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Predictive Utility and Measurement Properties of the Strength of Implementation Intentions Scale (SIIS) for Condom Use

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Abstract

Background—Implementation intentions are situation-linked action plans that increase health behaviors such as condom use. Few studies have measured the strength of implementation intentions, especially regarding condom use. Non-injection drug users are at high risk for HIV due to risky sexual practices. Substance use before sex may increase risky sexual behaviors, and implementation intentions are a promising, practical route for HIV prevention.

Purpose—This prospective study assessed the measurement properties of the newly developed Strength of Implementation Intentions Scale (SIIS) for condom use and investigated whether the SIIS predicted condom use one-year later. The study evaluated whether behavioral intentions and alcohol or methamphetamine use before sex modified the relationship between the SIIS and condom use.

Methods—Participants were 590 non-injection drug users convicted of nonviolent drug offenses in court-mandated outpatient drug diversion programs. They completed self-directed computer assessments at baseline and at one-year follow-up. Measures included demographics, behavioral intentions to use condoms, the SIIS for condom use, alcohol and methamphetamine use before or during sex, and condom use. Psychometric properties, direct, and interaction effects of the SIIS were evaluated using structural equation modeling and general linear regressions.

Results—The SIIS, behavioral intentions, and condom use were positively correlated and discriminant validity between all three constructs; the SIIS predicted condom use one-year later in this high-risk population. No significant interactions were detected.

Conclusions—The SIIS is predictive of condom use behavior, is psychometrically sound and distinct from behavioral intentions, and can be incorporated into HIV prevention interventions and used as a mediator variable. In addition, it can be used as an outcome measure where a follow-up is not feasible. The SIIS can also be tailored for additional HIV-related behaviors such as HIV-

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testing, adhering to antiretroviral medication, prescribing and adhering to pre-exposure prophylaxis, and other health behaviors.

Keywords

HIV; alcohol use; methamphetamine use; behavioral intention; implementation intentions; SIIS; non-injection drug users; drug diversion

Implementation intentions (IIs) strategically link an action plan to perform a behavior with a situation or cue, in the form of, “If situation X occurs, then I will perform behavior Y” (Gollwitzer, 1999; Gollwitzer and Oettingen, 2011). For example, “If I bring someone home from the bar to have sex, then I will use a condom.” II formation allows participants to specify situations and their response when that situation arises, controlling their behavior based upon specific environmental cues (Milne et al., 2002). Some studies suggest that IIs create “instant habits” suggesting an automatic process (Aarts and Dijksterhuis, 1999; Webb and Sheeran, 2004, 2007); other research on prospective memory conducted in a laboratory provides counter evidence (McDaniel and Scullin, 2010).

An initial correlational study on IIs found that forming IIs was beneficial for completing difficult but not easy goals (Gollwitzer and Brandstätter, 1997). Experimental studies also found that forming IIs have been effective in promoting health behaviors including: a) eating healthy (Adriaanse et al., 2011; Armitage, 2007), b) smoking cessation (van Osch et al., 2010), c) reducing alcohol use (Murgraff et al., 2007), d) cervical cancer screenings (Sheeran and Orbell, 2000), e) contraception use (Martin et al., 2011), and f) condom carrying behavior (Arden and Armitage, 2008; de Vet et al., 2011). One study reported that the more specific participants were in forming IIs, the more likely they were to continue to abstain from smoking seven months after the intervention (van Osch et al., 2010). Another study found that forming IIs reduced emergency contraception and pregnancy test consultations, and results were confirmed two years after baseline (Martin et al., 2011).

Unprotected sex is a principle route for the transmission of HIV (Centers for Disease Control and Prevention [CDC], 2013). Non-injection drug users (NIDUs) are a frequently neglected population and are at substantial risk for HIV infection because of risky sexual practices (Crawford and Vlahov, 2010; Mitchell and Latimer, 2009). IIs are a promising and practical route for HIV prevention among NIDUs. Two studies found that forming IIs for carrying condoms led to effective behavioral change (Arden and Armitage, 2008; de Vet et al., 2011). Adolescents and adults who formed IIs were significantly more likely to carry condoms than those who did not form IIs (Arden and Armitage, 2008). Due to the complex nature of using condoms, research also suggested that specific IIs that focus on purchasing, discussing, and using condoms would be more effective in increasing condom carrying behavior and condom use (de Vet et al., 2011).

Assessment of Implementation Intentions

As just outlined, experimental manipulations of IIs have been found to predict a range of health behaviors, including condom use. However, the investigation of the predictive utility of *measures* of IIs regarding condom use is a new area of research, and only a few studies

have even *assessed* IIs regarding this behavior (Arden and Armitage, 2008; Svenson et al., 2002). Measures of IIs ask pivotal questions about whether detailed plans have been made about when, where, or how a behavior will be acted on, in line with theory and experimental literature on II formation. Specific content of measures is suggested by intervention research. For example, Arden and Armitage (2008) contend that HIV interventions on IIs should focus on proper condom use, obtaining and carrying condoms, and condom negotiation. Developing a scale with relevant content that measures the perceived strength of the link between temporal or spatial features of the situation (e.g., when, where) and a specified response (using condoms) would be useful in this regard as condom use requires multiple steps and behaviors; IIs involve a link between situational features and a planned behavior. A scale measuring II strength may be used as a fidelity check to gauge if the participants have properly formed IIs (Hagger and Luszczynska, 2014) or as a mediator in theoretical models. Some individuals may have already formed IIs in the absence of an intervention and thus acknowledge a link between a situation and planned behavior. IIs, or at least some aspect of these action plans, may be measureable regardless of intervention exposure. However, previous research has not examined whether measures of IIs predict later behavior or if they can be psychometrically discriminated from measures of intentions.

Strength of Implementation Intentions Scale (SIIS) for Condoms

The SIIS was developed in a previous study to determine reliability and immediate effects on intermediate (mediator) variables (see Nydegger et al., 2013). The scale was conceptualized similarly to Rise and colleagues (2003) who developed a scale to measure IIs regarding recycling and exercising. Participants were asked if they had made detailed plans about when, where, and how they were going to engage in those behaviors, and they responded “yes” or “no”. However, there were very few items, and the behaviors were simple (e.g., what day a participant will exercise). In addition, items from the action-specific planning scale by Abraham and colleagues (1999) aided in developing the content of the items for the SIIS, such as when to put on a condom, how to discuss condom use if a partner is reluctant to use one, and when to put one on during a sexual encounter. The previous study determined that this scale had good internal consistency reliability ($\alpha = 0.92$). Further, the study found that a manipulation of IIs for condom use strongly influenced (Cohen’s $d = 0.82$) scores on the measure of this construct, suggesting that the measure is sensitive to II interventions and detects action plan formation (Nydegger et al., 2013).

Potential Moderators of Implementation Intention Effects

Some potential moderators of the effects of IIs on behavior include behavioral intentions, alcohol use, and methamphetamine use (Hagger and Luszczynska, 2014; Rise et al., 2003; Sheeran et al., 2005).

Behavioral intentions

In a meta-analysis, Gollwitzer and Sheeran (2006) found that participants with extremely strong behavioral intentions were more likely to act (on any behavior) after forming IIs during an intervention. One study examining behavioral intentions as a moderator of IIs and exercising found no increased effect between IIs and exercise when behavioral intentions

where high. Researchers hypothesized that the lack of identifying behavioral intentions as a moderator could be due to participants' already high behavioral intentions to exercise (Rise et al., 2003). Additional research found intention strength to be a moderator between IIs and behavior (Hagger and Luszczynska, 2014; Sheeran et al., 2005).

Substance use

Studies examining men (LaBrie et al., 2005) and women (Caldeira et al., 2009) have found that those who were intoxicated during sex were less likely to use condoms. Other studies found no association between drinking alcohol before or during sex and subsequent condom use (Calsyn et al., 2011; Leigh et al., 2008a, 2008b). Condom use was consistent regardless of alcohol use; participants regularly (or rarely) used condoms (Calsyn et al., 2011; Leigh et al., 2008b).

One study found that men who used methamphetamine before or during a sexual encounter were less likely to use condoms; this relationship was not significant among women (Leigh et al., 2008a). Men using methamphetamine were more likely to test HIV-positive than men who never used methamphetamine, even after controlling for demographic variables, exposure to blood, and the use of cocaine, alcohol, or marijuana during sex (Molitor et al., 1998). A more recent study among men did not find an association between recent methamphetamine use and condom use. However, the majority of the participants, regardless of methamphetamine use, did not use condoms; therefore, differences may have been difficult to detect (Krawczyk et al., 2006).

Stacy and colleagues (1999) predicted that alcohol and drug use would attenuate the relationship between behavioral intentions and condom use. Yet, no moderating effects of alcohol or drug use between behavioral intentions and condom use were found to be significant. The lack of moderating effects of alcohol and drug use could be due to behavioral intentions only accounting for a small variance in behavior (Gollwitzer, 1999). If behavioral intentions account for a small change in behavior, then detecting any moderating effect may be difficult. However, once someone forms an II, they are more likely to act than if they solely formed behavioral intentions.

Alcohol myopia theory suggests that consuming alcohol can impair attention, cognition, and information processing (Staples et al., 2015; Steele and Josephs, 1990). Individuals who consume alcohol may be more responsive to immediate, salient cues, such as engaging in sex because they are aroused, which could lead to risky sexual behavior (MacDonald et al., 2000; Shuper et al., 2009). A person under the influence of alcohol may be unable to process environmental cues that would under normal circumstances lead them to use a condom during sex (Staples et al., 2015). Similarly, the use of methamphetamine before or during sex may impair one's judgment, leading individuals to ignore cues indicating that they should use a condom (Molitor et al., 1998). Instead, individuals under the influence of methamphetamine before or during sex may engage in risky sex in response to the salient cue: sexual arousal.

Overview

This study first evaluated the model fit and factor structure of the previously developed Strength of Implementation Intentions Scale (SIIS) for condom use (Nydegger et al., 2013). The SIIS measures the perceived strength of the link between the situation (e.g., where or when) and the person's response. In addition, this study sought to evaluate the potential overlap with behavioral intentions in an analysis that reveals whether the constructs can be discriminated. Next, the authors investigated whether the SIIS for condom use would predict condom use at one-year follow up. Further, several interactions were evaluated to determine a) if the relationship between SIIS and condom use one-year later would be stronger among individuals with higher behavioral intentions to use condoms than lower behavioral intentions; and b) if the relationship between the SIIS and condom use would be stronger among those who did not use alcohol or methamphetamine before or during sex.

Method

Participants

Participants were 590 individuals who had been convicted of a nonviolent drug offense and participated in a court-mandated outpatient drug diversion program. Individuals were eligible to be in the study if they spoke English, were able to provide written consent, and did not have any cognitive, language, or hearing impairments. Participants ranged in age from 18 to 62 ($M = 30.68$, $SD = 10.45$). Thirty percent of participants were non-Hispanic White, 51% were Hispanic, and the remaining 11% were other minorities or mixed race/ethnicity. Within two hours before or during sex, 64% percent reported alcohol use and 39% reported methamphetamine use.

Procedures

This study used a two-time point, prospective, cohort study design. Prior to recruitment and participant arrival, data collectors set up a mobile computer lab at the drug diversion sites in Southern California. Data collectors obtained written consent and completed Confidential Subject Contact Sheets to be used for follow-up assessment from all participants. Participants were assured that their survey responses would be confidential by explaining the attainment of a Certificate of Confidentiality issued by the National Institutes of Health. Participants were then directed to sit at any laptop of their choosing. The assessment was self-directed so that participants could complete the assessment at their own pace. Participants had 90 minutes to complete the assessment, though most required less time. They were compensated \$10 for their effort.

Follow-up assessment took place one year later either in a drug diversion facility or another nearby location. This assessment was also self-directed and participants had 90 minutes to complete the computer-based assessments. Participants were compensated \$50 for their effort. Those who were unable to attend the in-person assessment were told that they could complete a secure, online version and were mailed a \$50 gift card. Claremont Graduate University's Institutional Review Board approved all procedures.

Measures

Demographics—Gender, age, race/ethnicity, and sexual orientation were assessed at baseline. Race/ethnicity was categorized as: non-Hispanic white, Hispanic, and other ethnic categories. The three race/ethnicity categories were dummy coded for analyses. Sexual orientation was dichotomized into heterosexual and having had sex with someone of the same sex in the past 12 months. Sexual orientation is further broken down by gender in Table 1.

Behavioral intentions—Behavioral intentions were measured using seven items at baseline (Stacy et al., 2006). The first five items were: *How likely is it that you would use a condom (or get the other person to use one) with someone you:...* 1) *have never had sex with before*, 2) *have known only for a few weeks or less*, 3) *know had other sexual partners*, 4) *have dated for a long time*, and 5) *have already had sexual intercourse*. The last two questions were: *I intend on using a condom:...* 6) *whenever I have sex with a casual partner* and 7) *if I have sex with someone I have just met*. Response options ranged from *definitely not* (0) to *definitely yes* (3). The mean of items was used for the behavioral intentions score with higher scores indicating greater intentions to use condoms.

SIIS for condom use—The SIIS for condom use was measured at baseline using nine items specifying the strength of the link between the situation (i.e., when or where) and the participants' responses (Nydegger et al., 2013). Participants responded to the following: *I have made detailed plans:...* 1) *about when I will carry a condom*, 2) *about when I will use a condom for vaginal intercourse or anal intercourse*, 3) *about when I will use a condom the next time I have oral sex*, 4) *on where I will keep condoms readily available*, 5) *on what I will say to a partner about using condoms before having sex*, 6) *about what I will say if my partner refuses to use a condom*, 7) *about the actions I will take if my partner refuses to use a condom*, 8) *about how I will put on a condom or offer one to my partner before sex*, and 9) *about when I will put on a condom or offer one to my partner*. The items cover temporal, spatial, and social features of condom behaviors considered central to condom use (de Vet et al., 2011). Responses ranged from *strongly disagree* (1) to *strongly agree* (6). The mean of all items was used for a SIIS for condom use score, with higher scores indicating greater strength of IIs to use condoms.

Alcohol and methamphetamine use before or during sex—Participants were asked at baseline, “*During the past 4 months, have you used any of the following drugs either during sex or within 2 hours of sex?*” (Gillmore et al., 1992). Participants responded by checking drugs used before or during sex. For this study, only alcohol and methamphetamine (e.g., speed, crystal, crank) were considered. Participants who checked that they used alcohol were coded as 1 and those who did not were coded as zero. The coding procedure for methamphetamine was the same. Participants who reported alcohol use, but not before or during sex, were coded as 0; the same procedure was used for methamphetamine.

Condom use—Condom use was assessed at baseline and one-year follow up (Stacy et al., 1999). Participants were asked: *In the past 4 months, how often did you (or your partners)*

use condoms in each of these situations:... 1) with someone you had never had sex with before, 2) with someone you had known only for a few weeks or less, 3) with a casual partner, 4) with a new main partner, 5) when having sex with multiple partners, 6) with someone you know had other sexual partners, 7) with someone you had dated for a long time, and 8) with someone you had already had sex with. Response options ranged from *never* (1) to *always* (5). The mean of all items provided a condom use score with higher scores indicating increased condom use.

Data Analyses

The psychometric properties, direct, and interaction effects of the SIIS were evaluated using structural equation modeling and general linear regressions. Using baseline measures, overall goodness of fit was evaluated using structural equation modeling in Mplus (Muthen and Muthen, 2015) using the chi-square goodness-of-fit test (χ^2); comparative fit index (CFI); root-mean-square error of approximation (RMSEA) and its confidence interval; and the Tucker-Lewis index (TLI; MacCallum et al., 1996). SAS® software Version 9.4 (SAS Institute Inc., 2013) was used to conduct general linear regressions to evaluate direct and interaction effects. All regression models included condom use at baseline as a covariate. The outcome variable, condom use one-year later, was bimodal. Analyses used the natural log of the condom use variable. Interaction terms consisted of the products of variables of interest, with continuous variables centered on their means prior to analyses (Cohen et al., 2003). Intraclass correlations for dependent variables across sites were assessed because data collection occurred across 10 program sites. Because intraclass correlations were equal to zero, multilevel analyses were not performed (Heck et al., 2010).

Missing data were handled using multiple imputations ($n = 40$) under the normal model to avoid variance lost (Graham, 2009). Attrition at one-year follow-up was high given the hard-to-reach population under study with a total of 284 participants completing the assessment (48% completed one-year follow-up). However, theoretically, large amounts of missing data should not be a critical problem as long as the sample size is large enough and the missing values are missing at random (Graham, 2009; Mulla et al., 2009). The analytic sample excluded those who indicated condom use was not applicable ($n = 71$) or had no sex in the past four months ($n = 13$).

Results

Demographic characteristics are presented in Table 1. Means and standard deviations for behavioral intentions, the SIIS, and condom use at one-year follow-up are also presented in Table 1. Higher scores indicate more behavioral intentions to use condoms, stronger IIs to use condoms, and more condom use. The internal consistency reliability for the SIIS was good ($\alpha = 0.96$).

Confirmatory Factor Analysis (CFA) Model Evaluating the SIIS, Behavioral Intentions, and Condom Use

CFA procedures evaluated the relative convergence of three factors: the SIIS, Behavioral Intentions, and Condom Use. The scale items/indicators in the model adequately reflected

the three latent factors. However, the *a priori* factor structure of the model did not fit the data very well, $\chi^2(249) = 1498.24$, $p < 0.0001$, RMSEA = 0.10 (95% CI: 0.09, 0.10), CFI = 0.85, and TLI = 0.84. Several modification indexes were examined. The indexes revealed that two Behavioral Intentions items, 4 and 5, would significantly load on the SIIS, revealing a lack of discriminant validity for those items. In addition, several correlated errors revealed significance. It can be appropriate to consider allowing for correlated errors because these correlations often explain only minor covariation not explained fully in the model (Byrne et al., 1989; Tanaka and Huba, 1984). Because of the lack of discriminant validity in the two Behavioral Intention items (4 and 5, see Measures section) and their small loading size (standardized loadings < 0.21), these items were removed from the model. In addition, significant correlated errors were added between several indicators that did not have relevance for tests of discriminant validity across factors (see Figure 1).

This final model fit the data well with respect to practical indexes of fit, with $\chi^2(200) = 498.04$, $p < 0.0001$, RMSEA = 0.05 (95% CI: 0.05, 0.06), CFI = 0.96, and TLI = 0.95. While χ^2 was still significant in the final model, model fit is not based solely on χ^2 (Bentler, 1980; Byrne et al., 1989). The RMSEA, CFI, and TLI for the final model were consistent with recommended adequate model fit (Hu and Bentler, 1999). Factor correlations were significant for the SIIS and Behavioral Intentions factors ($r = 0.47$, $p < 0.0001$); Behavioral Intentions and Condom Use factors ($r = 0.56$, $p < 0.0001$); and the SIIS and Condom Use factors ($r = 0.57$, $p < 0.0001$). As hypothesized, all three factors, the SIIS, Behavioral Intentions, and Condom Use, were significantly and positively correlated. In addition, all nine items of the SIIS were significant and moderate-to-large in size ($p < 0.001$; see Figure 1).

Tests of criteria for discriminant validity—An alternative model to the final model fixing the factor correlation between the SIIS and Behavioral Intentions factors at 1.00 was estimated, with $\chi^2(201) = 1997.64$, $p < 0.0001$. This alternative model fit the data significantly worse than the final model depicted in Figure 1, with $\chi^2_{\text{diff}}(1) = 1499.61$, $p < 0.0001$. A second alternative model fixed the correlation between the SIIS and Condom Use factors at 1.00, with $\chi^2(201) = 1274.64$, $p < 0.0001$. Again, this alternative model fit the data significantly worse than the final model, with $\chi^2_{\text{diff}}(1) = 776.61$, $p < 0.0001$. The alternative models where factor correlations were set at 1.00 fit the data significantly worse; this pattern of findings provides support for discriminant validity among the tested constructs (Kenny, 1976; Marshall et al., 1993; Torkzadeh et al., 2003). As hypothesized, the SIIS and Behavioral Intentions constructs were empirically distinguishable.

General Linear Regression Models

Hierarchical regression and moderated regression models were analyzed both with (adjusted) and without (unadjusted) demographic predictors. These predictors included age, gender, ethnicity, and sexual orientation. Adjusted and unadjusted regression models using and not using multiple imputations showed a similar pattern of results. Therefore, results presented are from simultaneous models without adjusting for demographic variables since these were non-significant predictors and the primary findings revealed an identical pattern

across analyses. The 40th imputation was used to report cumulative R^2 from the hierarchical model.

Results revealed that condom use at baseline and alcohol use before or during sex significantly predicted condom use one-year later (p s < 0.05). As hypothesized, the SIIS significantly predicted condom use one-year later ($t = 3.15$, $p < 0.05$). The full model accounted for 32.41% of the variance in condom use at one year follow up, and the SIIS accounted for 9.66% of the variance (based on the cumulative R^2 of the hierarchical model of the 40th imputation; see Table 2).

In the regression model evaluating the modifying effect of behavioral intentions, the variables were entered in the following order: condom use at baseline, alcohol use, methamphetamine use, behavioral intentions, the SIIS, and the interaction term of behavioral intentions and the SIIS. Results revealed no significant interaction between the SIIS and behavioral intentions as predictors of condom use one-year later ($t = 0.13$, $p > 0.05$). In the regression model evaluating the modifying effect of alcohol use before or during sex, the variables were entered in the following order: condom use at baseline, behavioral intentions, methamphetamine use, alcohol use, the SIIS, and the interaction term of alcohol use and the SIIS. Similarly, no significant interaction was revealed between the SIIS and alcohol use during sex predicting condom use one-year later ($t = 1.12$, $p > 0.05$). In the regression model evaluating the modifying effect of methamphetamine use before or during sex, the variables were entered in the following order: condom use at baseline, behavioral intentions, alcohol use, methamphetamine use, the SIIS, and the interaction term of methamphetamine use and the SIIS. Again, no significant interaction was revealed between SIIS and methamphetamine use during sex as predictors of condom use one-year later ($t = 1.19$, $p > 0.05$). Thus, the SIIS predicted condom use one year later, yet behavioral intentions, alcohol use, and methamphetamine use did not modify that relationship.

In order to ensure the primary results did not depend on the correlated errors specified in the measurement model, results were re-analyzed removing one item from each pair where correlated errors were allowed. The results from the supplementary CFA and regression analyses were quite similar to the initial results using those procedures. The model fit in the CFA was similar ($\chi^2(101) = 279.06$, $p < 0.0001$), and the regression model showed the same pattern of significance regarding the interaction terms and SIIS. The first order effect of the SIIS explained an identical percent of variance adjusting for all other variables and achieved an identical level of significance to that shown in Table 2. Thus, the results replicated across measurement models.

Discussion

This prospective study evaluated the predictive utility of the newly developed SIIS for condom use (Nydegger et al., 2013). First, the current study examined the psychometric properties of the new scale and then identified whether the SIIS predicted condom use at one-year follow-up. Additionally, this study identified whether this relationship was moderated by behavioral intentions to use condoms and alcohol and methamphetamine use before or during sex. Findings from the CFA to test the relative convergence of the SIIS,

behavioral intentions to use condoms, and condom use revealed the constructs to be positively correlated but with strong discrimination between constructs. The test of discriminant validity only evaluated one minimal criterion for discriminant validity and did not conduct an exhaustive test, such as with a multi-trait, multi-method matrix procedure. However, the independent predictive utility of the SIIS, adjusting for previous intentions, also lends credibility to the distinction between SIIS and behavioral intentions.

Further, the SIIS strongly predicted condom use at one-year follow-up, controlling for condom use at baseline. This is the first known study to identify the predictive validity of any type of II assessment over an extended period of time. While two prior studies investigated forming IIs and condom carrying behavior, these studies did not measure the strength of IIs, and the follow-up interval was only two months later (Arden and Armitage, 2008; de Vet et al., 2011). The current study *measured* strength of IIs with a follow-up occurring one-year later.

Evaluation of the moderating effect of behavioral intentions on the relationship between the SIIS and condom use one-year later was not supported. Previous research measuring the moderator effects of behavioral intentions on the relationship between IIs and other health behaviors has been inconclusive. Although two studies found that behavioral intentions moderated IIs and a behavior (Hagger and Luszczynska, 2014; Sheeran et al., 2005), Rise and colleagues (2003) found no such relationship and suggested this was due to the already high behavioral intentions. The average score of behavioral intentions to use condoms in the current study (2.17 out of 3.00) suggests the high score may have affected the interaction analysis. Another possibility is that behavioral intentions may not be as necessary when predicting condom use. Further, in regression models evaluating the direct effect of predictors, behavioral intentions accounted for approximately 3.29% of the variance in condom use one year later, whereas the SIIS accounted for almost 10.00% of the variance, even after adjusting for all other direct effect predictors. This provides evidence that the SIIS may be a stronger predictor of behavior than behavioral intentions in some instances.

Finally, results revealed that alcohol and methamphetamine use before or during sex did not moderate the relationship between the SIIS and condom use one-year later. A previous study also found no support for alcohol and drug use as moderators of the relationship between behavioral intentions to use condoms and future condom use (Stacy et al., 1999). This prior study may have not detected interaction effects due to behavioral intentions accounting for a small portion of variance in behavior (Gollwitzer, 1999). The current study proposed that because IIs account for more variance in behavior, the moderation relationship between strength of IIs and condom use would be significant. However, the relationships were found to be non-significant, supporting previous research (Stacy et al., 1999). These results perhaps also suggest that individuals who have strong IIs to use condoms (or use condoms habitually) may continue to pick up on environmental cues that indicate the need to use a condom, even if under the influence of alcohol or methamphetamine. This contributes to arguments that IIs may reflect an automatic process (Gollwitzer, 1999), such that IIs still predict condom use even when cognition may be disrupted by alcohol or methamphetamine use.

The significant predictions for condom use provide support for future use of the SIIS as a fidelity check or mediator for interventions utilizing IIs to increase condom use. Further, this scale can be used as an outcome measure in situations where a follow-up behavior is not feasible. Behavioral intentions to use condoms, alcohol use before or during sex, and methamphetamine use before or during sex were not moderators between the SIIS and condom use one-year later. This is consistent with the view that IIs may form “instant habits” (Aarts and Dijksterhuis, 1999; Webb and Sheeran 2004, 2007), given predictive effects of IIs were not affected by substance use before sex. If having strong behavioral intentions or using a substance prior to or during sex does not impact the relationship between a drug user’s strength of IIs to use condoms and future condom use, then an instant habit may be formed regardless of one’s behavioral intentions or substance use.

An alternative explanation for the lack of moderation between the SIIS and condom use one-year later may be due to individuals’ condom use, regardless of their intentions and substance use. Two studies found no relationship between alcohol and condom use, indicating that participants either used condoms or did not regardless of alcohol use (Calsyn et al., 2011; Leigh et al., 2008b). Participants in the present study may be consistent with condom use over time rather than having formed “instant habits.” Additional research demonstrated that once intentions are deactivated, IIs no longer affect behavior (Brandstätter et al., 2001). These findings suggest that IIs may not necessarily form “instant habits.” Future research is needed to investigate these underlying processes.

Limitations

A significant amount of attrition occurred at the one-year follow-up as a result of the hard-to-reach, high-risk population studied. Future research might evaluate differences between demographic groups and replicate findings in other high-risk populations, such as men who have sex with men. To account for missing data, multiple imputations were conducted. Importantly, analyses were run using multiple imputations, not using multiple imputations, adjusted, and unadjusted. The SIIS significantly predicted condom use one-year later across all analyses (unadjusted utilizing multiple imputations, adjusted using multiple imputations, unadjusted not using multiple imputations, and adjusted not using multiple imputations). The major hypothesis tests investigated in this study were consistent across analytic procedures.

With regard to measurement, the study measured both substance use and condom use questions over the past four months; yet, because the follow-up was one year later, it poses a potential limitation. The regression models focused on the prediction of condom use, adjusting for previous levels of condom use assessed one year earlier. However, this simple prospective design only captures linear effects over time and cannot capture complex growth patterns or curvilinear effects over time that can be detected across three or more waves. However, it can be argued that predictive effects detected over a one-year period, adjusting for earlier levels of the dependent variable, can reveal an important relationship at least across these two distal time points. The findings do not address whether more numerous assessments, either over shorter or longer time periods, would show different prospective patterns (Ployhart and MacKenzie Jr., 2015). In addition, all measures were self-report. It is

possible that measuring IIs or any other sensitive construct increases a person's susceptibility to memory, social desirability, or self-presentation bias. Thus, future experimental research should investigate possible effects of these potential biases on the measure.

Future Research

While there are currently many effective II interventions (Oettingen, 2012), future studies using IIs to increase condom use may utilize the SIIS to: a) determine if IIs have already been formed, and b) serve as a fidelity check to ensure participants have properly formed IIs. The SIIS can be used as an intermediate or mediator variable in interventions designed to prevent the spread of HIV. Measuring the strength of one's IIs to use condoms provides a good measure of immediate program effects (Nydegger et al., 2013), shows good discriminant validity with behavioral intentions to use condoms, and is a good predictor of condom use one year later.

Additionally, the SIIS can be used in future intervention research investigating program effects of HIV risk variables. This scale may be extremely beneficial to drug diversion programs, which may desire a quick proxy measure of effects on HIV risk variables and are typically not able to conduct research or follow-ups. The SIIS can be used by programs conducting HIV prevention interventions as a way to measure immediate intervention effects. Future research should consider reproducing this study with other populations, tailoring the SIIS to other health behaviors, and investigating the poly-use of psychoactive substances.

Conclusion

In sum, the SIIS is a psychometrically sound measure that can be incorporated into HIV prevention interventions. The scale showed a strong relationship to condom use considering the one-year follow-up period and showed evidence of discriminant validity with this behavior. This finding, coupled with the ability of the scale to detect intervention effects (Nydegger et al., 2013), implies the scale can be used as an outcome measure in situations where a follow-up of behavior is not feasible. In addition, future studies might further investigate this relationship in other populations, settings, and with respect to other behaviors. Since IIs are used to promote healthy behavior change (Adriaanse et al., 2011; Armitage 2007; Martin 2011, Murgraff et al., 2007; Sheeran and Orbell 2000; van Osch et al., 2010) and are relevant for many additional health behaviors, researchers could consider tailoring the SIIS toward: other HIV-related behaviors such as HIV testing, adhering to antiretroviral medication, prescribing and adhering to pre-exposure prophylaxis; and other health behaviors such as physical activity, diet, screening behavior, and prescription adherence.

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Research Highlights

- A recent scale measuring implementation intentions is psychometrically strong.
- The results show discrimination between implementation and behavioral intentions.
- Neither intentions nor substance use moderated effects of implementation intentions.
- Implementation intentions predicted condom use one year later.

Table 1

Demographic and descriptive statistics of participants

	<i>N</i>	%
Age (<i>M, SD</i>)	30.68	10.45
Sex		
Male	425	72.03
Female	158	26.78
Missing	7	1.19
Sexual Orientation		
Heterosexual male	317	53.73
Heterosexual female	124	21.02
Men who have sex with men	42	7.12
Women who have sex with women	21	3.60
Missing	86	14.58
Race/Ethnicity		
White (non-Hispanic)	176	29.83
Hispanic (not mixed)	298	50.51
Other racial/ethnic minority or mixed	62	10.51
Missing	54	9.15
Alcohol use before or during sex		
Did not consume alcohol	130	22.03
Consumed alcohol	378	64.07
Missing	82	13.90
Methamphetamine use before or during sex		
Did not consume methamphetamine	297	50.34
Consumed methamphetamine	230	38.98
Missing	63	10.68
Behavioral intentions (<i>M, SD</i>)	2.17	0.80
SIIS for condom use (<i>M, SD</i>)	3.56	1.87
Condom use one-year later (<i>M, SD</i>)	2.70	1.64

Table 2

One-year longitudinal prediction of condom use

Variable	Simultaneous Model			Cumulative R^2
	<i>B</i>	<i>SE</i>	<i>t</i>	<i>p</i>
Intercept	-0.21	0.09	-2.47	0.0152
Condom use at baseline	0.09	0.03	2.75	0.0070
Behavioral intentions	0.13	0.07	1.89	0.0621
Alcohol use	0.31	0.09	3.54	0.0006
Methamphetamine use	-0.05	0.09	-0.59	0.5600
Strength of Implementation Intentions Scale	0.09	0.03	3.15	0.0023
				0.32

Note. Results are from a simultaneous model; cumulative R^2 s are from a hierarchical model of the 40th observation. Regression analyzed without multiple imputations adjusting for demographic variables, unadjusted regression without multiple imputations, and adjusted regression with multiple imputations all produced similar results.