Published in final edited form as:

Arch Sex Behav. 2016 February ; 45(2): 415–428. doi:10.1007/s10508-015-0619-9.

Psychometric Properties and Validity of a Multi-dimensional Risk Perception Scale Developed in the Context of a Microbicide Acceptability Study

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Abstract

Currently available risk perception scales tend to focus on risk behaviors and overall risk (vs partner-specific risk). While these types of assessments may be useful in clinical contexts, they may be inadequate for understanding the relationship between sexual risk and motivations to engage in safer sex or one's willingness to use prevention products during a specific sexual encounter. We present the psychometric evaluation and validation of a scale that includes both general and specific dimensions of sexual risk perception. A one-time, audio computer-assisted self-interview was administered to 531 women aged 18–55 years. Items assessing sexual risk perceptions, both in general and in regards to a specific partner, were examined in the context of a larger study of willingness to use HIV/STD prevention products and preferences for specific product characteristics. Exploratory and confirmatory factor analyses yielded two sub-scales: general perceived risk and partner-specific perceived risk. Validity analyses demonstrated that the two subscales were related to many sociodemographic and relationship factors. We suggest that this risk perception scale may be useful in research settings where the outcomes of interest are related to motivations to use HIV and STD prevention products and/ or product acceptability. Further, we provide specific guidance on how this risk perception scale might be utilized to understand such motivations with one or more specific partners.

Keywords

Sexual risk; Risk perception; HIV/STD prevention; Microbicides

Introduction

Sexual risk for HIV/AIDS and other sexually transmitted diseases (STDs) is often defined by the number of sexual partners, unprotected sexual encounters, or any combination of those and other behaviors that may put one at risk for disease (Yao et al., 2009).

Traditionally, most measures of sexual risk focus on behavior. The Brief HIV Screener (BHS) captures a number of sexual risk behaviors including number of partners, anal sex, STD history, trading sex, and partner behaviors; most of the questions are based on a 10-year time period (Gerbert, Bronstone, McPhee, Pantilat, & Allerton, 1998). The HIV-Risk Taking Behavior Scale (HRBS) assesses risk behaviors including number of partners, condom use with different types of partners, and anal sex, and the questions are based on a 1-month time frame (Darke, Hall, Heather, Ward, & Wodak, 1991).

Behaviorally based assessment of sexual risk is useful in settings such as health clinics where sexual health counseling may be tailored to the needs of the patient (Patel, Yoskowitz, Kaufman, & Shortliffe, 2008), in the context of clinical trials of sexual health interventions to determine eligibility based on high- or low-risk status (Rosen et al., 2008), and as a proxy for high risk behavior and actual disease incidence (Alexander et al., 2014). However, measures that are restricted to the respondent's own sexual behaviors may be inadequate when the outcomes of interest are risk context (inclusive of partner's risk), one's motivation to engage in safer sex, or willingness to use prevention products. In this situation, some measure of risk perception may be necessary to tap into the cognitive processes behind sexual decision-making.

Perceived risk and susceptibility to HIV have been shown to be associated with safe sex behaviors (e.g., Rosengard et al., 2005). There are currently available scales that tap into the more cognitive and affective aspects of sexual decision-making, including the Sexual Risks Scale: Perceived Susceptibility (SRS-P), the Sexual Risk Cognitions Questionnaire (SRCQ), and the Perceived Risk of HIV Scale (PRHS). The SRS-P is a 4-item scale measuring perceived risk (DeHart & Birkimer, 1997). In the SRCQ, a variety of reasons to *not* use a condom are rated on a 5-point Likert scale for how often the thought occurs, from *never* to *very frequently* (Shah, Thornton, & Burgess, 1997). The PRHS is a 10-item scale measuring the cognitive, affective, and intuitive aspects of HIV-risk perception on a variety of 4- to 6-point Likert scales (Napper, Fisher, & Reynolds, 2012).

While these recent measures move beyond strict behavioral assessment, they are still limited to an aggregate perception based on sexual behaviors with multiple partners over a given period of time. However, numerous studies have shown that sexual risk perception—that is, one's views of their own risk—is associated with partner-specific factors such as partner type (e.g., main or non-main; Mehrotra, Noar, Zimmerman, & Palmgreen, 2009). The decision to engage in or not to engage in safer sex behaviors may also be specific to a given partner or type of partner (DePesa, Eldridge, Deavers, & Cassisi, 2014). For example, many

people believe that knowing or trusting a partner increases that partner's safety (Masaro, Dahinten, Johnson, Ogilvie, & Patrick, 2008). Rosengard et al. (2005) found that whether a woman views her partner as a main or casual partner may determine decision-making about safe sex.

Vaginal microbicides products are currently undergoing clinical trials and may offer one important vehicle for protecting women from sexual transmission of HIV/AIDS in the near future. Vaginal microbicides could prevent or significantly reduce HIV transmission; some may also provide protection against other STDs, and still others may have contraceptive effects (aAIDS Vaccine Advocacy Coalition, 2014a, 2014b; CAMI Health, 2014; Global Campaign for Microbicides; International Partnership for Microbicides, 2002–2011). Acceptability of these products among women and willingness to use them are essential for product uptake and sustained use (Mantell et al., 2005).

These findings are part of a larger study that examined women's willingness to use microbicides and preferences for certain product characteristics in the context of their relationships, sexual behavior, and other factors. We have previously reported that women with non-main sexual partners have higher predicted willingness to use microbicides (Morrow et al., 2007a). The purpose of the current report is to present the psychometric evaluation and validation of a scale of sexual risk perception that includes both general risk and partner-specific risk perception, and to discuss the potential uses and limitations of the newly developed scale.

Method

Participants

A cross-sectional questionnaire was administered using an audio computer-assisted self-interview (A-CASI) format on laptop computers equipped with headphones. Screening was conducted either in person or over the telephone. If eligible, potential participants were provided with a more comprehensive description of the study. Informed consent forms were read to them, with staff providing further explanations and responding to any questions. Once consent was obtained, participants completed the questionnaire on the laptop privately and independently, with an interviewer being available for questions or technical issues. A detailed explanation of study procedures has been described elsewhere (Morrow et al., 2007a).

Women were recruited from various venues (e.g., public media, community-based organizations, social service and treatment organizations, and word of mouth) in four (4) states in the northeast U.S. (Connecticut, Massachusetts, New York, and Rhode Island). Eligibility criteria (self-report) included being 18–55 years old; being Black/African-American (Black), Latina/ Hispanic (Latina), or White; having had vaginal sex with at least one male sex partner in the last 12 months; being HIV-negative or of unknown HIV status; not being pregnant; and being able to read and comprehend English. Non-proportional quota sampling was used to recruit subgroups sufficient to address the overall research questions (Morrow et al., 2007c). Black, Latina, and White women were enrolled because these are the racial/ethnic groups that did and still do make up the largest proportions of HIV-infected

women in the United States (Centers for Disease Control and Prevention, 2001, 2014). The sampling strategy was designed to result in the enrollment of approximately one-third Latina, one-third Black, and one-third White women across sites. With respect to partner status, further sample stratification recruited approximately one-third with one (1) male vaginal sex partner in the last 12 months, while two-thirds had two or more (2+) male vaginal sex partners in the last 12 months. For further recruitment details, see Morrow et al. (2007a).

Participants were reimbursed \$30 for completing the questionnaire. Where appropriate, participants were provided up to \$10 reimbursement for travel or child/elder care required for them to participate. All procedures were approved by the local Institutional Review Board.

Randomization of Partner—Women who reported having one sexual partner in the last 12 months were asked to label him as either a “main,” “casual,” or “other” partner. These categories were selected based on qualitative scale development work where the data indicated that women defined relationships within the concepts of emotional connectedness and commitment/fidelity. A “main” partner was defined as “someone you feel an emotional commitment to, like a boyfriend, fiancé, husband, or your man.” A “casual” partner was defined as “someone you know, such as a friend, but aren’t in any sort of committed relationship with,” and an “other” partner was defined as “someone you don’t know much about, for example, a client, or maybe someone you have never met before you have sex.” Women who reported having two or more sexual partners in the last 12 months were asked to identify their least frequent, most frequent, most important, and most recent sexual partners and to label them as main, casual, or other partners, as described above. For multi-partnered women, the computer randomly chose one of her identified partners, and for women who reported only one partner, that person was used. Women were asked to answer the questions about the chosen partner for the partner-specific risk items.

Measures

The full questionnaire consisted of an initial eligibility screener and questions that assessed multiple content areas including history of vaginal product use (e.g., vaginal medications or lubricants), preferences for specific microbicide characteristics (e.g., formulation), self-efficacy for vaginal product and condom use, sexual norms of friends and significant others, partner identification as described above, general risk perception, partner-specific relationship context (e.g., partner age, monogamy), positive and negative aspects of partner-specific relationship quality (Morrow et al., 2011) and communication, partner-specific sexual norms, partner-specific sexual behavior (e.g., types of sex, how often a condom or barrier method was used), partner-specific risk perception, context of participant’s last sexual episode with the chosen partner, willingness to use a hypothetical microbicide with the chosen partner (Morrow et al., 2007a), importance of various product characteristics and protective properties in a potential microbicide (e.g., make sex feel better, have no odor; Morrow et al., 2007b), self-efficacy for microbicide use (Fava et al., 2013), STD, HIV testing, and drug use history, and demographics. Questionnaire items, instructions, and order were carefully decided using relevant literature, expert reviews, and cognitive interviews.

Item and section ordering were selected to optimize conceptual flow from more general information (e.g., norms) and historical sexual behavior and risk assessment, to current/recent partner-specific behavior and risk. For more information on the full questionnaire, see Morrow et al. (2007a). Individual risk items are presented in Fig. 1.

Statistical Analysis

Initial descriptive statistics, exploratory dimensional analyses (EDA), and concurrent validity analyses were conducted using IBM SPSS Statistics for Windows, Release 20.0.0 (©IBM Corp., 2011, Armonk, NY, www.ibm.com). Confirmatory Factor Analyses (CFA) were performed using the Mplus 7.0 (Muthen & Muthen, 1998–2012) structural equation modeling program (Steiger & Lind, 1980).

The final sample ($N=531$) available for the study was divided randomly into two subsamples. Subsample 1 ($N=265$) was used for EDA and initial reliability analyses to determine the initial factor structure and potential sets of subscale items. Subsample 2 ($N=266$) was used for CFA and further instrument refinement. A final CFA was done using the complete sample to obtain more stable estimates of item loadings, model fit, and reliability.

For the EDA, the Scree Test (Cattell, 1966), the minimum average partial (MAP) procedure (Velicer, 1976), and an implementation of the parallel analysis (PA) procedure (Horn, 1965; O'Connor, 2000) were employed in a preliminary step to aid in the determination of the underlying dimensional structure. Both a principal components analysis (PCA) and a maximum likelihood factor analysis (MLFA) were then conducted to examine the suggested recommendations for the underlying dimensional structure. For CFA model evaluation purposes, we examined the Chi-Square Test of Model Fit, the Comparative Fit Index (CFI; Bentler, 1990), the Tucker Lewis Index (TLI; Tucker & Lind, 1973), and the standardized root mean square residual (SRMR; Bentler, 1989). Values above 0.95 for the CFI and TLI, in combination with SRMR values of less than 0.06, are generally considered to indicate very good model fit (Hu & Bentler, 1999).

Concurrent validity analyses used analysis of variance and Bonferroni-adjusted p values to determine significance, or Pearson r correlations. The Tukey–Kramer HSD post hoc test procedure was used to compare grouping variables with 3 or more levels. If a homogeneity of variance violation occurred, the Brown-Forsythe or Welch/Brown-Forsythe Robust tests of equality of means was used, followed by the Games-Howell post hoc test procedure to compare grouping variables with three or more levels. Omega-squared, a population-adjusted measure of variance accounted for, or r^2 , a measure of variance accounted for with respect to the Pearson correlation statistic, were also calculated to describe the effect size of each statistically significant result. A Bonferroni adjustment to help control for Type I error was applied with respect to each set of 28 concurrent ANOVA and Pearson correlation validity analyses with each subscale, and an individual analysis was deemed statistically significant at $p < .002$.

Results

Sample Demographics

A total of 922 women were screened for the study: 17 % were ineligible due to study eligibility criteria, 16 % were eligible but were not enrolled due to having reached full enrollment for their targeted demographic group, and 9 % were eligible and scheduled but did not keep the appointment. The final sample included 531 women of the 922 who were screened for the study. Using purposive sampling, approximately equal numbers of White ($n = 172$; 32 %), Black ($n = 193$; 36 %), and Latina ($n = 166$; 31 %) women were enrolled. The average participant age was 33.8 years ($SD = 9.6$) and 58 % ($n = 308$) reported that they had never been married. Most reported having two or more male vaginal sexual partners in the past 12 months ($n = 376$, 71 %) while 29 % ($n = 155$) reported one male partner over the same time period. Thus, the non-proportional quota sampling target for race/ethnicity and number of sexual partners was achieved. More than half of the participants had a high school education or less (54 %), were unemployed (55 %), and reported an annual household income of less than \$15,000 (52 %). Participants reported on main (58 %), casual (32 %), and other (10 %) partners. They had been in a sexual relationship with their chosen male partner for varying lengths of time: 16 % less than 1 week, 10 % 1 week–1 month, 10 % 1–3 months, 10 % 3–6 months, 13 % 6 months–1 year, 23 % 1–5 years, and 18 % more than 5 years; and 44 % had lived with their chosen partner in the past year. For additional sample details, see Morrow et al. (2007a, b).

Measurement Development Analyses

EDA were conducted on the set of four items developed to measure participant evaluation of their risk of contracting an STD or HIV with respect to their general sexual activities and their sexual activities with a specified partner, using the Subsample 1 responses, with an effective sample size of 260 cases after listwise deletion (5 cases or 1.9 % missing data). The three procedures used to provide guidance for the dimensional structure underlying the four Perceived Risk items each suggested a one-dimensional solution as the best representation. We also examined the two-factor and component solutions; however, the off-factor loadings for the items were fairly high and borderline complex for this representation. Therefore, we accepted the one component factor solution as the best solution within the EDA. The item loadings resulting from the PCA and MLFA one-dimensional solutions are presented in Table 1. This solution accounted for 76 % of the variance. Reliability was measured using Cronbach's (1951) coefficient alpha statistic and was 0.89 for the Perceived Risk Scale.

Confirmatory Factor Analysis (CFA)

A CFA was next conducted using the responses to the four items of Subsample 2, with an effective sample size of 263 after listwise deletion (3 cases or 1.1 % missing data). The model examined specified a one-dimensional solution with four item parameters freed to load on a single factor, and each item error variance allowed to be freely estimated. This overall model fit poorly based on several measures of model fit, $\chi^2(2) = 152.83$, $p < .001$; CFI = 0.75; TLI = 0.26; SRMR = 0.13 (Bentler, 1989). Modification indices provided within the output suggested that a 2 correlated factors model might provide a better dimensional

representation. This model was a significant improvement over the previous model. While the overall model based on the Minimum Fit Function chi square statistic still did not achieve statistical non-significance, $\chi^2(1) = 14.02$, $p < .001$, the improvement in overall model fit was significant as judged by the Chi-Square difference test, $\chi^2(1) = 138.81$, $p < .001$. Also, the alternative fit indices were greatly improved with the CFI = 0.98, the TLI = 0.87, and the SRMR = 0.015. Reliability (Cronbach's coefficient alpha) for the two subscales in this subsample was 0.87 for the general perceived risk subscale, and 0.91 for the partner-specific perceived risk subscale. The pattern of item loadings and the latent factor intercorrelation is presented in Fig. 1.

A final CFA was conducted on the effective complete sample ($N = 523$) available for analysis. The same two dimensional model was examined with two item parameters freed to load on a general perceived risk factor, 2 item parameters freed to load on a partner-specific perceived risk factor, a correlation allowed to be freely estimated between the two latent constructs, and each item error variance allowed to be freely estimated. Item loadings and the correlation between the latent constructs were similar to those obtained in the CFA conducted on Subsample 2 and are also presented for comparison in Fig. 1. While the overall model based on the Minimum Fit Function chi square statistic did not achieve statistical non-significance ($\chi^2(1) = 8.69$, $p = .003$), the alternative fit indices indicated very good fit with the CFI = 0.99, the TLI = 0.97, and the SRMR = 0.009. Cronbach's coefficient alpha reliability coefficients for the two subscales in the complete sample were 0.86 for the general perceived risk subscale, and 0.91 for the partner-specific perceived risk subscale.

Validity Analyses

Overview—After completion of the CFAs, concurrent validity analyses were conducted. Twenty-eight demographic and theoretically relevant variables were examined for their relationship to the general perceived risk subscale and the partner-specific perceived risk subscale. The subscales were measured by summing items that assessed risk using 5-point response formats ranging from 0 (*no risk*) to 4 (*very high risk*). The partner-specific perceived risk subscale ($M = 1.59$, $SD = 1.88$) had a potential score range of 0–8. The general perceived risk subscale ($M = 1.73$, $SD = 1.87$) had a potential score range of 0–8. For each subscale, participant scores were represented across the full range applicable. The general and partner-specific perceived risk subscales were strongly correlated at 0.63 ($p < .001$; $N = 523$).

Concurrent Validity—Of the 28 variables examined with respect to the partner-specific perceived risk subscale, six were not statistically significant ($p > .05$; participant's age, the age difference between the participant and her partner, length of sexual relationship, the two microbicide importance subscales [product characteristics and protective properties], and the importance of a microbicide protecting against pregnancy), nine variables were nominally significant ($p < .05$; race/ethnicity, marital status, moved in past 12 months, household income, whether participant or partner had any medical reason that prevented the participant from getting pregnant, how often did a partner use a condom during anal sex, location of last sex episode, anal sex at last sex episode, and willingness to use microbicides) but not significant after applying a Bonferroni adjustment ($p < .002$), and 13 variables were

significant ($p < .002$; see Table 2). Means, standard deviations, effect sizes, and any Tukey–Kramer HSD post hoc test differences for all analyses significant after Bonferroni adjustment are presented in Table 2.

Of the 28 variables examined with respect to the general perceived risk subscale, six were not statistically significant ($p > .05$; race/ethnicity, the age difference between the participant and her partner, how often did a partner use a condom during anal sex, the two microbicide importance subscales [product characteristics and protective properties], and the importance of a microbicide protecting against pregnancy), five variables were nominally significant ($p < .05$; participant's age, marital status, moved in past 12 months, HIV testing history, and willingness to use microbicides) but not significant after applying a Bonferroni adjustment ($p < .002$), and 17 variables were significant ($p < .002$; see Table 3). Means, standard deviations, effect sizes, and any Tukey–Kramer HSD post hoc test differences for all analyses significant after Bonferroni adjustment are shown in Table 3.

Discussion

The four perceived risk items loaded onto two factors that represented general and partner-specific risk and the best-fitting model included a strong correlation between the general and partner-specific factors. Approximately 30 % of our sample had only one partner in the past year, and almost 60 % were reporting on a main partner and, thus, there may be a high degree of overlap between their general and perceived risk that accounted for the high correlation. The perceived risk scales may be used separately to assess both general and partner-specific risk, or they may be combined into a higher-order factor. Researchers using these scales will want to consider their population of interest when deciding how to score and analyze these scales.

As can be seen in Table 2, mean scale scores for the perceived risk subscales are significantly higher in individuals that have characteristics of a higher risk profile, including those who have a greater number of sexual partners in the past year, how often a condom is used for vaginal sex, and those who have a recent history of STDs (Mayo Clinic Staff, 2014). This was expected given that these are typical risk behaviors. Sociodemographic factors including living arrangements, incarceration history, education, employment status, and household financial situation were also significantly related to the subscales. This is consistent with the trend of increasing HIV prevalence among those of lower socioeconomic status in the United States (Karon, Fleming, Steketee, & De Cock, 2001). These results indicate that the perceived risk subscales are associated with a number of factors that are known to be related to HIV/STD risk perception and actual level of risk.

Relationship factors like the partner type and positive and negative qualities of the relationship were associated with the risk subscales. This is consistent with the literature supporting partner-specific factors influencing safer sex behaviors (Lansky, Thomas, & Earp, 1998; Masaro et al., 2008; Rosengard et al., 2005). In the context of decision-making about HIV prevention, partner-specific assessment may be crucial to understanding intention and ability to engage in safer sex behaviors. In our previous work, we have already demonstrated that willingness to use a microbicide depends on partner type such that women

who are reporting on a non-main partner are more likely to report being willing to use such a product compared to women who are reporting on a main sexual partner (Morrow et al., 2007a).

Willingness to use a microbicide and desired prevention product characteristics were not significantly related to the perceived risk subscales. Willingness to use was nominally related to both subscales after Bonferroni correction ($p < .05$) indicating a non-statistically significant trend. Of note, this sample of women was fairly willing to use a microbicide (average scale score 31.5, $SD = 6.9$, median = 32, out of a potential range of 8–40 with a higher score indicating greater willingness to use; Morrow et al., 2007a) and the higher degree of willingness in this sample may have limited our ability to detect a significant association. It should also be noted that participants were asked to rate their willingness to use a well-described but, nonetheless, hypothetical microbicide as there is no currently available microbicide, and this study was not completed in the context of a drug trial. It is possible that risk perception might serve as a better predictor of actual product use or non-use and, thus, we suggest further evaluations of these relationships in the context of clinical trials where the outcome is actual product use. In terms of the lack of relationship between risk and desired product characteristics, it is possible that women who feel they are at risk for HIV or STDs will decide whether or not to try prevention products—at least initially—regardless of concerns about product characteristics. However, it is possible that product characteristics will be more salient for maintenance of product use. Again, we suggest that these relationships be further explored in the context of clinical trials and actual product use.

There are numerous situational and cognitive factors that influence an individual's awareness and perception of sexual risk, and thereby influence decision-making about protective behaviors such as condom and/or microbicide use. The perceived risk items, and—in particular—the partner-specific items, were intended to offer an advantage over the currently available scales (i.e., the BHS, HRBS, SRCQ, SRS-P, and PRHS) that do not address the complete range of issues involved in decision-making about whether to use or not use a prevention product with any given partner at any given time. The entire questionnaire was carefully designed using reviews of relevant literature, expert reviews, and cognitive interviews to determine item content and wording, response options, instructions and transition statements, and item and section order. Participants were asked to think about their partner(s) in the past year immediately prior to being asked about their general risk perception. They were asked a series of questions regarding their relationship with the chosen partner including relationship quality, communication about risk and HIV/STD prevention, partner-related sexual norms, and specific sexual behaviors before they were asked to rate their partner-specific risk. These inquiries may have been a critical foundation for participants' cognitive evaluations of risk. Therefore, we urge researchers or clinicians that may be interested in using this risk perception scale to precede the risk items with partner-specific questions that will prepare the participant to provide a contextually grounded assessment of risk. To this end, we provide detailed information and sample items in the "Appendix" section as to the types of questions we asked prior to asking the participants to rate their general and partner-specific risk.

In the current study, we chose to focus on recent sexual activity and one chosen male sexual partner. Limiting the risk perception time frame to the past 3 months offered a look at current thinking about sexual risk. Asking the participants to report on a variety of factors related to a single chosen male sexual partner (even if the participant reported multiple partners in the past year) allowed us to explore the ratings of risk perception in the context of their current behavior with this partner. These characteristics may offer an advantage over more general or behaviorally based scales when considering decision-making about whether or not to use a microbicide in the context of a specific sexual episode with a specific sexual partner. In the context of clinical trials, assessment of partner-specific perceived risk may be relevant to understanding how and why a person decides to use or not to use the study product for any given sexual encounter. It would be possible to have a participant report on multiple previous or ongoing partners, and this may be preferred depending on the nature of the study. However, it should be noted that we highly recommend that participants only be asked to rate their risk perception after appropriate lead-in questions have asked (see Appendix section for further guidance). Those who wish to utilize these risk perception items will need to balance their research or assessment objectives with participant burden.

There are a number of limitations that should be noted. First, given that the present study was cross sectional, we were unable to determine whether there were any causal or longitudinally predictive relationships between the risk items and the factors used for scale validation. Second, it is not possible to say if the specific combination of time frames and general and partner-specific questions maximized the association between risk perception and the other variables. For example, some women were reporting on partners with whom they had most recently had sex 3–12 months prior to completing the questionnaire. In fact, 50 participants last had sex with their chosen partner 3–6 months before the study, and 70 participants last had sex with their chosen partner 6–12 before the study. This may have introduced recall bias and increased the hypothetical nature of future-oriented questions if the participant was no longer in a sexual relationship with the chosen partner. Third, for women with multiple partners, we did not obtain partner-specific risk perception information for all possible partners; only the chosen partner. Future studies will need to determine whether this algorithm will be sufficient for specific research populations. Fourth, 30 % of women had only one partner in the past year and thus their report of partner-specific risk wholly overlapped with their report of general risk in the past year. This may be one of the reasons that the general and partner-specific perceived risk scores were highly correlated. Finally, partner type was also limited to three broad categories (main, casual, or other) which may have limited our understanding of the nuance of various relationship types.

The current perceived risk scale is not intended to be a clinical tool for assessing risk. Several advantages that the scale offers in capturing a woman's current risk perception may become limitations when attempting to use this scale as a clinical risk assessment. Perceived sexual risk may be a poor indicator of actual risk, and the more the questions are based on subjective assessments of risk, the more skewed the evaluation may become. For example, in a study of 96 partner dyads who had begun having sexual contact in the previous 3 months, only 26 % of those whose partner had other partners were aware of this, and this was associated with increased rate of sexually transmitted infections (Drumright, Gorbach,

& Holmes, 2004). Additionally, questions are partner-specific and refer to a specific time frame, and, thus, these questions offer an incomplete picture of an individual's overall risk and may not be appropriate for clinical or other research contexts where longer-term historical risk is salient.

The utility of this scale is in its ability to capture women's current and partner-specific risk perception. This validated instrument will be useful in research pertaining to women's perceptions and the impact of those perceptions on sexual decision-making. In clinical trials, these scales may be used at repeated time intervals to assess women's current perceptions of risk with either a single or multiple partners to understand patterns of adherence and how that might vary by specific partner or type of partner (main vs non-main). Understanding current perceptions of risk may also help to contextualize women's evaluations of new investigational products. This tool may help researchers identify women who perceive themselves to currently be at risk for STDs, HIV, or unintended pregnancy and who may be more likely to be a potential user of new prevention products.

Acknowledgments

The National Institutes of Mental Health (NIMH) grant R01MH064455 funded this work. The authors thank the following people for their contributions: Hilda Castillo, Allison Cohn, Michelle Gomez, Alyssa Israel, Luz Lopez, Angela Martinez, Mayra Morales, C. Teal Pedlow, and Andronike Tsamas, research staff; Cynthia Woodsong, consultant; and Susan Cu-Uvin, Kenneth H. Mayer, and Patricia Symonds, co-investigators. They would also like to thank the women who participated in the study and all the community-based organizations that collaborated to facilitate recruitment efforts. Lawrence Severy is now Professor Emeritus at the University of Florida. Lawrence Shulman is now retired and occasionally provides consulting services.

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Appendix. Risk Perception Scale with Instructions and Suggestions for Use

The complete questionnaire used in this study was carefully designed using reviews of relevant literature, expert reviews, and cognitive interviews to determine item content and wording, response options, instructions and transition statements, and item and section order. In addition to the general and partner-specific risk items that we have developed and validated, we suggest, in the boxes below, items, and content that should precede risk assessment.

The two general items are summed to create a scale score with a possible range of 0–8, and the two partner-specific items are summed to create a scale score with a possible range of 0–8.

Prior to asking participants to rate their general perceived risk, we asked participants with one male sexual partner in the past year to identify and label (i.e., main, casual, or other) this partner. We asked participants with more than one male sexual partner in the past year to identify and label their least frequent, most frequent, most important, and most recent partner(s) in the past year.

The next two questions are about sexually transmitted diseases, or STDs. STDs are infections that you may get from a sex partner, like herpes, trich, chlamydia, gonorrhea, or HIV.

Based on your sexual activities over the PAST 3 MONTHS, how much do you think you are at risk for having a sexually transmitted disease (STD)? (Choose one)

- 0 No Risk
- 1 Small Risk
- 2 50/50 Risk
- 3 High Risk
- 4 Very High Risk
- 8 Refuse to Answer

Based on your sexual activities over the PAST 3 MONTHS, how much do you think you are at risk for having HIV? (Choose one)

- 0 No Risk
- 1 Small Risk
- 2 50/50 Risk
- 3 High Risk
- 4 Very High Risk
- 8 Refuse to Answer

Prior to asking participants to rate their partner-specific perceived risk for the chosen partner, we asked them to consider various factors related to their relationship with their chosen partner including their relationship context (partner age, whether the participant had lived with the partner in the past 12 months, length of sexual relationship with partner [see item 1 below], frequency of sex with partner [see item 2], monogamy [see items 3 and 4], whether participant or partner had any medical reason that prevented her from getting pregnant, childbearing intentions with chosen partner, and if they had used any methods to prevent pregnancy or STDs in the past 3 months), relationship quality (Morrow, et al., 2011), relationship communication (whether or not participant and partner had discussed her STD and HIV risk history, his STD and HIV risk history, protecting themselves against STDs and HIV, if they had agreed on a protection plan, and if she felt confidence discussion her risk history, his risk history, and protecting each other from STDs and HIV), partner-specific norms regarding sexual and prevention behavior, and specific sexual behaviors with the partner (frequency of vaginal, anal, and oral sex, frequency of using condoms or barriers for sex). We also recommend assessing whether the participant or her partner uses alcohol or drugs in conjunction with sex and if the sexual relationship involves trading sex for money or other needs or goods.

1. How long did you have ANY kind of sex with [computer inserts name/initials of chosen partner]? (Choose one)

- Less than 1 week
- 1 week but less than 1 month
- 1 month but less than 3 months
- 3 months but less than 6 months
- 6 months but less than 12 months

- 12 months but less than 5 years
- 5 years or more
- Refuse to Answer
2. Most recently, how often did you have ANY kind of sex with this partner?
(Choose one)
- Every day or nearly every day
- 3 to 4 days per week
- 1 to 2 days per week
- 1 to 3 days per month
- Less than once a month
3. During the time you were having sex with him, did you have ANY kind of sex
with anyone else?
- Yes
- No
- Refuse to Answer
4. During that time, do you think he had ANY kind of sex with anyone else?
(Choose one)
- Definitely yes
- Yes, I think so
- No, I don't think so
- Definitely no
- Refuse to Answer

Based on your sexual activities *with this partner* over the PAST 3 MONTHS/PAST 12 MONTHS*, how much do you think you are at risk for having a sexually transmitted disease (STD)? (Choose one)

- 0 No Risk
- 1 Small Risk
- 2 50/50 Risk
- 3 High Risk
- 4 Very High Risk
- 8 Refuse to Answer

*It is possible that the participant was reporting on a male sexual partner with whom she had had sex within the past 12 months, but not within the past 3 months. For those women who had most recently had sex with the chosen partner 3–12 months prior to completing the questionnaire, participants were asked to rate their partner specific-risk for having an STD and for having HIV in the past 12 months.

9 Not Applicable

Based on your sexual activities *with this partner* over the PAST 3 MONTHS/PAST 12 MONTHS*, how much do you think you are at risk for having HIV? (Choose one)

- 0 No Risk
- 1 Small Risk
- 2 50/50 Risk
- 3 High Risk
- 4 Very High Risk
- 8 Refuse to Answer
- 9 Not Applicable

Fig. 1. Standardized parameter values for the two correlated factors model with the combined subsamples ($n = 523$), and with subsample 2 ($n = 263$) standardized parameter values in parentheses

Table 1Component and factor pattern item loadings in subsample 1 ($N = 260$)

Variable	Perceived risk	
	PCA	MLFA
Based on your sexual activities over the past 3 months, how much do you think you are at risk for having a sexually transmitted disease (STD)? [Section F]	0.83	0.69
Based on your sexual activities over the past 3 months, how much do you think you are at risk for having HIV? [Section F]	0.88	0.75
Based on your sexual activities <i>with this partner</i> over the past 3 months (past 3 or 12 months) ^a , how much do you think you are at risk for having a sexually transmitted disease (STD)? [Section L]	0.88	0.90
Based on your sexual activities <i>with this partner</i> over the past 3 months (past 3 or 12 months) ^a , how much do you think you are at risk for having HIV? [Section L]	0.89	0.92

Response options: no risk; small risk; 50/50 risk; high risk; very high risk

PCA principal components analysis, MLFA maximum likelihood factor analysis

^aFor the partner-specific STD and HIV-risk questions, women were asked to think about their sexual activities with the chosen partner in the past 3 months. In the event that the participant had not engaged in any sexual activities with the chosen partner in the past 3 months, she was asked to think about her sexual activity with the chosen partner in the past 12 months. The questions were combined for analysis

Table 2

Frequencies, means, standard deviations, and post hoc differences (including *F* statistic with degrees of freedom and effect sizes) for Bonferroni-adjusted significant differences for the partner-specific perceived risk

Education ²					
High school or less	281	1.9	2.1	19.56	<.001 .033
Some college or more	242	1.2	1.6	(1,515)	
Sex partners (past 12 mo) ^I					
1 _a	152	0.7	1.2	21.86	<.001 .113
2 _b	117	1.6	1.9	(3,289)	
3–9 _b	159	1.9	1.9		
10+ _c	95	2.5	2.1		
Partner type ^I					
Main _a	306	1.2	1.7	14.81	<.001 .066
Casual _b	165	2.0	1.8	(2,130)	
Other _b	52	2.5	2.4		
STD history ^I					
Never _a	313	1.2	1.6	15.28	<.001 .064
Yes, not in past 12 mo _b	120	1.9	1.9	(2,239)	
Yes, past 12 mo _c	87	2.5	2.2		
HIV test history ^I					
Never _a	58	1.1	1.7	8.55	<.001 .024
Yes, not in past 12 mo _a	168	1.3	1.6	(2,249)	
Yes, past 12 mo _b	294	1.9	2.0		
Lived on street, in homeless shelter or treatment facility last 12 mo ²					
No	400	1.4	1.7	23.84	<.001 .050
Yes	123	2.4	2.1	(1,178)	
Incarceration history ^I					
Never _a	383	1.4	1.8	9.56	<.001 .043
Released > 12 mo ago _{a, b}	95	2.0	1.9	(2,103)	

Released in past 12 mo ^b	39	2.7	2.3			
Employed full- or part-time						
No	280	1.9	2.0	14.07	<.001	.025
Yes	233	1.3	1.7	(1,511)		
Financial situation						
Comfortable with extras ^a	131	1.1	1.8	5.68	.001	.027
Enough, but no extras ^{a, b}	126	1.7	1.9	(3,511)		
Enough, had to cut back ^b	122	1.6	1.9			
Not enough ^b	136	2.0	1.8			
Positive sexual relationship	516	$r = -.20$		<.001	($r^2 = .04$)	
Positive aspects of relationship	516	$r = -.37$		<.001	($r^2 = .13$)	
Negative aspects of relationship	516	$r = .27$		<.001	($r^2 = .07$)	
Frequency of condom use						
During vaginal sex	523	$r = -.18$		<.001	($r^2 = .03$)	

Omega-squared is a population-adjusted measure of systematic variance accounted for ² is a commonly used measure of variance accounted for with respect to the Pearson Correlation statistic. Variable subscripts (a, b, c, d) that differ indicate significant differences ($p < .05$) between levels of a grouping variable with more than 2 levels based on the Tukey–Kramer HSD post hoc test. Mean scale scores range from 0 to 8 for General Perceived Risk and 0–8 for Partner-Specific Perceived Risk

¹ Brown-Forsythe Robust test of equality of means

² Welch/Brown-Forsythe Robust test of equality of means

Table 3

Frequencies, means, standard deviations, and post hoc differences (including *F* statistic with degrees of freedom and effect sizes) for Bonferroni-adjusted significant differences for the general perceived risk

Education ²					
High school or less	281	2.0	2.1	17.50	<.001 .029
Some college or more	242	1.4	1.5	(1.510)	
Sex partners (past 12 mo) ¹					
1 _a	152	0.7	1.1	39.56	<.001 .195
2 _b	117	1.6	1.6	(3.340)	
3–9 _b	159	2.0	1.7		
10+ _c	95	3.2	2.2		
Partner type ¹					
Main _a	306	1.3	1.7	21.20	<.001 .091
Casual _b	165	2.2	1.8	(2.140)	
Other _c	52	2.9	2.3		
Medical reason to prevent pregnancy					
No	413	1.6	1.8	10.62	.001 .018
Yes	108	2.3	2.0	(1.519)	
Location of last sexual episode ²					
Home or partner's home	422	1.6	1.8	11.04	.001 .024
Away from home	101	2.3	2.1	(1.134)	
Anal sex during last sex episode					
No	448	1.6	1.8	19.70	<.001 .035
Yes	75	2.6	2.1	(1.521)	
STD history ¹					
Never _a	313	1.3	1.6	21.56	<.001 .089
Yes, not in past 12 mo _b	120	2.0	1.8	(2.235)	
Yes, past 12 mo _c	87	2.8	2.2		
Lived on street, in homeless shelter or Treatment Facility last 12 mo ²					
No	400	1.5	1.7	17.72	<.001 .039

Yes	123	2.4	2.1	(1,175)	
Incarceration History ¹					
Never ^a	383	1.4	1.7	17.22	< .001
Released > 12 mo ago ^b	95	2.5	2.1	(2,133)	.074
Released in past 12 mo ^b	39	2.8	2.0		
Employed full- or part-time ²					
No	280	2.1	2.0	25.86	< .001
Yes	233	1.3	1.5	(1,505)	.044
Financial situation ¹					
Comfortable with extras ^a	131	1.1	1.6	10.92	< .001
Enough, but no extras ^{a, b}	126	1.7	1.7	(3,495)	.054
Enough, had to cut back ^b	122	1.6	1.8		
Not enough ^c	136	2.4	2.0		
Household income ¹					
Low (< 15 K) ^a	275	2.0	2.0	13.23	< .001
Medium (15–36 K) ^b	160	1.5	1.6	(2,421)	
High (36 K+) ^c	63	1.0	1.1		
Positive sexual relationship	516	$r = -.19$		< .001	($r^2 = .04$)
Positive aspects of relationship	516	$r = -.38$		< .001	($r^2 = .14$)
Negative aspects of relationship	516	$r = .22$		< .001	($r^2 = .05$)
Length of sexual relationship	522	$r = -.14$		.001	($r^2 = .02$)
Frequency of condom use					
During vaginal sex	523	$r = -.15$		.001	($r^2 = .02$)

Omega-squared is a population-adjusted measure of systematic variance accounted for r^2 is a commonly used measure of variance accounted for with respect to the Pearson Correlation statistic. Variable subscripts (a, b, c, d) that differ indicate significant differences ($p < .05$) between levels of a grouping variable with more than 2 levels based on the Tukey–Kramer HSD post hoc test. Mean scale scores range from 0 to 8 for General Perceived Risk and 0–8 for Partner-Specific Perceived Risk

^a Brown-Forsythe the Robust test of equality of means

^b Welch/Brown-Forsythe the Robust test of equality of means