95% Confidence Interval	Wald Statistic
Substance Abuse	327.66***				226.01***			
HIV-Positive		1.52	1.22-1.90	13.93***		1.85	1.33-2.58	13.37***
Homeless		3.49	2.76-4.41	108.98***		2.89	2.31-3.61	86.84***
Runaway		0.83	0.59-1.18	1.08		1.23	0.89-1.69*	1.59
CJS-Involved		4.61	3.64-5.85	159.20***		3.66	2.81-4.76	92.70***
MHS-Involved		1.27	1.02-1.58	4.48*		0.89	0.72-1.10	1.13
Injection Drug Use	467.32***				197.11***			
HIV-Positive		9.43	7.06-12.59	231.80***		4.00	2.59-6.25	37.149***
Homeless		7.09	5.28-9.53	168.86***		5.46	3.98-7.49	111.07***
Runaway		0.51	0.29-0.89	5.60*		0.54	0.30-0.97	4.25*
CJS-Involved		4.79	3.47-6.61	90.64***		4.25	2.97-6.07	63.13***
MHS-Involved		1.58	1.10-2.27	6.25*		1.11	0.75-1.65	0.27

Note. For all models fit tests, χ^2 has five degrees of freedom; N = 4,141 males and N = 4,110 females.

For all individual effects tests, the Wald statistic has one degree of freedom; N = 4,141 males and N = 4,110 females.

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

Table 6

Prediction of HIV Status from Re-Coded (Dichotomous) Risk Behaviors

Independent Variable	Males					Female				
	Odds Ratio	95% Confidence Interval for Odds Ratio	Wald Statistic	B	R	Odds Ratio	95% Confidence Interval for Odds Ratio	Wald Statistic	B	R
a) Prediction Equations when Risk Variable About Sex with an HIV-Positive Partner Can Be Asked										
Risky Sex with Men	.82	.58-1.16	1.27	-.20	.00	.35	.21-.59	15.27***	-1.05	-.10
Risky Sex with Women	.12	.09-.17	8.75***	-2.11	-.24	.19	.10-.38	22.86***	-1.65	-.12
Sex with IDU	.50	.29-.88	6.60*	-.70	-.04	1.04	.50-2.17	.01	.04	.00
Survival Sex	1.10	.69-1.73	.15	.09	.00	.39	.19-.82	6.18*	-.93	-.06
Sex with an HIV-Positive Partner	17.25	11.91-25.99	227.22***	2.85	.30	86.26	52.43-141.93	307.79***	4.46	.48
Sexually Transmitted Diseases	3.65	2.37-4.79	45.58***	1.21	.13	3.15	2.01-4.94	25.08***	1.15	.13
Substance Abuse	.77	.55-1.10	2.05	-.26	.00	1.49	.93-2.40	2.71	.40	.02
Injection Drug Use	9.82	6.00-16.07	82.60***	2.28	.18	1.87	.88-3.97	2.68	.63	.02
Homeless	1.04	.66-1.64	.03	.04	.00	.76	.39-1.46	.70	-.28	.00
Runaway	1.40	.75-2.60	1.12	.33	.00	.46	.18-1.20	2.51	-.77	-.02
CJS-Involved	.52	.27-.98	4.09*	-.66	-.03	1.15	.57-2.31	.15	.14	.00
MHS-Involved	1.50	.99-2.26	3.66	.40	.03	1.99	1.17-3.38	6.42*	.69	.06
b) Prediction Equations when Sex with an HIV-Positive Partner Cannot Be Asked										
Risky Sex with Men	1.81	1.37-2.39	17.58***	.59	.08	.54	.34-.85	6.95**	-.62	-.06
Risky Sex with Women	.10	.07-.13	203.12***	-2.32	-.28	.38	.23-.85	12.39***	-.96	-.09
Sex with IDU	1.03	.64-1.66	.02	.03	.00	3.68	2.25-6.02	26.79***	1.30	.14
Survival Sex	1.34	.90-2.00	2.11	.29	.01	.73	.42-1.25	1.34	-.32	.00

(Table continues)

Table 6

Prediction of HIV Status from Re-Coded (Dichotomous) Risk Behaviors

Independent Variable	Males					Female				
	Odds Ratio	95% Confidence Interval for Odds Ratio	Wald Statistic	B	R	Odds Ratio	95% Confidence Interval for Odds Ratio	Wald Statistic	B	R
Sexually Transmitted Diseases	6.71	4.97-9.05	155.31***	1.90	.25	4.06	2.80-5.88	54.86***	1.40	.20
Substance Abuse	.81	.59-1.11	1.78	-.22	.00	1.25	.83-1.86	1.15	.22	.00
Injection Drug Use	10.33	6.58-16.23	102.80***	2.34	.20	2.12	1.19-3.76	6.57*	.75	.06
Homeless	.90	.60-1.34	.28	-.11	.00	.78	.45-1.35	.78	-.25	.00
Runaway	1.31	.74-2.34	.85	.27	.00	.54	.24-1.19	2.34	-.62	-.02
CJS-Involved	.45	.25-.82	6.94*	-.79	-.04	1.38	.80-2.39	1.32	.32	.00
MHS-Involved	1.34	.93-1.95	2.44	.30	.01	1.89	1.23-2.90	8.54**	.64	.07

Note: *p < .05, **p < .01, ***p < .001

Table 7

Most Recent Participant Risk Behaviors: Pattern Coefficients (Factor Loadings) for Analysis for Two-Factor and Three-Factor Exploratory Maximum Likelihood Solutions in the Derivation Sample

	Two-Factor Solution				Three-Factor Solution					
	Males		Females		Males			Females		
	Factor 1	Factor 2	Factor 1	Factor 2	Factor 1	Factor 2	Factor 3	Factor 1	Factor 2	Factor 3
Risky Sex with Men	.24	-.59	1.00	.01	.46	.06	.30	1.00	.06	-.05
Risky Sex with Women	.13	.72	-.23	.33	-.91	.04	.10	-.23	.31	.02
Sex with an Injection Drug User	.69	.04	.04	.58	.01	.56	.16	.03	.50	.16
Survival Sex	.54	-.16	.03	.58	.09	.28	.35	.03	.49	.15
Sex with an HIV-Positive Partner	.48	-.35	-.01	.30	.25	.13	.51	-.05	-.02	.69
Sexually Transmitted Diseases	.40	-.04	.21	.20	-.08	-.02	.56	.20	.10	.19
Substance Abuse	.39	.23	.10	.44	-.20	.31	.08	.11	.47	-.06
Injection Drug Risk	.66	.03	-.04	.69	.08	.86	-.12	-.03	.77	-.08
Correlations Among Factors										
Factor 1	1.00		1.00		1.00			1.00		
Factor 2	-.13	1.00	.09	1.00	.01	1.00		.05	1.00	
Factor 3					.17	.56	1.00	.13	.40	1.00

Note. N = 2,033 males and N= 2,039 females. These derivation samples are a random selection of the total samples of 4,141 males and 4,110 females. Method is maximum likelihood factor analysis with a direct oblimin rotation using product-moment correlations.

Table 8

Confirmatory Factor Analysis Solutions for Risk Behavior Model for Derivation and Cross-Validation Sample: Males

Model Paths	Derivation Sample (N = 2,033)			Validation Sample (N = 2,108)		
	WLS Estimate	Standard Error	Test Value	WLS Estimate	Standard Error	Test Value
Factor 1 to						
Sex with Men	1.00	---	---	1.00	---	---
Sex with Women	-1.77	0.18	-9.73*	-1.92	0.25	-7.57*
Sex with an HIV-Positive Person	0.72	0.07	9.71*	0.57	0.08	7.34*
Substance Abuse	-0.54	0.07	-8.14*	-0.53	0.07	-7.56*
Factor 2 to						
Injection Drug Use	1.00	---	---	1.00	---	---
Substance Abuse	0.59	0.07	15.68*	0.63	0.04	17.01*
Sex with an IDU	0.44	0.09	5.19*	0.37	0.08	4.58*
Factor 3 to						
Sex with an HIV-Positive Person	1.00	---	---	1.00	---	---
Sex with Men	0.65	0.04	16.51*	0.69	0.04	18.01*
Sex with IDU	0.59	0.09	6.26*	0.72	0.10	7.56*
Sexually Transmitted Disease	0.87	0.05	17.98*	0.75	0.04	17.91*
Survival Sex	1.04	0.06	17.47*	1.07	0.05	21.66*
Measurement Errors						
Sex with Men	0.42	0.04	9.61*	0.37	0.05	7.72*
Sex with Women	0.10	0.10	1.02	0.08	0.12	0.72*
Sex with an HIV-Positive Person	0.17	0.06	3.17*	0.19	0.05	3.67*
Injection Drug Use	0.02	0.07	0.27*	0.00	0.06	0.01
Substance Abuse	0.57	0.04	15.13*	0.55	0.04	14.05*
Sex with IDU	0.27	0.05	5.23*	0.17	0.04	3.85*
Sexually Transmitted Disease	0.49	0.05	10.65*	0.62	0.04	14.23*
Survival Sex	0.27	0.06	4.15*	0.20	0.05	3.53*

(Table continues)

Table 8

Confirmatory Factor Analysis Solutions for Risk Behavior Model for Derivation and Cross-Validation Sample: Males

Model Paths	Derivation Sample (N = 2,033)			Validation Sample (N = 2,108)		
	WLS Estimate	Standard Error	Test Value	WLS Estimate	Standard Error	Test Value
Factor Variances and Covariances						
Factor 1	0.28	0.04	7.73*	0.25	0.04	6.24*
Factor 2	0.98	0.07	14.34*	1.00	0.06	16.64*
Factor 3	0.68	0.05	13.21*	0.68	0.05	14.63*
Factor 1 with Factor 2	0.00	0.02	0.04	0.01	0.02	0.75
Factor 1 with Factor 3	0.00	0.02	-0.13	0.04	0.02	2.76
Factor 2 with Factor 3	0.61	0.04	16.57*	0.62	0.03	18.27*

Note. Models for both samples used weighted least squares estimation. Paths with an asterisk are statistically significant at the $p <$ .001 level. The model for the derivation sample yielded model fit of $\chi^2(13, N = 2{,}033) = 76.24$, CFI = .996, RMSEA = .048. The model for the validation sample yielded model fit of $\chi^2(13, N = 2{,}108) = 69.93$, CFI = .997, RMSEA = .046

Table 9

Confirmatory Factor Analysis Solutions for Risk Behavior Model for Derivation and Cross-Validation Sample: Females

Model Paths	Derivation Sample (N = 2,039)			Validation Sample (N = 2,071)		
	WLS Estimate	Standard Error	Test Value	WLS Estimate	Standard Error	Test Value
Factor 1 to						
Sex with Men	1.00	---	---	1.00	---	---
Sex with Women	-0.44	0.09	-4.75*	-0.41	0.11	-3.85*
Sexually Transmitted Disease	0.38	0.08	4.86*	0.37	0.10	-3.84*
Factor 2 to						
Injection Drug Use	1.00	---	---	1.00	---	---
Sex with Women	0.52	0.05	10.82*	0.58	0.05	11.89*
Substance Abuse	0.80	0.04	19.37*	0.79	0.04	21.26*
Sex with an IDU	0.67	0.06	11.61*	0.64	0.06	10.35*
Survival Sex	0.61	0.05	11.73*	0.68	0.06	11.29*
Factor 3 to						
Sex with an HIV-Positive Person	1.00	---	---	1.00	---	---
Sex with an IDU	0.31	0.07	4.73*	0.40	0.09	4.64*
Sexually Transmitted Disease	0.60	0.08	7.67*	0.57	0.07	8.28*
Survival Sex	0.40	0.07	5.58*	0.32	0.08	4.09*
Measurement Errors						
Sex with Men	<0.01	0.21	<0.01	<0.01	0.25	<0.01
Sex with Women	0.66	0.06	11.67*	0.63	0.06	10.24*
Sex with an HIV-Positive Person	0.12	0.14	0.88	0.18	0.13	1.46
Injection Drug Use	0.13	0.05	2.48	0.15	0.05	3.05
Substance Abuse	0.45	0.04	11.62*	0.47	0.04	12.82*
Sex with an IDU	0.37	0.06	6.13*	0.28	0.06	5.01*
Sexually Transmitted Disease	0.54	0.06	9.32*	0.70	0.05	13.81*
Survival Sex	0.37	0.06	6.13*	0.32	0.05	5.93*

(Table continues)

Table 9

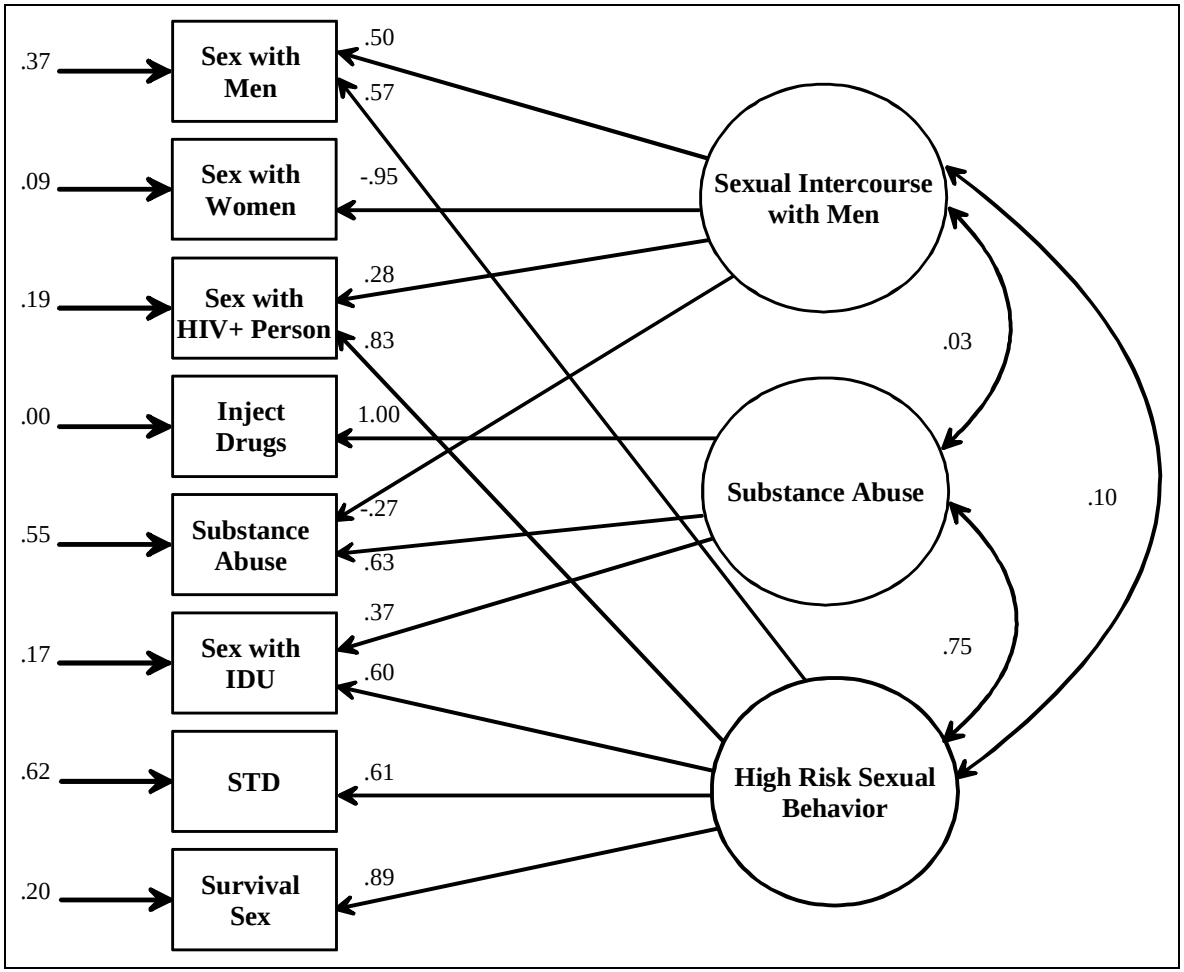
Confirmatory Factor Analysis Solutions for Risk Behavior Model for Derivation and Cross-Validation Sample: Females

Model Paths	Derivation Sample (N = 2,039)			Validation Sample (N = 2,071)		
	WLS Estimate	Standard Error	Test Value	WLS Estimate	Standard Error	Test Value
Factor Variances and Covariances						
Factor 1	1.00	0.21	4.82*	1.00	0.24	4.07*
Factor 2	0.87	0.05	17.88*	0.85	0.04	20.03*
Factor 3	0.88	0.14	6.24*	0.82	0.12	6.60*
Factor 1 with Factor 2	0.21	0.03	6.92*	0.18	0.03	6.37*
Factor 1 with Factor 3	0.00	0.04	.14	0.04	0.04	0.88
Factor 2 with Factor 3	0.34	0.05	6.91*	0.45	0.05	9.63*

Note. Models for both samples used weighted least squares estimation. Paths with an asterisk are statistically significant at the $p < .001$ level. The model for the derivation sample yielded model fit of $\chi^2(13, N = 2,039) = 67.78$, CFI = 0.996, RMSEA = .045. The model for the validation sample yielded model fit of $\chi^2(13, N = 2,071) = 61.51$, CFI = 0.997, RMSEA = .042.

Figure 1

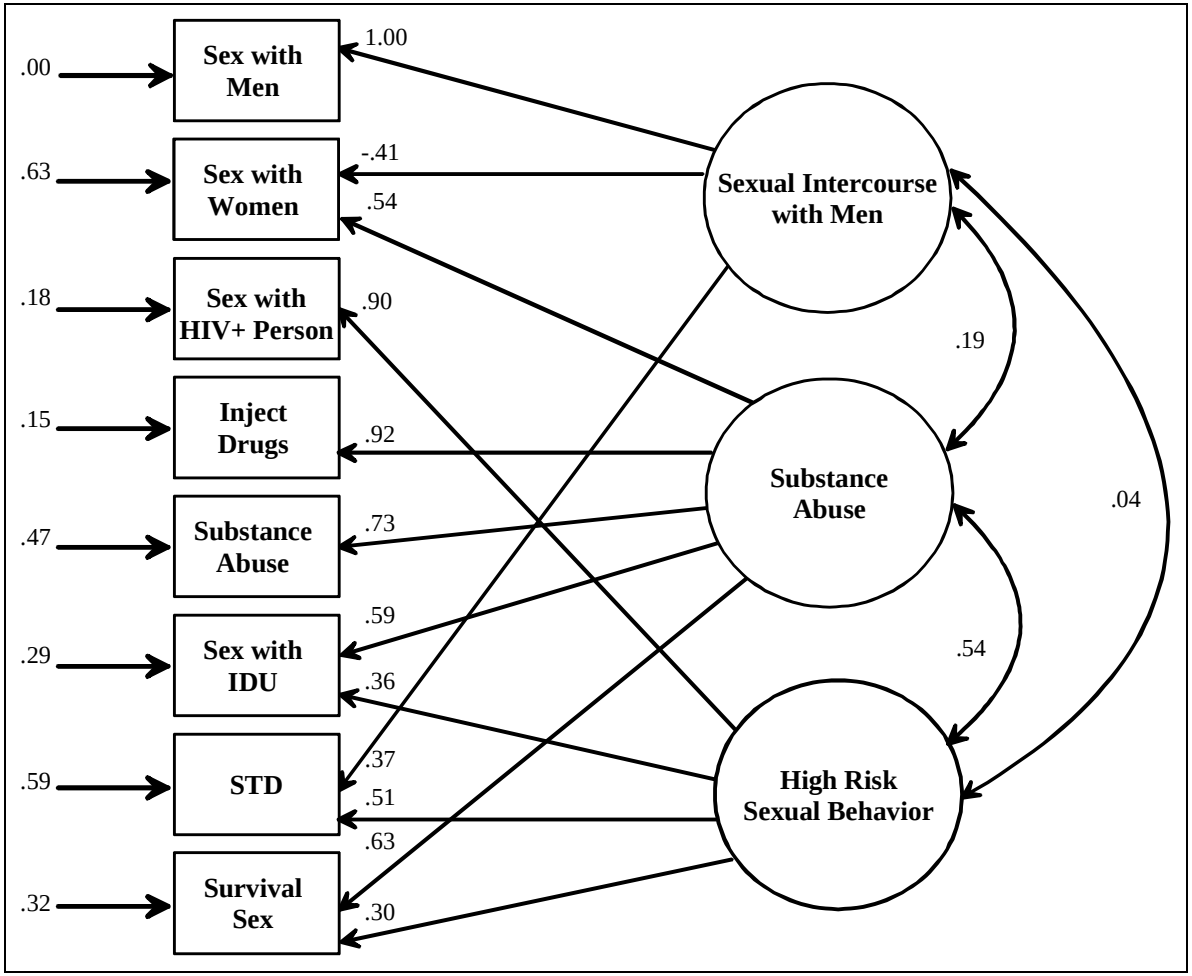
Confirmatory Analysis of Risk Behaviors for Males: Cross-Validation Sample



Note. Weighted Least Squares Estimation, (13, N = 2,108) = 69.93, CFI = .997, RMSEA = .046; Fully standardized coefficients are shown.

Figure 2

Confirmatory Factor Analysis of Risk Behaviors for Females: Cross-Validation Sample



Note. Weighted Least Squares Estimation, (13, N = 2,071) = 61.51, CFI = .997, RMSEA = .042; Fully standardized coefficients are shown.