Published in final edited form as:

J Behav Med. 2014 June ; 37(3): 511–523. doi:10.1007/s10865-013-9507-8.

Perceived Susceptibility to AIDS Predicts Subsequent HIV Risk: A Longitudinal Evaluation of Jail Inmates

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Abstract

Theories of health behavior change suggest that perceived susceptibility to illness precedes health-protective behavior. We used a cross-lagged panel design to explore the relationship between perceived susceptibility to AIDS, and HIV risk behavior pre-incarceration and post-release in a sample of 499 jail inmates, a group at high risk for HIV. We also explored moderators of this relationship. HIV risk was calculated with a Bernoulli mathematical process model. Controlling for pre-incarceration HIV risk, perceived susceptibility to AIDS predicted less post-release HIV risk; the reverse relationship was not supported. Consistent with health behavior change theories, perceived susceptibility seemed to partially guide behavior. However, this relationship was not true for everyone. African-Americans and individuals high in borderline personality features exhibited no relationship between perceived susceptibility and changes in HIV risk. This suggests that targeted interventions are needed to use information about risk level to prevent HIV contraction.

Keywords

HIV risk; Bernoulli; jail inmates; perceived susceptibility; cross-lagged

Although notable advances have been made in the treatment of HIV/AIDS, no cure exists. Prevention efforts to fight against the spread of HIV/AIDS often stall due to concerns about how to effectively combat a complex disease with finite amounts of time, resources, and money. Under these logistical constraints, a promising strategy has been to identify and target groups at heightened risk of contracting this disease. The 12.9 million individuals who cycle through jails in the United States each year represent one such group (Freudenberg, 2006).

While the prevalence of HIV in the general population is approximately 0.38% (Centers for Disease Control and Prevention, 2011), rates of infection for incarcerated individuals are three to four times higher. Researchers have estimated that approximately 2% of jail and prison inmates are diagnosed with HIV/AIDS (Maruschak, 2010). Inmates and former inmates frequently report behaviors in the community in the period preceding incarceration (Adams et al., in press; Margolis et al., 2005) and immediately following release (Adams et

al., in press; Morrow et al., 2007) that place them at risk for HIV. These findings represent a major public health concern, relevant to all, as incarcerated individuals with HIV are most likely to have contracted the disease while in the community (Spaulding, Stephenson, Macalino, Ruby, Clarke, & Flanigan, 2002), and the majority of inmates ultimately spend more time in the community than incarcerated.

Seal and others (2010) identified 44 published interventions targeting incarcerated individuals' HIV risk between 1983 and 2008; they concluded that although some of these interventions led to short-term positive change, many suffered from design limitations which minimized evaluation of their efficacy. Thus, there continues to be a need for knowledge and prevention efforts directed at this high risk population to better protect the community-at-large and former offenders. The current longitudinal study focuses on how perceptions of AIDS susceptibility relate to future unsafe sexual and drug behaviors that increase risk of HIV infection among recently released jail inmates.

Perceived susceptibility has been conceptualized as a vital motivational factor, which moves individuals to take preventive action to avoid an illness that they believe themselves to be at risk of contracting. While some theories place perceived susceptibility in a central role (e.g., health belief model, protection motivation theory, AIDS risk reduction model), others view it as an important contributor for proximal determinants of intentions to engage in health protective behavior (e.g., theory of reasoned action, theory of planned behavior, integrative model). Lending some support to these theories, Gerrard, Gibbons, and Bushman (1996) concluded from their meta-analysis of 26 studies that perceived susceptibility to HIV was associated with HIV risk behavior. However, the observed correlation ($r = .11$) was small, suggesting that the majority misperceive their probability of infection, which may translate into individuals unknowingly engaging in high risk behaviors.

Although the majority of models of health behavior posit that to some extent, individuals use their perceived susceptibility to an illness to make decisions about engaging in health-protective changes, to what extent is this true in the realm of HIV risk? Further, are there individual differences in how well people use their perceptions of HIV susceptibility to guide later HIV risk behavior? Empirically, these questions have not been answered using a longitudinal design with a high-risk incarcerated population. However, in other populations, there is some evidence that perceived risk for HIV infection can motivate individuals to engage in HIV testing (Spielberg et al, 2003), and there is evidence that individual-level differences can moderate the benefits of HIV education and prevention interventions (Bryan, Robbins, Ruiz, & O'Neill, 2006; Schmiede, Feldstein Ewing, Hendershot, & Bryan, 2010); likewise these individual differences, like race and positive outlook may influence the extent to which perceived susceptibility to HIV affects future HIV risk by inflating, reducing, or reversing the association. Answering these questions as they relate to individuals who cycle in and out of the criminal justice system may provide areas for intervention to protect this high-need group as they re-enter the community and re-establish sexual and/or drug use practices.

Because we were primarily interested in moderators of the relationship between perceived susceptibility and HIV risk as they function in an incarcerated sample, we specifically

targeted personality and behavioral constructs that are prevalent in this population, and would have theoretical value in the association between perceived susceptibility and HIV risk. Psychopathy is characterized by a callous, shallow and manipulative interpersonal style that is combined with antisocial, and often reckless behavior. Between 15 and 30 percent of incarcerated individuals meet criteria for psychopathy (Hare, 2003). Individuals with this personality trait show little concern about the effects of their actions on others, and often fail to avoid behaviors that have been previously punished (Hare, 2003). Given these tendencies, individuals high in psychopathy may be especially unlikely to modify their risk behavior in the moment based on prior perceptions.

Borderline personality disorder (BPD) is defined as a pervasive personality disorder characterized by unstable relationships with others, strong negative feelings about themselves, self-harming behaviors, and impulsivity. Despite being rarely discussed in correctional literature, a high percentage (12–45%) of inmates meet criteria for BPD (Conn, Warden, Stuewig, Kim, Harty, Hastings, & Tangney, 2010). Individuals who meet diagnostic criteria for borderline personality disorder have neurocognitive impairments in their decision-making (Bazan et al., 2002) that may lead them to ignore self-assessments of their AIDS risk, further increasing the likelihood of impulsive high risk behaviors.

Optimism has been implicated as an important factor for incarcerated individuals that may contribute to positive health and behavior, as it has been linked to fewer physical ailments during incarceration (Heigel, Stuewig, & Tangney, 2010) and avoidance of substance use postrelease (Carvajal, Clair, Nash, & Evans, 1998). However, optimism may result in an “optimistic bias” where individuals fail to use information about their risk level to influence subsequent behavior; in line with this perspective, Jackson, Wernicke, and Haaga (2003) found that dispositional optimism in prison inmates was associated with lower probability of entering treatment, suggesting that high hope was an indicator of underestimation of the need for treatment.

Substance abuse and dependence histories are prevalent throughout the criminal justice system, with approximately half of all prisoners meeting the criteria for diagnosis of drug abuse or dependence (Chandler, Fletcher, & Volkow, 2009). With respect to perceived susceptibility to HIV among drug users, some researchers have found a positive association between perceived risk of HIV and future seroconversion, suggesting that those who become HIV-positive were aware of their heightened risk of doing so (Somlai, Kelly, Heckman, Hackl, Runge, & Wright, 2000; Woods et al, 2005). Others have found low perception of HIV risk among drug users, despite these samples engaging in a variety of high risk behaviors (Mitchell & Latimer, 2009; Singer, Dai, Weeks, & Malave, 1998). Taken together, these divergent findings suggest that those individuals with a history of substance dependence may engage in high levels of HIV risk, either partially by underestimating their susceptibility to the disease, or by recognizing their risk and failing to act in health protective ways.

Each of these four constructs (optimism, psychopathy, borderline personality features, substance dependence), along with demographic characteristics may provide insight into the heterogeneous HIV risk behaviors of recently released inmates. Specifically, by focusing on

individual factors that moderate the linkage between perceived susceptibility to AIDS and changes in risk behavior, we may be able to identify specific subgroups of incarcerated individuals who are particularly vulnerable to HIV infection. Moreover, such findings would provide the foundation for fine-tuning prevention efforts, targeting subgroup-specific factors that attenuate the extent to which perceptions guide behavior. The inclusion of these individual difference variables in the present study represents an initial inquiry into potential moderators of the relationship between perceived susceptibility to AIDS and post-release HIV risk behavior.

The present study contributes to the literature in two ways. First, prior research has relied upon HIV risk measures that give equal weight to various risk behaviors, ignoring the relative risks associated with each behavior (e.g., that sharing injection drug paraphernalia is riskier than unprotected vaginal sex). Additionally, prior work on this topic has been hindered by coarsely assessed risk classifications (i.e., “low risk” versus “high risk”) as well as inconsistent operational definitions of risk level that make it difficult to compare findings across studies (Schroder, Carey, & Vanable, 2003). The present study constitutes a step forward in the literature, as we used a Bernoulli mathematical model to estimate HIV risk, which incorporates the relative risk of infection associated with unprotected sexual intercourse and risky injection drug use. Second, our understanding of HIV risk factors has been hampered by an abundance of cross-sectional studies. To our knowledge, this is the first study to explore the association between perceived susceptibility to AIDS and HIV risk behaviors using a longitudinal design in a sample of incarcerated individuals.

The present study had several aims. First, we examined the relationship between perceived susceptibility to AIDS at the beginning of incarceration with their HIV risk behavior during the prior year in the community. At one year post-release, we again examined the relationship between perceived susceptibility and HIV risk behavior. Drawing upon prior literature, we hypothesized that there would be a small, positive association between these constructs within each of the two time points (Gerrard et al., 1996). Second, we investigated the hypothesis that perceptions of susceptibility to AIDS during initial incarceration predict later HIV risk behavior following release from jail. Specifically, we hypothesized that greater perceived susceptibility to AIDS at Time 1 (initial incarceration) would predict decreases in HIV risk from Time1 to Time 2 (one year post-release), providing evidence that changes in HIV risk behavior is in part guided by appraisals of susceptibility to the disease. Third, we explored several demographic (age, gender, race), personality (borderline personality features, psychopathy, optimism) and behavioral (substance abuse) variables as potential moderators of the association between perceived susceptibility to AIDS and changes in HIV risk behavior. These moderator analyses attempted to capture the heterogeneity of incarcerated individuals in terms of demographics, personality traits, and behaviors, and how that affects the relationship between HIV risk beliefs and propensities.

Method

Participants

Data are from 499 participants in a larger longitudinal study examining moral emotions (e.g, shame and guilt) and criminal recidivism in a single jail in a Washington DC suburb

(Tangney, Mashek, & Stuewig, 2007). Incoming inmates were eligible to participate if they were (1) either (a) sentenced to a term of four months or more, or (b) arrested on at least one felony charge other than probation violation, with no bond or with a bond greater than \$7,000, (2) assigned to the jail's medium or maximum security "general population" (e.g., not in solitary confinement, not in a separate forensics unit for actively psychotic inmates), and (3) had sufficient language proficiency to complete study protocols in English or Spanish. Participants were recruited for baseline assessment between 2002 and 2007; post-release data are still being collected. Figure 1 shows the flow of data collection included in this paper's analyses.

Procedure

After assignment to the jail's "general population," eligible inmates were invited to participate. Interviewers emphasized the voluntary and confidential nature of the project, stressing that the decision to participate or not would have neither an effect on their status at the jail nor on their release date. To maintain confidentiality, Time 1 interviews (initial incarceration) were held in professional visiting rooms, used by attorneys, or in secure classrooms. Individuals who completed the initial 4–6-session baseline assessment received honoraria of \$15 to \$18, an amount deemed to be sufficient for compensation, without being coercive. Participants were assured that their data were protected by a Certificate of Confidentiality from DHHS. The Institutional Review Board for the University approved the full study protocol.

The majority of the Time 2 (one year post-release) interviews were conducted via telephone; 38% were completed in person owing to the participant's re-incarceration. Individuals who completed the two-hour Time 2 interview received a \$50 honorarium. On average, 2.7 years (*S.D.* = 1.62) elapsed between the Time 1 and Time 2 interviews.

Measures

Perceived susceptibility—Perceived susceptibility to AIDS was assessed at Time 1 and Time 2 using two questions from the TCU AIDS Risk Assessment (ARA; Simpson, 1997): 1) "You believe that you could become exposed to the AIDS virus" and 2) "You think you really could get AIDS" (Simpson, 1997). These items were assessed on a Likert-type scale ranging from 1 "Strongly Disagree" to 5 "Strongly Agree." The two items were highly correlated at both time points ($r = .71, .65$, respectively), and participants' mean score was used to create an index of perceived susceptibility.

Psychopathy—Psychopathy was measured using the Psychopathy Checklist: Screening Version (PCL:SV; Hart, Cox, & Hare, 1995). The PCL:SV was scored at Time 1 based on a review of criminal history records and in-depth face to face clinical interviews that averaged two to three hours in duration. Psychopathy is related to, but distinct from antisocial personality disorder, as it includes interpersonal and affective traits in addition to measures of persistent violations of social norms (Hare, 1991). The PCL:SV is composed of 12 items rated by assessment clinicians on a 3-point scale, from 0 = the item does not apply to the individual to 2 = applies well to the individual. As detailed in Hastings et al., (2008), randomly selected cases ($n=54$) were double-coded by an expert referent clinician. Single

measure intra-class correlations, using a one-way random effects model, were .85, .79, and .85 for Factor 1, Factor 2, and Total PCL:SV scores, respectively. For these analyses we use the total psychopathy score.

Borderline personality features—Symptoms of Borderline Personality Disorder were assessed using the Borderline Features scale of the Personality Assessment Inventory (PAI; Morey, 1991). The Borderline Features scale is composed of four subscales with six items each. *Affective instability* assesses intense emotional experiences with an emphasis on anger, *Identity Problems* assesses confusion about self-identity and a lack of an integrated concept of self and others, *Negative relationships* assesses ambivalence about interpersonal relationships and is characterized by dependence, fear of abandonment and distrust, and *Self-Harm* might be more accurately labeled *Impulsivity*, as most items assess impulsivity and risk-taking, vs. self-harm behaviors, per se. Internal reliability of the total scale was high ($\alpha = .89$) while the subscales were acceptable ($\alpha = .64$ to $.77$; mean $\alpha = .73$). Research shows that scores on the PAI Borderline Features scale converge with clinicians' diagnoses of borderline personality disorder based on DSM-IV-TR criteria (Critchfield, Levy, & Clarkin, 2007; Jacobo, Blais, Baity, & Harley, 2007).

Optimism—Dispositional optimism was assessed at Time 1 using an abbreviated version of the Values in Action- Inventory of Strengths Hope/Optimism scale (VIA; Peterson & Seligman, 2003). Four items were used: "I always look on the bright side," "I can always find the positive in what seems negative to others," "Despite challenges, I always remain hopeful about the future," and "If I feel down, I always think about what is good in my life". Responses ranged from 1 "not at all like me" to 5 "very much like me." This modified Optimism scale demonstrated good reliability ($\alpha = .75$; Heigel, Stuewig, & Tangney, 2010).

Substance dependence—Drug and alcohol dependence was assessed at Time 1 using the Texas Christian University Correctional Residential Treatment Form, Initial Assessment (TCU-CRTF, Simpson & Knight, 1998). Four substance dependence scales assessed dependency on alcohol (17 items), marijuana (8 items), opiates (18 items), and cocaine (14 items) in the year prior to incarceration. Responses ranged from 0 "never" to 4 "7 or more times," and assessed each DSM-IV substance dependence domain.

HIV risk—HIV risk is a composite of a variety of risky behaviors, including both injection drug use and unprotected sexual behaviors. We used items from the TCU ARA (Simpson, 1997) measuring the frequency of unprotected sexual acts and injection drug sharing behaviors in the 30 days prior to incarceration and the 30 days prior to the one-year post-release interview to compute overall measures of HIV risk (cumulative risk) at two points in time. We used a modified Bernoulli mathematical model to express the probability P of HIV infection (Pinkerton & Abramson, 1993). The Bernoulli model provides a useful estimate of HIV risk because it is expressed in meaningful terms (percentages), takes into account the infectivity rate of each specific risk behavior, and allows for the inclusion of a variety of behaviors that contribute to overall levels of risk (Holtgrave, Leviton, Wagstaff, & Pinkerton, 1997). In this model, P represents the cumulative likelihood that a given person becomes infected after engaging in multiple, specific acts of unprotected intercourse and/or

sharing needles and drug paraphernalia over a given time period, and is expressed via the equation:

$$P=1 - (1 - A)(1 - D), \quad (1)$$

where A is the probability of infection from unprotected vaginal, anal, and oral sex contacts:

$$A=\pi_1[1 - (1 - \alpha_1)^{n1}(1 - \alpha_2)^{n2}(1 - \alpha_3)^{n3}], \quad (1a)$$

and D is the probability of infection from injection drug-related activities:

$$D=1 - (1 - \pi_2\alpha_4)^{n4}, \quad (1b)$$

Equation 1 parameters are shown in Table 1. The Bernoulli model includes both estimated and measured parameters. Measured parameters (n1–n4) were obtained from participants' self-reported risk behaviors (e.g., frequency of sex, frequency of shared needle use). Estimated parameters ($\pi_{1,2}$, α_{1-4}) were approximated from available data regarding the infectivity of specific acts with high- versus low-risk partners. Based upon the work of Pinkerton and Abramson, we estimated that there was a 10% chance that the participant's partner was HIV-positive if the participant reported having unprotected sex with an injection drug user or a person who exchanges sex for drugs or money (Pinkerton & Abramson, 1993). For all other participants, we estimated that there was a 5% chance that their partners were HIV-positive.

Data Analysis

Preliminary analyses explored variable distributions, sample characteristics, simple correlations, and attrition using SPSS Version 16.0 software (SPSS, 2008). Model testing was conducted using a full-information maximum likelihood algorithm in Mplus Version 6.0 (FIML; Muthén & Muthén, 2010), which uses all of the information of the observed data to create parameter estimates and standard errors. When data are either missing completely at random or are missing at random, FIML estimates are unbiased and efficient (Enders & Bandalos, 2001). Even when data are not missing at random, FIML estimates on average outperform conventional approaches like listwise deletion (Enders & Bandalos, 2001). As a check on the robustness of the findings, models were run with and without using FIML. A cross-lagged panel design was used to test the relationships between perceived susceptibility of AIDS and HIV risk across the two time points in the study using Mplus Version 6.0 (Muthén & Muthén, 2010). The cross-lagged panel approach allows for the simultaneous analysis of two dependent variables, thus making it possible to detect bidirectional relationships between variables over time. Model fit was evaluated using a variety of fit indices. A non-significant chi-square (χ^2) suggests that the model fits the data. A Root Mean Square Error of Approximation (RMSEA) under .05, a Comparative Fit Index (CFI) over .95, and a Standardized Root Mean Square Residual (SRMR) under .08 indicate close fitting models (Hu & Bentler, 1999).

Results

Sample Demographics

The sample was 68% male; participants were on average 32 years old ($SD = 9.8$, range: 18–69) at the initial assessment, had completed 12 years of education ($SD=2.3$, range: 0–19), and were diverse in race and ethnicity: 43% African American, 36% Caucasian, 10% Latino, 3% Asian, 4% “Mixed,” and 4% “Other.” Consistent with other studies of incarcerated individuals, 2.5% reported being HIV positive; these participants were excluded from the present analyses. Participants were incarcerated for a variety of reasons, including violent offenses (22%), theft/fraud (54%), drug offenses (28%), noncompliance with a legal mandate (26%), and miscellaneous (20%). (Percentages do not add up to 100% because many were charged with more than one offense).

Preliminary Analyses

Attrition/missing data across time points—Of the 460 participants who were eligible for the one year post-release follow-up, 343 (74.6%) were reinterviewed, with 17 refusing and 100 unable to locate. Of the 343 follow-up participants, 70 were not administered the HIV perceptions questions because the post-release interview being collected beyond the window of eligibility for time-sensitive data (protocols focused on objective questions). Others were not administered the perceived susceptibility questions because these questions were added after data collection began ($n=27$). Still others provided invalid information regarding HIV risk behavior ($n=20$). Finally, three individuals contracted HIV between interviews and were excluded leaving a sample of 223 individuals with valid post-release HIV risk data. Participants who completed both Time 1 and Time 2 did not differ significantly from eligible participants who only completed Time 1 on any baseline variables of interest in the present study (t 's < 2.5).

Descriptive statistics for perceived susceptibility to AIDS, HIV risk, dispositional optimism, borderline features, psychopathy, substance dependence, age, gender, and race appear in Table 2. At Time 1, half (49.8%) of the sample reported no measurable risk of HIV contraction in reference to the 30 days prior to incarceration. Participants' HIV risk ranged from 0 (negligible, measured to the hundredth-thousandth place) to 0.18 (18 out of 100 chance of contracting HIV). Participants' average HIV risk was lower at Time 2 (30 days prior to the 1 year post-release interview) than at Time 1 ($t(210) = -3.22$, $p < .001$), as was their perceived susceptibility to AIDS ($t(229) = -6.40$, $p < .001$). A majority (64.6%) reported no measurable HIV risk at Time 2; those who did show calculable risk ranged from 0 to 0.07. To put these probabilities in context, it should be noted that a single sexual encounter with a known HIV-positive person carries a 3 out of 1000 chance (.003) of disease transmission, suggesting that the level of risk at both Time 1 and Time 2 are quite high (Klatt, 2010).

What is the concurrent relationship between perceived susceptibility to AIDS and HIV risk?

Table 2 presents the bivariate relationships among the key variables in the study at both time points. Perceived susceptibility was moderately stable over time ($r = .42$, $p < .001$) while

HIV risk was less so ($r = .26, p < .001$), suggesting that there were individual differences in changes in both perceptions and behavior over time. To answer our first aim we examined the concurrent relationship between perceived susceptibility and HIV risk. Consistent with our prediction for Time 1 there was a small but positive relationship ($r = .09, p = .04$). Surprisingly, at Time 2 perceived susceptibility and HIV risk was negatively correlated ($r = -.17, p = .01$). When examining these relationships prospectively at the bivariate level, Time 1 perceived risk was not significantly related to Time 2 HIV risk ($r = -.11, p = .13$), and Time 1 HIV risk was not related to Time 2 perceived susceptibility ($r = .09, p = .16$). To examine these relationships when controlling for prior behavior we ran a cross-lagged model.

Does perceived susceptibility to AIDS predict subsequent HIV risk?

Figure 2a shows the complete cross-lagged model. Both the autocorrelations and synchronous correlations for perceived susceptibility to AIDS and HIV risk were statistically significant. Two alternative models were tested, one estimating the prospective path from perceived susceptibility to HIV risk and the second estimating the prospective path from HIV risk to perceived susceptibility. The hypothesized cross-lagged effect from Time 1 perceived susceptibility to HIV risk at Time 2 was significant ($\beta = -.15, p = .02$), and this model fit the data well ($\chi^2(1) = 0.18, p = .67$, RMSEA = .00, CFI = 1.00, SRMR = .01), explaining a significant amount of variance in HIV risk ($R^2 = .11$). An alternative model with a cross-lagged effect from HIV risk at Time 1 to perceived susceptibility to AIDS at Time 2 showed that this path was non-significant ($\beta = .03, p = .64$), and did not exhibit close model fit ($\chi^2(1) = 4.38, p = .04$, RMSEA = .08, CFI = 0.94, SRMR = .04). This suggests that, consistent with many health behavior models, early perceptions of susceptibility to AIDS predict later HIV risk, rather than early HIV risk behavior predicting later perceptions of susceptibility (Becker, 1974; Belcher, Sternberg, Wolotski, Halkitis, & Hoff, 2005).¹

Do individual differences moderate the relationship between perceived susceptibility to AIDS and subsequent HIV risk behavior?

Beyond the directionality of influence between perceived susceptibility to AIDS and HIV risk behavior, we were interested in individual difference variables that may affect the extent to which people use their past experiences and perceptions to guide subsequent risk behavior. Thus, we expected that demographic traits (age, gender, race), personality variables (optimism, borderline personality features, psychopathy) and past behavior (substance dependence) would moderate the relationship between perceived susceptibility to AIDS and later HIV risk behavior. Moderation of the cross-lagged path between Time 1 perceived susceptibility and Time 2 HIV risk was tested separately for all moderators (see Figure 2c).² All moderators included in the present study were assessed at Time 1; where

¹To determine whether the loss of participants in Time 2 affected the models presented, we reanalyzed the cross-lagged model using only the participants ($N = 223$) with data at both time points. As in the full sample, Time 1 perceived susceptibility to AIDS predicted changes in HIV risk ($\beta = -.15, p = .03$), while early HIV risk behavior did not predict changes in perceptions of susceptibility ($\beta = .01, p = .93$). Parameter estimates in this reduced sample model were similar in size to the full model (Figure 2b). Fit indices continued to show better fit for the model including perceptions of susceptibility to changes in HIV risk ($\chi^2(1) = 0.01, p = .93$, RMSEA = .00, CFI = 1.00, SRMR = .001) than the alternative path ($\chi^2(1) = 4.74, p = .03$, RMSEA = .13, CFI = 0.94, SRMR = .04).

significant bivariate relationships existed between perceived susceptibility and moderators, a correlation was included in the model to account for additional multicollinearity and to enhance model fit.

Demographics—Age neither directly predicted changes in HIV risk ($\beta = -.08, p = .17$) nor moderated the relationship between perceived susceptibility to AIDS and changes in HIV risk ($\beta = .03, p = .60$), $N=498$, $\chi^2(6) = 11.61, p = .07$, RMSEA = .04, CFI = 0.91, SRMR = .03. Gender was not a significant predictor of changes in HIV risk ($\beta = .07, p = .25$) in the model. Gender also failed to moderate the relationship between perceived susceptibility and changes in HIV risk ($\beta = -.06, p = .38$), $N=498$, $\chi^2(6) = 2.12, p = .91$, RMSEA = .00, CFI = 1.00, SRMR = .02. A main effect of race emerged in the model, such that being white, relative to African-American, was associated with greater HIV risk at Time 2 ($\beta = .15, p = .04$). There was also a trend toward race as a moderator of the relationship between perceptions of susceptibility to AIDS and changes in HIV risk ($\beta = -.17, p = .08$). Greater perceived susceptibility at Time 1 was associated with decreases in HIV risk behavior between Times 1 and 2 for white participants. The same finding was not true for African-Americans, as perceived susceptibility at Time 1 was unassociated with changes in HIV risk. Unlike in the previous models, when race was included, perceived susceptibility to AIDS was not a significant predictor of changes in HIV risk ($\beta = -.02, p = .79$). This model, demonstrated good fit ($N=498$, $\chi^2(3) = 5.44, p = .14$, RMSEA = .04, CFI = 0.97, SRMR = .03).

Personality—In the model including psychopathy as a moderator, psychopathy ($\beta = .20, p < .01$) predicted changes in HIV risk. However, psychopathy did not moderate the relationship between perceived susceptibility and changes in HIV risk ($\beta = -.04, p = .59$), $N=443$, $\chi^2(3) = 0.30, p = .96$, RMSEA = .00, CFI = 1.00, SRMR = .01. When borderline personality features were included as a moderator in the model, neither perceived susceptibility to AIDS ($\beta = -.12, p = .08$) nor borderline personality features ($\beta = -.04, p = .58$) predicted changes in HIV risk. However, there was a significant interaction between borderline personality features and perceived susceptibility ($\beta = .16, p = .02$). Specifically, for those individuals who had low to moderate borderline personality features, greater perceived susceptibility to AIDS at Time 1 was associated with a decrease in HIV risk behavior between Times 1 and 2 (Figure 3). For individuals high in borderline personality features, there was no relationship between Time 1 perceived susceptibility to AIDS and changes in HIV risk behavior. This model also demonstrated good fit to the data ($N=463$, $\chi^2(6) = 4.68, p = .59$, RMSEA = .00, CFI = 1.00, SRMR = .01). Although the model including dispositional optimism fit the data well ($N = 498$, $\chi^2(6) = 8.15, p = .23$, RMSEA = .03, CFI = 0.97, SRMR = .03), optimism was not a significant predictor of changes in HIV risk ($\beta = -.05, p = .49$) and did not moderate the modeled pathway between perceived susceptibility to AIDS at Time 1 and HIV risk at Time 2 ($\beta = .03, p = .63$).

²Moderators of the alternative model were also explored. None of the hypothesized moderators affecting the relationship between Time 1 HIV risk and changes in perceived susceptibility were significant. Additionally, all of these models exhibited poor model fit.

Substance dependence—A trend towards symptoms of alcohol dependence in the year prior to incarceration predicting changes in HIV risk emerged ($\beta = .12, p = .06$); alcohol dependence did not moderate the relationship between Time 1 perceived susceptibility to AIDS and changes in HIV risk behavior ($\beta = .09, p = .23$), $N=498$, $\chi^2(3) = 0.89, p = .83$, $RMSEA = .00$, $CFI = 1.00$, $SRMR = .01$. Time 1 opiate dependence was largely unrelated to changes in HIV risk ($\beta = -.00, p = .96$) and did not moderate the relationship between perceived susceptibility to AIDS and changes in HIV risk ($\beta = -.04, p = .63$), $N=498$, $\chi^2(3) = 3.04, p = .39$, $RMSEA = .01$, $CFI = 1.00$, $SRMR = .02$). Time 1 cocaine dependence was unrelated to changes in HIV risk ($\beta = -.11, p = .08$) and did not moderate the proposed path between perceived susceptibility and changes in HIV risk ($\beta = .00, p = .99$), ($N=498$, $\chi^2(3) = 2.66, p = .45$, $RMSEA = .00$, $CFI = 1.00$, $SRMR = .02$). Time 1 marijuana dependence was unrelated to changes in HIV risk ($\beta = -.09, p = .22$) and did not moderate the relationship between perceived susceptibility to AIDS and changes in HIV risk ($\beta = -.15, p = .17$), ($N=498$, $\chi^2(3) = 3.40, p = .33$, $RMSEA = .02$, $CFI = 0.99$, $SRMR = .02$).

Discussion

This study examined the relationship between jail inmates' perceived susceptibility to AIDS and their subsequent HIV risk, as measured by a cumulative risk index. We also explored age, gender, race, borderline personality features, psychopathy, dispositional optimism, and substance dependence history as potential moderators of this relationship.

We found evidence of a small, positive relationship between perceived susceptibility to AIDS assessed just after incarceration intake and pre-incarceration HIV risk level. These results are consistent with the modest correlation ($r=.11$) cited in Gerrard, Gibbons, and Bushman's (1996) meta-analysis. The obtained correlation demonstrates the extent of participants' misperception. This suggests that there is ample room for intervention to rectify incorrect assumptions about risk within the incarcerated population.

Beyond the concurrent correlation between perceived susceptibility to AIDS and HIV risk level at baseline, our findings suggest that, to a limited extent, people use their past behavior combined with prior perceptions of susceptibility to AIDS to adjust subsequent HIV risk behaviors. This practice is consistent with health models that posit that perceptions of vulnerability to illness precede health behavior change. These results are promising, as they point to the potential usefulness of modifying incorrect assumptions about risk level to promote safer sexual and needle practices in the future.

The observed relationship between perceptions of susceptibility to AIDS and subsequent changes in HIV risk behavior was consistent across many segments of our sample. Specifically, the association between perceptions of susceptibility to AIDS and changes in HIV risk behavior generalized across inmates regardless of age, gender, dispositional optimism, psychopathy, and substance dependence. That is not to say that these variables are not important in understanding the complex relationship between perceptions of susceptibility to AIDS and HIV risk behavior. For example, dispositional optimism and alcohol dependence were significantly related to both of these constructs. It may be the case that optimism and alcohol dependence affect perceptions of vulnerability, which go on to

affect actual behavior, rather than acting as a moderator of the relationship. It is also conceivable that psychopathy and substance dependence history may similarly affect perceptions of vulnerability, leading to differences in actual risk behavior.

In this sample, age was unrelated to all variables of interest. Significant levels of HIV risk behavior occurred across all age groups, not just among younger people. Furthermore, the relationship of perceived susceptibility to changes in HIV risk did not vary by age. Gender was also unrelated to HIV risk, though Adams et al. (in press) present evidence that men and women inmates engaged in a somewhat different profile of HIV risk behavior (women were more likely to have used injection drugs prior to incarceration; men were more likely to have engaged in high levels of unprotected sex with non-primary partners). The present findings suggests that despite the observed differences in HIV risk profiles between men and women, the extent to which they used information about past behavior and prior perceptions of susceptibility to inform later HIV risk behavior did not differ.

We did find evidence that there are specific demographic characteristics and personality traits that may influence how much individuals use past perceptions of susceptibility to AIDS to guide behavior. Although, when accounting for Time 1 HIV risk level, higher perceptions of susceptibility to AIDS at Time 1 were associated with lower HIV risk at Time 2 for most people in the sample, this was not true for African-Americans or for individuals with elevated levels of borderline personality features. In these two groups, baseline perceptions of vulnerability were unrelated to changes in HIV risk behavior. For African-Americans, this failure to incorporate risk levels to guide behavior may represent conspiracy theories prevalent in this group about the origin and nature of HIV. Studies have shown that African-Americans are more likely to mistrust messages about HIV and to believe that the government created the disease, and this is associated with a failure to use condoms and engage in safe sex practices (Bogart & Thorburn, 2005; Bogart, Galvan, Wagner, & Klein, 2011); this belief system may require specialized intervention to promote change among this group. For those with high levels of borderline personality features, recognizing while ignoring risk may be a symptom of the disorder, meriting specific attention to treat the underlying psychiatric condition in order to improve self-assessments of risk, and to motivate subsequent changes in behavior.

High risk sexual and drug use behaviors were evident prior to incarceration and post-release in our sample, though there was considerably less HIV risk behavior reported in the year following release from jail, with two-thirds of the sample reporting no HIV risk behavior at that time. For those individuals who continue to be at risk of contracting HIV, our findings suggest that interventions to modify HIV risk behavior among jail inmates may need to identify and focus on specific individual-level characteristics to ensure success across an array of people. Although targeted and tailored interventions may be difficult to employ in correctional settings due to concerns about singling out specific groups and costs associated with refining interventions for multiple subpopulations, we echo Seal et al.'s (2010) assertion that tailoring interventions is necessary to increase intervention efficacy since incarceration is a larger societal problem disproportionately experienced by particular groups.

The limitations of this study include the relatively small sample size for women relative to men, which compromised our ability to detect potentially noteworthy gender differences. This study was limited to a single jail and included only relatively serious offenders, thus it is not known whether these results will generalize to other offenders and to non-correction (community) populations. In Time 2, our cumulative HIV risk variable was restricted, with nearly two-thirds of the sample showing no measurable risk, which limited our power to detect potentially meaningful effects in analyses. There was considerable attrition at Time 2 owing to the transient nature of this population and because the measure of perceived HIV risk was added after data collection was underway. Notably, though, there were no baseline differences between those who did and did not complete Time 2 assessments. Our measure of perceived susceptibility assessed perceived AIDS risk rather than HIV risk; this was an artifact of the predominant terminology at the start of the study. A more refined measure for future study would specifically assess perceived susceptibility to HIV. Additionally, we did not have access to information about sexual orientation in this sample, which may have influenced our findings.

Our study is the first to use a longitudinal design to assess the relationship between perceptions of susceptibility to HIV and actual HIV risk behavior among jail inmates, a group that is at high-risk for contraction of the disease. This design allows for a more stringent test of directionality between these constructs than do the cross-sectional designs prevalent in this line of research. Further, this project is one of the first to explore moderators of the relationship between perceptions of susceptibility and actual HIV risk in this population. This is an important avenue for further exploration, as identifying particular subgroups that use this risk information differently can allow for targeted interventions to align perceptions, and ultimately reduce actual risk.

The present study also contributes to the literature by incorporating epidemiologically-based estimates of HIV risk. Although individuals may not rely on the relative risks associated with each behavior when calculating their personal perceptions of risk, calculating risk in this way provides risk levels that are easily understandable and that have practical significance. If other researchers incorporate similar methods of calculating HIV risk, cross-study comparisons can more easily be made (Cohen & Bruce, 1997). Given the number of individuals who cycle in and out of local jails annually -- 12.9 million people -- and the fact that inmates represent a high-risk group for HIV/AIDS contraction, it is imperative that research be conducted to inform interventions to reduce risk, capitalizing upon what is known about associations between perceptions of susceptibility and actual behavior, along with known strategies for health promotion.

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Figure 1.
Consort Diagram of Study Participants

Figure 2.

Cross-Lagged Models

Note: Standardized estimates are given for each path; * $p < .05$, ** $p < .01$.

Figure 3.

BPD features and race as moderators of the relationship between Time 1 perceived susceptibility to AIDS and changes in HIV risk

Notes. Results are controlled for Time 1 HIV risk. Time 2 HIV risk has been multiplied by 100 for ease of interpretation. Perceived susceptibility and BPD points on the graph represent ± 1 standard deviation for each construct.

Table 1

Bernoulli HIV Risk Equation Parameters

Symbol	Description	Model parameter estimates	Source of estimate
<i>Estimated parameters</i>			
π_1	Probability that a sex partner is infected	0.10 (high-risk partner) 0.03 (low-risk partner)	Tempalksi et al., 2009; CDC, 2012
π_2	Probability that a non-sexual injection partner is infected	0.10	Tempalksi et al., 2009
α_1	Per contact probability of HIV transmission for vaginal sex	0.0006	Boily et al., 2009
α_2	Per contact probability of HIV transmission for anal sex	0.0073	Baggaley et al., 2010
α_3	Per contact probability of HIV transmission for oral sex	0.0002	Baggaley et al., 2008
α_4	Per contact probability of HIV transmission for syringe sharing	0.0067	CDC, 2005
<i>Measured parameters</i>			
n1	Number of acts of unprotected vaginal sex	All measured parameter values were derived from individual-level self-reported risk behavior	
n2	Number of acts of unprotected anal sex		
n3	Number of acts of unprotected oral sex		
n4	Number of acts of syringe sharing		

Note. Probability of partner's infection is based on local prevalence rates.

Table 2

Descriptive Statistics For and Intercorrelations Among Key Study Variables

	N	M (SD)	1	2	3	4	5	6	7	8	9	10	11	12	13	14
1. Time 1 Perceived Susceptibility	499	3.00 (1.49)		.09*	.42**	-.11	.23**	.33**	-.20**	.01	.04	-.05	.10*	.17**	.15**	.14**
2. Time 1 HIV Risk	499	0.01 (0.03)			.09	.26**	.08	.18**	-.14**	-.06	-.03	.07	.02	.22**	.09	-.02
3. Time 2 Perceived Susceptibility	231	2.35 (1.50)				-.20**	.11	.13	-.09	-.06	.02	-.16*	-.02	.14*	-.03	.14*
4. Time 2 HIV Risk	223	0.004 (0.01)					.19**	-.02	-.06	-.12	.09	.24**	.14*	-.01	-.10	-.05
5. Time 1 Psychopathy	444	12.12 (4.95)						.27**	-.07	.03	.25**	-.16**	.20**	.07	.30**	.27**
6. Time 1 BPD	464	63.10 (12.67)							-.43**	-.06	-.03	.09	.32**	.24**	.36**	.28**
7. Time 1 Optimism	499	3.91 (0.67)								.06	-.01	-.32**	-.15**	-.17**	-.18**	-.09
8. Age	499	31.91 (9.77)									-.17**	.01	.05	.11*	.32*	-.19**
9. Gender	499	31% F 69% M										-.06	.12**	-.09*	-.05	.19**
10. Race	395	54% A 46% C											.08	.24**	.06	-.06
11. Time 1 Alcohol Dependence	494	0.70 (1.00)												.09	.27**	.28**
12. Time 1 Opiate Dependence	497	0.44 (1.15)													.35**	.04
13. Time 1 Cocaine Dependence	498	0.95 (1.44)														.16**
14. Time 1 Marijuana Dependence	493	0.53 (0.97)														

Notes: For gender, 0 = female, 1 = male. For race, 0 = African-American, 1 = Caucasian.

*
p < .05,**
p < .01.