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SEXUAL RISK REDUCTION BEHAVIORS AMONG YOUNG HETEROSEXUAL ADULTS

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Abstract—Although young, sexually-active heterosexuals have always been at risk for contracting sexually transmitted diseases, the recent appearance of Acquired Immunodeficiency Syndrome (AIDS) has increased the possible peril of sexual experimentation. Currently, behaviors to reduce the risk of contracting AIDS are being widely advocated. The present study examines predictors of self-reported risk reduction behaviors in a sample of 188 young, sexually-active heterosexuals. Three factors (perceptions of personal vulnerability, sexual behavior history, and homophobia) were hypothesized to predict levels of worry about contracting a sexually transmitted disease. Worry, in turn, was hypothesized to predict behavior change. Structural equation modeling provided support for these predictions, but found somewhat different patterns for women and men. For both sexes, higher levels of worry were a significant predictor of risk reduction behavior implementation. For women only, more extensive sexual behavior histories significantly predicted levels of worry. In contrast, for men only, perceptions of personal vulnerability and homophobia were significant predictors of worry. Results suggest that gender plays an important role in understanding cognitive predictors of sexual risk reduction behaviors.

Key words—AIDS, sexual behavior, risk perception, young adults

INTRODUCTION

Although teenagers and young adults have always experimented with premarital sex, the last 20 years have seen a trend toward greater experimentation by more individuals at a younger age and with more partners [1, 2]. Unfortunately, the recent appearance in this country of a deadly sexually transmitted virus, HIV (Human Immunodeficiency Virus), the pathogen responsible for Acquired Immunodeficiency Syndrome (AIDS), and the rising incidence of other sexually transmitted diseases (STDs) have greatly increased the potential costs of sexual experimentation. This has led to concern about ways to reduce these risks among younger heterosexuals [3–7]. Although the earliest reported AIDS cases were associated with male homosexual transmission and intravenous drug use, heterosexual sexual transmission will increasingly play a role in HIV spread [8–11]. Reduction of risk for HIV transmission through sexual behavior, at present, is dependent upon behavioral changes that will also reduce the incidence of other STDs [6]. This paper considers factors that may lead young, sexually-active heterosexuals to alter their behavior so as to reduce the risks of contracting HIV or other sexually transmitted diseases.

In understanding what might lead young adults to reduce their risks of acquiring an STD, both rational and irrational factors merit consideration [12]. The current study evaluated the influence of rational factors, derived from the popular Health Belief Model [13], and irrational factors that link concern about AIDS to homophobia and fear of homosexuals [14, 15]. Specifically, the impact on risk reduction of four factors was examined: perceived personal vulnerability, sexual behavior history, extent of worry about contracting STDs, and homophobia. In addition, possible differences in the predictors of risk reduction for men and women were considered.

According to the Health Belief Model [13], people rationally evaluate their risk for particular diseases and change their behavior accordingly. This expectancy-value theory suggests that people will engage in risk reduction behaviors if they perceive themselves to be at risk for contracting a serious disease and if they believe that specific behavioral changes will be effective in reducing their risk. The theory adds that this process is triggered by a specific 'cue-to-action,' a signal that motivates behavioral change [16]. The present study examined two elements of the Health Belief Model: risk, measured at both a cognitive (perceptions of personal vulnerability) and behavioral (sexual behavior history) level and the impact of 'worry' as a motivating cue-to-action. It was predicted that those individuals who perceive themselves at greater personal risk will have enacted sexual risk reduction behaviors, provided they have been cued-to-action through their worry about contracting an STD. Optimal levels of fear can serve as psychologically distressing motivators to reduce risk [17]. Previous research has shown that concerns about contracting STDs is positively associated with risk reduction behaviors [6].

For the present study, it was assumed that young adults are aware that sexual activity increases their risk of contracting STDs, such as AIDS, although they may not necessarily understand exactly what behaviors will effectively reduce their risk [18–23]. Risk reduction behaviors, therefore, were conceptualized broadly as changes that young adults might view as effective, including reducing their number of new

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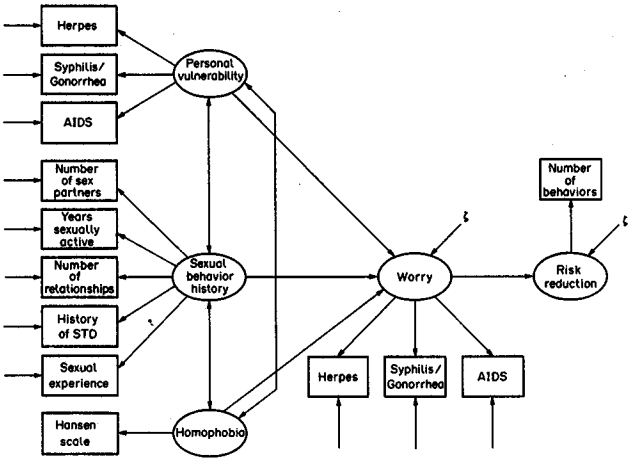

Fig. 1. A model of sexual risk reduction.

sexual partners, waiting longer to become sexually active with someone, and avoiding certain sexual behaviors, as well as using condoms.

Another perspective on preventive health behavior recognizes that seemingly irrational factors may also influence behavior [12, 24]. Historically, in times of epidemics, avoidance of presumed infectious persons has been common, even when avoidance is ineffective [25]. In the case of AIDS, many Americans may associate the disease with homosexual behavior since homosexual males are heavily represented among reported AIDS cases [26]. Consequently, it could be hypothesized that those heterosexual individuals who are already homophobic, who want to avoid and limit the social influence of homosexuals, might be more worried about contracting AIDS. That is, in some nonrational way, homophobia may lead to heightened concern about contracting AIDS, quite apart from an individual's own sexual history. Therefore, we predicted that among heterosexuals higher levels of homophobia would be associated with greater worry about contracting AIDS. As a result, of this greater worry, homophobia might indirectly be linked to decreases in risky behavior.

Figure 1 depicts the model of risk reduction behavior evaluated in this study. The figure is a schematic presentation of a set of linear regression equations which are solved simultaneously. Variables actually measured in the study are depicted as boxes. Labeled circles represent latent constructs estimated by our statistical procedures. Unique variances, or measurement error, are indicated by the unlabeled arrows directed at each item in the figure. The figure shows four key predictor constructs (perceived personal vulnerability, sexual behavior history, homophobia, and extent of worry about contracting an STD) believed to influence the outcome construct of risk reduction behaviors. As indicated by the single-headed arrows, it was hypothesized that perceived vulnerability, sexual behavior history and homophobia all influence worry about contacting an STD which then motivates the individual to engage in risk reduction behavior. Double-headed arrows indicate hypothesized intercorrelations among predictor constructs. The model assumes that concern about AIDS is highly correlated with concern about contracting other sexually transmitted diseases, such as syphilis, gonorrhea and herpes. This, in fact, turned out to be true for the current sample.

A fifth predictor of interest was gender. There is reason to question whether factors leading to risk reduction behavior are identical for men and women. Generally, women have been more conservative in their attitudes about sex and in their personal sexual behavior, although the gender gap has narrowed [2]. Because of the possibility of pregnancy and, more specifically in relationship to AIDS, the continuing debate over the relative efficiency of HIV transmission between males and females [27], the risks of sexual activity may be more salient to women than to men. This might lead to greater worry about the consequences of sexual behavior among women than men. On the other hand, American men appear to show greater levels of homophobia and hostility toward homosexuals, especially toward gay men, than do women [28]. This might suggest that men will worry more than women. Given this reasoning, it

appeared worthwhile to examine possible sex differences in risk reduction behavior. No specific predictions were made about how the sexes might differ.

METHODS

Participants

In order to obtain a large sample of unmarried, exclusively heterosexual, sexually-active young adults, questionnaires were administered to 337 introductory psychology students at a large, urban California university. Participants completed questionnaires in partial fulfillment of course requirements. All were unmarried; approximately half were female and half were male. Questionnaires completed by a few older students (26 years old or greater) were excluded. In the initial informed consent process, participants were advised that they could discontinue participation at any time without penalty. No one, in fact, did so.

In addition to questions concerning heterosexual sexual experiences, included were two items asking participants to specify their own sexual orientation and whether or not they had ever had a homosexual sexual experience. Those students who reported at least one previous heterosexual coitus experience, a heterosexual sexual orientation, and no homosexual sexual experience comprise the sample of interest.

The final sample consisted of 91 women and 97 men. Their median age was 19 years ($\bar{X} = 19.7$, SD = 1.6, range = 18–25 years). Reflecting the ethnic mixture of the university student body, most participants were Caucasian (73%); the balance were from diverse backgrounds including Hispanic (11%), Black (7%), and Asian (5%). Religious backgrounds also varied including 24% Protestant, 31% Catholic, and 19% Jewish. Most participants (56%) reported coming from middle class backgrounds.

Procedure

As part of a larger study of dating relationships, participants complete a detailed 19-page questionnaire in groups of 6 to 20 students. Groups generally included both sexes, and participants always sat far apart to allow complete privacy in completing the anonymous questionnaires. Measures relevant to this investigation are described below, in the order in which they appeared in the questionnaire.

Measures

Sexual behavior history. Five aspects of the participant's sexual history were assessed: (1) years since first sexual experience (years sexually active), (2) total number of serious dating relationships, (3) total number of different sexual partners, (4) history of ever being treated for a sexually transmitted disease, and (5) extent of sexual experiences. For the latter, participants indicated which of five possible sexual behaviors they had ever experienced including vaginal intercourse with and without a condom, fellatio, cunnilingus, and anal intercourse. Behaviors were recorded into the following categories and Guttman scaled in this order: vaginal intercourse with condoms, vaginal intercourse without condom, active oral sex, receptive oral sex, and anal intercourse. Scale coefficients (Coefficient of Reproducibility = 0.94; Coefficient of Scalability = 0.72) appeared adequate [29]. Guttman scaling has been used elsewhere [30] to successfully scale sexual behavior.

Worry about STDs. Participants indicated on three, 6-point items how worried they were about getting a sexually transmitted disease such as gonorrhea or syphilis, contracting genital herpes, and being exposed to HIV. These three items constitute the measurement of worry as a cue to reduce risk.

Perceived personal vulnerability. Students estimated, using three separate 100 mm visual analogue scales anchored at 0 and 100, their own personal probability of ever contracting a sexually transmitted disease, developing herpes, and being exposed to HIV. These measures were used as an index of perceived vulnerability risk for contracting a sexually transmitted disease.

Risk reduction behaviors. Participants were asked whether they had changed their sexual behavior to reduce their risk of developing a sexually transmitted disease. If so, they were asked to indicate if they had used any of eight possible risk reduction behaviors listed. These behaviors included celibacy, reducing the number of new sexual partners, questioning partners about previous sexual experiences, waiting to have sex until a partner is better known, using condoms or spermicides, and avoiding high risk behaviors, such as unprotected anal or oral intercourse. Although the relative efficacy of each behavior varies tremendously, for example, questioning partners [31] vs using condoms, our interest here was in the initiation of self-perceived risk reduction behaviors not the actual reduction of HIV risk. These behaviors were chosen based on a previous study of risk reduction behavior among gay men [32].

A risk reduction index was calculated based on the number of items answered in the affirmative. Scores ranged from 0 to 8 ($\bar{X} = 1.7$, SD = 2.02).

Homophobia. Participants complete the Hansen [33] Homophobia Scale, a 15-item measure of negative attitudes toward homosexuality. The measure was chosen because it does not include questions about the sexual behavior of homosexuals. Instead the questionnaire focuses on three correlated dimensions: social freedoms for homosexuals, avoidance of homosexuals, and a desire to limit the social influence of homosexuals [34]. For the current sample, the internal reliabilty of the scale was quite high (Cronbach's Alpha = 0.94).

Data analysis

For each gender separately. Hypotheses were tested using simultaneous elliptical reweighted generalized least-squares estimate of path-analytic models (see Refs [35, 36] for reviews). Procedures utilized the general approach of Bentler and Bonett [37], as specialized in the EQS computer program [38]. This approach allows for the evaluation of the adequacy of the theory to account for the sum of what is empirically observed. Specific theoretical predictions are translated into linear regression equations. For example, the Health Belief Model hypothesizes that if an individual is cued to action through, for example, worry about a disease (W), he or she will engage in risk reducing behavior (R). In this instance, the linear regression equation is $R = \beta W + \epsilon$, where

β equals a regression weighting of worry ratings and ϵ equals unique variance, or measurement error. The theory hypothesizes a set of constructs and their interrelationships, all of which can be reduced to similar linear equations. Measured variables are hypothesized to be a linear function of both the latent construct and unique variance or measurement error. This is essentially a measurement or factor model. For example, the latent construct of worry is hypothesized to underlie or 'cause' participants' responses to the three items indexing levels of worry about contracting syphilis/gonorrhea, herpes, and AIDS. Each item, however, also contains some unique variance that is not shared with the other two items.

Structural equation analysis allows for this set of hypothesized regression equations to be solved simultaneously in order to generate an estimated covariance matrix. Using a chi-square statistic, this estimated or predicted covariance matrix and the actual observed covariance matrix are compared. If hypothesized relationships are correct one would expect these matrices to be nearly identical, reflecting the theory's ability to predict what is empirically observed. In this instance, a nonsignificant chi-square statistic supports the theory. That is, there is no reason to believe that the matrices are not identical [39].

However, since this test is unable to specify how good a match these matrices are, further procedures seek to establish the adequacy of the estimated matrix to account for relationships [37]. To do this, first an initial Null model is evaluated in which it is hypothesized that there are no relationships between any of the measured variables. This provides an estimate of the amount of variance in the observed covariance matrix. Next, the Theoretical model, which is actually the model of interest, is tested in which theoretically hypothesized relationships are evaluated. Results from the two analyses are then compared by a chi-square difference test evaluating the gain in knowledge obtained by adopting a more specified model. A significant chi-square value suggests that the Theoretical model does improve our understanding of the data. Since sample size affects the chi-square statistic, two fit indices, rho (nonnormed) and delta (normed), are also calculated to give a gross estimate of the percentage of variance accounted for by the solution. The values of these indices range from approximately zero to one. Significance of the estimated parameters in the model is evaluated by critical ratio tests ($CR = \hat{\theta}/SE > 1.96$) to aid in interpretation of the results. Obtained values less than the critical ratio suggest that the relevant parameter is nonessential to the solution. Estimates reflect independent relationships of one construct with another.

Comparing the two genders. In order to evaluate possible structural differences between the two samples, a test version of the EQS (version 3.0) program was then employed. Parameter estimates were derived using maximum likelihood estimation. Estimation of two-group models introduces the concept of structured means [40] in which the effects of gender are evaluated as a covariate predictor of both measured variables and latent constructs during simultaneous estimation of structural models where factor structures are constrained to be equal across the two groups. A progression of hypotheses is evaluated: 1> are the measurement models for each latent construct equivalent across gender?; 2> is there a difference in the mean of each latent construct between genders?; and 3> are the structural equations parameter estimates linking latent constructs the same for both genders?

Initial analyses evaluate the similarities of covariance structures for each latent construct separately. Factor loadings are constrained to be equal for both groups, as are relationships between the measured variable and the structured mean. For one group, the structured mean is hypothesized as a predictor of the latent factor; in the other group, the relationship between structured mean and the latent variable is constrained at zero. This, in effect, forces variance attributable to group differences to be expressed as a difference in the latent factor. Unique variances and covariances of the measured variables and factor residual variances are allowed to vary between the two groups since they are presumed to index random measurement error. A nonsignificant chi-square value supports the hypothesis that the factor structures are the same for both men and women. A significant loading, as evaluated by a critical ratio test, of the structured mean on the latent variable for one group indicates a significant difference between the groups in the mean of the latent variable.

Next, the complete structural equation model is evaluated in which the equivalence of factor regression estimates can be directly tested. The structures of the latent constructs, as described above, and the structural equations parameters are constrained to be equal for both genders, while error variances and covariances are allowed to vary. A nonsignificant chi-square indicates that the model adequately represents the covariance structure of the data for both groups. Further analyses test for differences between the two groups in regression estimates.

RESULTS

Sex differences in measured variables

Before modeling relationships among study variables, sex differences in risk perception, sexual behavior history, homophobia, worry, and risk reduction were evaluated. As can be seen in Table 1, men and women did not differ significantly in most respects. In general, participants rated their odds of contracting a sexually transmitted disease, including herpes and AIDS, as approximately less than one in five, though men perceived themselves as being significantly less vulnerable to contracting AIDS than women did, $t\ (186) = 4.36$, $P < 0.001$.

Sexual behavior histories of men and women were also quite similar. Men and women reported being sexually active for the same length of time (approximately three years) and having had the same average number of serious dating relationships (1.8) and sexual partners (approximately four). Nevertheless, women were three times more likely than men to report having been treated for an STD at some

Table 1. Gender differences in study measures

	Women ($n = 91$)		Men ($n = 97$)	
	$\bar{x}$	SD	$\bar{x}$	SD
Personal vulnerability				
Estimated probability of personally being exposed to:				
A sexually transmitted disease	24.6	23.1	19.7	19.2
Herpes	19.2	19.4	14.9	15.4
AIDS	17.0	19.8	7.0	10.6**
Sexual behavior history				
Years sexually active	2.9	1.7	3.0	2.1
Number of relationships	1.8	1.1	1.8	1.5
Number of sexual partners	4.0	4.4	4.0	4.0
History of being treated for a sexually transmitted disease	15.2%		5.2%*	
Extent of sexual experiences	4.1	0.8	3.9	0.7
Hansen homophobia scale	31.8	12.2	41.0	14.2**
Worry				
Extent of worry about getting:				
A sexually transmitted disease	2.7	1.7	3.0	1.7
Herpes	2.6	1.8	2.9	1.8
AIDS	3.0	1.8	3.1	1.9
Number of risk reduction behaviors	1.5	1.8	1.9	2.2

Statistical differences evaluated by t-tests, with the exception of history of disease which was analyzed using a chi-square statistic.
*$P < 0.05$. **$P < 0.001$.

time in the past, $\chi^2(1) = 4.34$, $P < 0.05$. This probably reflects the broader range of minor physical symptoms that women can encounter from sexual activity resulting in higher incidence rates of medical care [41].

Both genders also reported similar moderate levels of worry about contracting a sexually transmitted disease (approximately 3 on a 6-point scale). Notably, participants were no more worried about contracting AIDS than other STDs such as herpes, gonorrhea, and syphilis. Self-reported levels of risk reduction behaviors were also equivalent with participants, on the average, indicating that they were employing less than two of possibly eight risk reduction behaviors.

Finally, men reported higher levels of homophobia than women, $t(186) \approx -4.74$, $P < 0.001$. This is consistent with previous research findings [28].

Intercorrelations among measured variables

Preliminary analyses computed Pearson intercorrelations for all measures. Given the high number of correlations, a significance level of 0.01 was adopted. These correlations are presented separately for men and women in Table 2. For both sexes, there was a significant and positive correlation between worry about contracting each of the three categories of STDs and self-reported reduction of risk. Other predictors of risk reduction behaviors differed by gender. For men only, greater homophobia was significantly correlated with higher levels of risk reduction. For women only, a positive history of being treated for an STD was significantly related to higher levels of risk reduction.

Other correlations examined the factors associated with heightened worry about contracting STDs. For women, the only significant predictor of worry was the number of previous sexual partners. For men, perceived personal vulnerability for contracting an STD (syphilis/gonorrhea and herpes) was significantly associated with worry about contracting syphilis or gonorrhea. Homophobia, also, significantly predicted worry about contracting AIDS.

These correlational analyses provide preliminary support for our research hypotheses, but cannot explicate the underlying structural relationships among key constructs. For this reason, structural equation modeling was used. We began first by performing separate analyses for women and men.

A model of women's risk reduction behavior

From a rational perspective, it was predicted that the extent to which women engaged in risk reduction behaviors would be a linear function of perceived vulnerability and sexual behavior history, as moderated by a cue-to-action, worry about contracting a sexually transmitted disease. Relationships between levels of worry and behavioral change, theoretically, should conform to a quadratic function [17]. However, partial correlations between measures of worry and risk reduction, where linear effects were removed, revealed no significant relationships except for women's fear of contracting AIDS, $r = 0.32$, $P < 0.001$. This suggests that linear estimates are a good approximation of the quadratic relationships. From an irrational perspective, it was also hypothesized that homophobia was an additional 'cause' of level of worry. Since the data are correlational, the direction of causation is presumed but not actually testable. Both rational indices and homophobia are depicted as intercorrelated.

Evaluations of the fit of the model are reported in Table 3. The model, as depicted in Fig. 1, can account for the relationships between measured variables. The fit indices (rho and delta, given in Table 3) indicate that 90% or more of the variance in the covariance matrix is accounted for by the predicted relationships. Further, parameter estimates suggest that sexual behavior history does significantly predict worry about contracting a disease (CR = 2.79, $P < 0.05$), which, in turn, significantly predicts

Table 2. Pearson intercorrelations of study measures by gender

	1	2	3	4	5	6	7	8	9	10	11	12	13
							Women						
Personal vulnerability													
1. STD	—	0.83**	0.61**	0.05	−0.04	0.09	0.24	0.13	0.05	0.23	0.24	0.12	0.18
2. Herpes	0.81**	—	0.70**	0.13	−0.03	0.11	0.14	0.12	−0.00	0.22	0.24	0.13	0.08
3. AIDS	0.38**	0.46**	—	−0.05	−0.13	0.04	0.07	0.10	0.01	0.15	0.15	0.09	0.05
Sexual behavior history													
4. Years sexually active	0.07	0.06	0.18	—	0.27*	0.45**	0.29*	0.25	0.05	0.17	0.21	0.14	0.11
5. Number of relationships	0.22	0.26*	0.06	0.26*	—	0.30*	0.14	0.37**	0.08	0.01	0.01	−0.01	0.06
6. Number of partners	0.04	0.02	0.06	0.44**	0.40**	—	0.47**	0.19	−0.12	0.28*	0.38**	0.12	0.23
7. History of STD	0.24	0.12	0.03	0.09	0.21	0.11	—	0.15	0.14	0.20	0.23	0.04	0.32*
8. Sexual experiences	0.08	0.11	0.14	0.17	0.25	0.19	0.03	—	0.05	−0.00	−0.02	0.17	0.03
9. *Homophobia*	−0.12	−0.13	−0.14	−0.03	0.08	0.12	−0.07	−0.05	—	−0.09	−0.06	0.02	0.03
Worry													
10. STD	0.31*	0.33**	0.21	0.15	0.08	0.21	0.08	−0.01	0.07	—	0.86**	0.61**	0.43**
11. Herpes	0.22	0.22	0.14	−0.02	0.03	0.11	0.01	−0.05	0.21	0.80**	—	0.64**	0.51**
12. AIDS	0.03	0.02	0.12	0.07	−0.05	0.08	−0.01	0.01	0.28*	0.60**	0.73**	—	0.32*
13. *Risk reducing Behaviors*	−0.08	0.07	0.14	0.14	0.12	0.20	−0.01	0.13	0.27*	0.40**	0.45**	0.31*	—
							Men						

Correlations in the top portion of the matrix are for women; those in the bottom portion are for men.
*$P < 0.01$. **$P < 0.001$.

Table 3. Evaluation of submodels of Fig. 1

Model	χ^2	*df*	Comparison	χ^2	*df*	Δ_{kl}	ρ_{kl}
			Women				
M_0: (Null model)	439.75*	78	$M_0 - M_1$:	393.78*	18	0.90	1.05
M_1: (Theory model)	45.98	60	$M_2 - M_1$:	2.99	1	0.01	0.01
M_2: (with β_{PW} and $\beta_{HW} = 0$)	48.97	62	$M_0 - M_2$:	390.78*	16	0.89	1.04
			Men				
M_0: (Null model)	388.45*	78	$M_0 - M_1$:	321.20*	18	0.83	0.97
M_1: (Theory model)	67.25	60	$M_2 - M_1$:	0.02	1	0.00	0.00
M_2: (with $\beta_{BW} = 0$)	67.27	61	$M_0 - M_2$:	321.18*	17	0.83	0.97

*$P < 0.001$.

extent of risk reduction behaviors (CR = 5.01, $P < 0.05$). In addition, women's perceptions of personal vulnerability for contracting an STD show a trend to positively predict worry (CR = 1.75, $P = 0.08$). Predictors of the cue-to-action (worry) latent construct account for approximately 11% of its variance ($R^2 = 1 -$ standardized δ). Approximately 14% of the variance in risk reduction behaviors is predicted by the other variables.

Still, evaluations of the regression weights linking perceived risk, sexual behavior history, and homophobia to level of worry indicate that a more restricted model may be more appropriate. Therefore, a second set of equations was calculated with linkages between worry and both personal vulnerability (β_{PW}) and homophobia (β_{HW}) constrained to be zero (Model M_2 in Table 3). Results indicate that this, too, is an adequate model of the observed relationships among study variables. A chi-square difference test comparing the gain in predictive power when the two relationships (personal vulnerability–worry; homophobia–worry) are hypothesized to exist is non-significant, as presented in Table 3, suggesting that these relationships may be unnecessary.

A model of men's risk reduction behavior

The same model as the one originally described above was evaluated for male participants. Evaluations of the fit of the model are reported in Table 3 and indicate that approximately 83% of the variance among the measured variables is accounted for by model. This model again appears to adequately account for the observed covariance structure of the data, although it is not quite as good a fit. In this instance, predictors of worry accounted for 6% of the variance and 11% of the variance in risk reduction behaviors is predicted from the other variables.

As with the women's model, not all latent constructs appeared essential to modeling risk reduction behavior. Parameter estimates of both perceptions of personal vulnerability (CR = 2.35, $P < 0.05$) and homophobia (CR = 2.34, $P < 0.05$) significantly predicted levels of worry, which in turn significantly predicted risk reduction behaviors (CR = 4.44, $P < 0.05$). Critical ratio tests suggest, though, that the latent construct of sexual behavior history is nonessential to the solution (CR = 0.11, $P > 0.10$). A second, more restricted model was then fit to the covariance matrix where the influence of behavioral history on levels of worry (β_{BW}) was constrained at zero. A chi-square difference test suggests that sexual behavior history does not significantly add to the structural equations model.

Comparing structural models across genders

Although the results presented thus far suggest that predictors of the cue-to-action may differ for men and women, further analyses were undertaken to specifically test for this. To do so, a two-group structural equation model procedure [42] was utilized that allowed for the simultaneous solving of regression equations for the two genders separately, but within the same analysis. This allows for comparisons between the genders of parameter estimates. The technique involves first solving for each latent construct considered separately. Then the complete structural equations model is tested.

Personal vulnerability construct. It was first hypothesized that measured perceptions of vulnerability for STDs, herpes, and AIDS resulted from a latent construct of perceived vulnerability, one's gender, and unique variance. Two separate questions are evaluated by this analysis. First, are the relationships among the measured variables similar for both men and women? Second, do men and women differ in their levels of perceived vulnerability?

As can be seen in Table 4, factor loadings (λ_1–λ_3) for the vulnerability measurement model were constrained to be equal for both men and women. In addition, structured means for the measured variables (μ_1–μ_3) were also constrained to be equal for the two genders in order to fix possible gender differences in the latent variable. Error variances were not constrained to be equal across the two groups since they presumably index only measurement error. As can be seen in Table 5, this measurement model (M_1) does not appear to be equivalent for both genders. However, allowing the unique variance of STDs and herpes to intercorrelate resulted in an adequate fit of the measurement model (M_2).

In order to test for gender differences in levels of perceived vulnerability, the structured mean for the latent variable (μ_ρ) in one group was constrained at zero but freely estimated in the other group. The presence of a sex difference would result in a significant parameter estimate linking gender and the latent construct of perceived vulnerability. This, in fact, was observed to be so (CR = -3.83, $P < 0.05$) suggesting that women experience a greater level of personal vulnerability to sexual transmitted diseases than men. The Critical Ratio value differs slightly from that reported in Table 4 because the latter is estimated from the complete model, discussed later.

Sexual behavior construct. A similar procedure was used to test for the sexual behavior measurement model. The five measured variables (years sexually

Table 4. Parameter estimates for men and women when solved simultaneously (Model M_3 in Table 5)

	Men ($n = 97$)	Joint parameters	Women ($n = 91$)
Structured means: measured variables			
Personal vulnerability			
μ_1: STD		2.59 (0.22)*	
μ_2: Herpes		2.07 (0.19)*	
μ_3: AIDS		1.62 (0.21)*	
Sexual behavior			
μ_4: Number of partners		1.31 (0.14)*	
μ_5: Years sexually active		0.59 (0.03)*	
μ_6: Number of relationships		1.85 (0.11)*	
μ_7: History of STD		1.08 (0.02)*	
μ_8: Sexual experience		3.97 (0.06)*	
Homophobia			
μ_9: Hansen Scale		3.18 (0.13)*	
Worry			
μ_{10}: STD		2.75 (0.17)*	
μ_{11}: Herpes		2.62 (0.18)*	
μ_{12}: AIDS		2.96 (0.17)*	
Sexual risk reduction			
μ_{13}: Risk behaviors		1.54 (0.20)*	
Structured means: latent variables			
μ_P: Personal vulnerability	−3.13 (0.25)*		0.0
μ_B: Sexual behavior	−0.05 (0.18)		0.0
μ_H: Homophobia	0.92 (0.19)*		0.0
μ_W: Worry	0.45 (0.34)		0.0
μ_R: Risk reduction	0.15 (0.26)		0.0
Factor loadings			
Perceived risk			
λ_1: STD		1.00	
λ_2: Herpes		0.95 (0.08)*	
λ_3: AIDS		1.15 (0.25)*	
Sexual behavior			
λ_4: Number of partners		1.00	
λ_5: Years sexually active		0.21 (0.04)*	
λ_6: Number of relationships		0.59 (0.14)*	
λ_7: History of STD		0.08 (0.03)*	
λ_8: Sexual experience		0.24 (0.07)*	
Homophobia			
λ_9: Hansen Scale		1.00	
Worry			
λ_{10}: STD		0.84 (0.05)*	
λ_{11}: Herpes		1.00	
λ_{12}: AIDS		0.74 (0.06)*	
Sexual risk reduction			
λ_{13}: Risk behaviors		1.00	
Error variances and covariances			
Perceived risk			
ϵ_1: STD	2.91 (0.46)*		2.82 (0.73)*
ϵ_2: Herpes	1.70 (0.29)*		1.46 (0.56)*
ϵ_3: AIDS	0.33 (0.23)		0.84 (0.72)
ϵ_{12}: STD/Herpes	1.70 (0.33)*		1.31 (0.60)*
Sexual behavior			
ϵ_4: Number of partners	0.65 (0.25)*		1.08 (0.27)*
ϵ_5: Years sexually active	0.12 (0.02)*		0.07 (0.02)*
ϵ_6: Number of relationships	1.65 (0.26)*		0.99 (0.17)*
ϵ_7: History of STD	0.04 (0.01)*		0.12 (0.02)*
ϵ_8: Sexual experience	0.47 (0.07)*		0.56 (0.09)*
ϵ_{47}: Partners/STD	−0.04 (0.03)		0.12 (0.05)*
Homophobia			
ϵ_9: Hansen Scale	0.0		0.0
Worry			
ϵ_{10}: STD	0.88 (0.17)*		0.68 (0.14)*
ϵ_{11}: Herpes	0.16 (0.15)		0.10 (0.14)
ϵ_{12}: AIDS	1.57 (0.24)*		1.81 (0.28)*
Sexual risk reduction			
ϵ_{13}: Risk behaviors	0.0		0.0
Factor residual variances and covariances			
ϕ_P: Perceived vulnerability	0.67 (0.24)*		2.38 (0.79)*
ϕ_B: Sexual behavior	1.05 (0.30)*		1.00 (0.31)*
ϕ_H: Homophobia	2.00 (0.29)*		1.47 (0.22)*
ϕ_W: Worry	2.54 (0.42)*		2.44 (0.43)*
ϕ_R: Risk reduction	3.61 (0.53)*		2.50 (0.38)*
ϕ_{PB}: Vulnerability/Behavior	0.14 (0.12)		0.08 (0.22)
ϕ_{PH}: Vulnerability/Homophobia	−0.20 (0.14)		0.02 (0.22)
ϕ_{BH}: Behavior/Homophobia	0.12 (0.17)		−0.02 (0.16)
Factor regressions			
β_{PW}: Vulnerability→Worry	0.56 (0.29)*		0.23 (0.12)
β_{BW}: Behavior→Worry	0.09 (0.20)		0.62 (0.23)*
β_{HW}: Homophobia→Worry	0.31 (0.12)*		−0.07 (0.14)
β_{WR}: Worry→Risk Reduction		0.57 (0.08)*	

Numbers in parentheses are standard errors of the parameter estimate.
*Critical ratio > 1.96.

Table 5. Evaluation of two-group models

Model	χ^2	*df*	Comparison	χ^2	*df*	Δ_{kl}	ρ_{kl}
Personal vulnerability							
M_0: (Null model)	145.03**	12	$M_0 - M_1$:	112.84**	8	0.95	0.47
M_1: (Factor model)	32.19**	4	$M_1 - M_2$:	30.79**	2	0.05	0.03
M_2: (with ϵ_{41} estimated)	1.40	2	$M_0 - M_2$:	143.63**	10	1.00	0.50
Sexual behavior history							
M_0: (Null model)	58.38**	30	$M_0 - M_1$:	28.84**	12	0.88	0.97
M_1: (Factor model)	29.47*	18	$M_1 - M_2$:	11.52**	2	0.04	0.04
M_2: (with ϵ_{47} estimated)	17.95	16	$M_0 - M_2$:	34.36**	14	0.92	1.01
Worry							
M_0: (Null model)	172.70**	12	$M_0 - M_1$:	168.19**	8	0.99	0.50
M_1: (Factor model)	4.51	4					
Complete model (modified Fig. 1)							
M_0: (Null model)	483.74**	182	$M_0 - M_1$:	310.66**	46	0.91	1.07
M_1: (Theory model; all predictors constrained to be equal)	173.08*	136	$M_1 - M_4$:	6.47*	1	0.00	0.01
M_2: (with all predictors not constrained)	166.08*	132	$M_4 - M_2$:	317.66**	50	0.91	1.07
M_3: (with β_{WR} constrained)	166.14*	133	$M_0 - M_3$:	317.60**	49	0.91	1.08
M_4: (with β_{WR} constrained and with specified parameters = 0)	166.61*	135	$M_0 - M_4$:	317.13**	47	0.91	1.08
M_5: (with β_{WR}, β_{PW} constrained and with specified parameters = 0)	167.77*	136	$M_0 - M_5$:	315.97**	46	0.91	1.07

*$P < 0.05$. **$P < 0.001$.

active, number of sexual partners, extent of sexual experiences, number of dating relationships, and history of being treated for a STD) were hypothesized as indicators of the latent sexual behavior construct. Factor loadings and structured means were constrained to be equal across genders. Unique variances of both measured and the latent variable were allowed to be freely estimated for each gender. And finally, the relationship between the latent construct and the structured mean was estimated for men but constrained at zero for women.

As can be seen in Table 5, this factor model (M_1) did not provide an adequate fit for the data. However, allowing the unique variances of number of sexual partners and history of STD treatment to intercorrelate generated an adequate fit (M_2). The estimate of the influence of gender on the latent factor indicated no significant difference between men and women in their level of sexual experiences ($CR = -0.32$, $P > 0.10$).

Homophobia construct. Since homophobia had been indexed with one measured variable and a previous *t*-test indicated significant differences between men and women, testing for possible differences within the structural equation procedure was redundant. As can be seen in Table 4, we hypothesized for the theory structural equation model evaluated later that the measured variable was measured without error and a function of both the structured mean (constrained to be equal for men and women) and a latent construct of homophobia (with a factor loading of 1.0 for both men and women). This approach fixed the sex difference in levels of homophobia into the latent variable.

Worry construct. This factor model was evaluated in a similar manner to the vulnerability and sexual behavior constructs described above. Both factor loadings and structured means on the measured variables were constrained to be equal for both genders; unique variances for measured variables and the latent construct were separately estimated for each gender. The relationship between the structured mean was estimated for men and fixed at zero for women. As can be seen in Table 5, this model (M_1) provided an adequate fit for the data. Evaluation of the structured mean loading on the latent factor revealed no significant difference between men and women ($CR = 1.14$, $P > 0.10$). Thus, level of worry about STDs appeared equivalent across genders.

Risk reduction construct. As with homophobia, the measured variable was depicted as measured without error and a function of a structured mean (with equality constraints) and a latent construct of risk reduction (factor loadings fixed at 1.0). Earlier univariate analysis of possible differences in risk behaviors between men and women indicated that there was no significant difference.

Evaluation of the structural equation model. Having evaluated possible gender differences in the covariance structures of the latent constructs, we were now ready to evaluate the complete structural equation model linking latent constructs. To do so, we used the covariance structures determined above, which only slightly modify the model depicted in Fig. 1 by allowing a correlation among ϵ_1 and ϵ_2 and ϵ_4 and ϵ_7. Structural equations predicting relationships among these structures were simultaneously solved for both genders. As shown in Table 5, when all predictors of worry and risk reduction are constrained to be equal for men and women, the model (M_1) falls slightly short of accounting for the covariance structure of the data (χ^2 (136) = 173.08, $P = 0.02$). Fit indices suggest that the tested model accounts for about 91% of the variance in the data set. Relaxing the model to allow for separate estimates of all four predictors does not significantly improve the fit (Chi-square difference test between M_1 and M_2, χ^2 (4) = 7.00, $P > 0.05$). This indicates that there is no evidence to believe that gender differences exist in all four structural equations linking latent constructs.

Despite the slight misfit of the model (M_1) in accounting for the covariance structure of the data, we proceeded to test for specific patterns of gender differences in the regression estimates. Our earlier

results had suggested that worry might be an equivalent predictor of behavior change for both men and women, but that predictors of worrying might differ. Our first analysis, then, evaluated the effect of constraining the relationship between worry and risk reduction behaviors to be equal for men and women but allowing linkages between the other latent constructs and worry to vary between men and women. Results of this analysis (Model M_3) are given in Tables 4 and 5. This model does not significantly improve the fit obtained in the first model where the four predictors were all constrained to be equal for both genders (Chi-square difference test between M_1 and M_3, χ^2 (3) = 6.94, $P > 0.05$).

Next, we tested in Model M_4 the hypothesis that sexual behavior history is a significant predictor of women's levels of worry while homophobia is a significant predictor of men's by constraining the regression weights of sexual behavior on worry at zero for men (freely estimated for women) and of homophobia on worry at zero for women (freely estimated for men). Regression estimates of perceived vulnerability on worry were separately estimated for men and women given the earlier results suggesting a significant relationship for men and a trend for women. Regression estimates of worry on risk reduction were constrained to be equal for men and women. This did result in a significantly better fit of the model (Chi-square difference test between M_1 and M_4, χ^2 (1) = 6.47, $P < 0.05$), although the model continued to fall slightly short of adequately accounting for the covariance structure of the data ($P = 0.03$). An estimate of the regression of perceived vulnerability to sexually transmitted diseases on extent of worry was again significant for men (CR = 2.12, $P < 0.05$) and showed a trend for women (CR = 1.84, $P = 0.06$). Thus, it appeared that sexual behavior predicts worry for women, but not for men, and homophobia predicts levels of worry for men, but not for women. A final model was tested in which the possibility of significant sex differences in the regression of vulnerability on worry was evaluated through adding an additional constraint that the regression weights linking vulnerability and worry were equal for both genders, M_5. A chi-square difference test between M_4 and this model was nonsignificant (χ^2 (1) = 1.16, $P > 0.10$) indicating that there is no reason to believe that this regression estimate is different for the two genders.

DISCUSSION

Concern over the risks of AIDS among young, sexually active heterosexuals is growing [3, 4, 8, 20, 21, 43]. Behaviors that put many of these individuals at risk for exposure to HIV also put them at risk for developing other sexually transmitted diseases. Results of the current study provide a beginning understanding of some of the factors that may be linked to risk reduction behaviors in this age group.

In this study, self-reported reduction of risky sexual behaviors was significantly related to the individual's level of worry about acquiring an STD. Worry about contracting STDs, such as AIDS or herpes, was a significant predictor of risk reduction behaviors for both men and women. However, while worry about STDs appeared to function equivalently for both sexes, factors that influence levels of worry differed by gender.

For women, the only significant predictor of worry was the woman's sexual history reflecting, perhaps, actual levels of behavioral risk. There was a nonsignificant trend for perceived personal vulnerability also to predict levels of worry. Homophobia was not a significant predictor of worry for women.

In contrast, for men, different factors predicted worry about acquiring STDs. Both perceptions of greater personal vulnerability for contracting an STD infection and higher levels of homophobia were significant predictors of men's level of worry. Personal sexual behavior history was not significantly related to men's self-reports of worry.

When the structural relations among study variables were compared between men and women, direct tests of these differences in predictors of worry demonstrated that perceptions of vulnerability are equally predictive of worry for both men and women, but, for women, sexual behavior history is significantly more important than it is for men, for whom, as stated above, it does not appear to significantly predict worry. And for men, homophobia is significantly more important in predicting worry than it is for women, for whom it does not play a significant role.

These results suggest that for both sexes in this study, heightened worry about STDs may have served as a cue-to-action that motivated the person to initiate risk reduction behaviors. Regardless of gender, those people who worrried most about STDs were most likely to report engaging in safer sexual practices. However, the sources of worry appeared to differ for each sex. For women, worry was linked to actual sexual experiences and perhaps a cognitive sense of vulnerability. For men, worry was based solely on cognitive factors, namely perceptions of personal vulnerability and homophobia.

In interpreting results presented here, two methodological issues should be kept in mind. First, although the conceptual model posits causal relationships, the actual data are correlational. For instance, it could be that worry causes the perception of vulnerability rather than the reverse direction indicated in the model. Second, the measure of risk reduction behaviors was participants' self-reports of such behaviors as limiting the number of new sexual partners and delaying sexual involvement. The actual effectiveness of these strategies is unknown. Nevertheless, these results have several implications for the development of preventive educational models for STD risk reduction and for future research.

Educational efforts aimed at preventing the spread of STDs among adolescents and young adults, a population known for perceiving themselves as invulnerable [5], often focus on disseminating sufficient information to individuals so as to instill an awareness of personal vulnerability [44]. However, a major finding from this study is that worry about STDs appears to be a more important proximal factor in reported risk reduction behaviors. Perceptions of vulnerability were associated with risk reduction only distally through their influence on level of worry about contracting an STD.

A second major finding from this study is that factors leading to increased worry may differ for men and women. Previous sexual experience, an index of actual behavior risk, is the current focus of common advice to evaluate one's level of AIDS risk. Individuals are encouraged to ask prospective partners about their sexual histories and to consider both individuals' pasts when negotiating sexual interactions [8, 43]. However, in the present study, only women appeared to be influenced by their behavioral pasts in their levels of current worry. The educational implication of this finding is that interventions may profit from tailoring strategies to the somewhat different motivating concerns of men and women. For example, emphasizing aspects of the person's actual behavioral history may be more effective with women than with men.

Third, this study sheds some light on the impact of homophobia on young heterosexual's views about AIDS. Consistent with previous work [28], concern about limiting the social rights and influence of homosexuals was greater among heterosexual men than women. Even more important, homophobia was found to be a significant factor in heterosexual men's degree of worry about AIDS, and consequently, in their self-reported risk reduction behaviors. For women, homophobia was not a factor in predicting personal worry or risk reduction. These findings document, but do not explain, this pattern. Subsequent research might profitably examine this topic in some detail.

At this point, however, it is worth reflecting on the way homophobia might be handled in preventive education campaigns aimed at younger heterosexuals. While one approach might argue that simply enhancing levels of homophobia in men will promote sexual risk reduction, this strategy is unlikely to lead to essential knowledge about behaviors that transmit HIV [20]. Since it is sexual behavior and sharing of intravenous drug paraphenalia that function as primary HIV transmission vectors, and not casual contact with homosexuals, interventions need to be designed to promote knowledge of risky behavior. In doing so, it may be prudent to be sensitive to the importance of heterosexual men's homophobia in understanding their concerns about AIDS. Most AIDS risk reduction programs currently in place have been developed for gay men and may not be appropriate, without considerable modification, for other populations [43]. Results of this study suggest that care should be exercised in exporting these programs for use with young heterosexual men. Homophobia is a potent predictor of the fear motive for reducing risk, perhaps through avoidance behaviors. It is unknown what impact this will have on educational efforts that are identified with the homosexual male community.

Finally, the study highlights the importance of considering both 'rational' and 'nonrational' factors in STD risk reduction behaviors. The Health Belief Model focuses on the importance of perceived susceptibility and seriousness of the disease as predictors of implementing behaviors that are viewed as effective at reducing risk. But, the present results indicate that seemingly logical predictors of behavior, such as number of previous partners or previous experience with contracting an STD, are not invariably linked to reduction of risky behaviors. Instead, more emotional, nonrational factors, such as homophobia, can play a significant part. The history of sexually transmitted diseases is replete with stories of irrational risk reduction strategies, including avoidance of public drinking fountains and ascribing most problems with STDs to the lower social classes [24]. Such responses presumably result from the complexity of cultural values related to sexuality and fears of disease [45]. Our findings underscore the importance of broadly considering the influence of distal, and nonrational, factors in developing preventive educational programs.

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REFERENCES

1. Chilman C. S. *Adolescent Sexuality in a Changing American Society*. U.S. Department of Health, Education and Welfare, National Institutes of Health, Publication No. 79-1426, 1979.
2. Holmes K. K. Sexually transmitted disease: An overview and perspectives on the next decade. In *Sexually Transmitted Diseases: 1980 Status Report*. U.S. Department of Health and Human Services, Public Health Service, National Institutes of Health, Publication No. 81-2213, 1981.
3. Centers for Disease Control. Human immunodeficiency virus infection in the United States: A review of current knowledge. *Morbid. Mort. Wkly Rep.* **36** (suppl. S-6), 1–48, 1987.
4. Koop C. E. *Surgeon General's Report on Acquired Immune Deficiency Syndrome*. U.S. Public Health Service, Washington, D.C., 1986.
5. Quackenbush M. Educating youth about AIDS. *Focus* **2**, 1–3, 1987.
6. Stone K. M., Grimes D. A. and Magder L. S. Personal protection against sexually transmitted diseases. *Am. J. Obstet. Gyn.* **155**, 180–186, 1986.
7. Yankauer A. The persistence of public health problems: SF, STD and AIDS. *Am. J. Publ. Hlth.* **76**, 494–495, 1986.
8. Cochran S. D. and Mays V. M. Women and AIDS-related concerns: Roles for psychologists in helping the worried well. *Am. J. Psychol.* **44**, 529–535, 1989.
9. Curran J. W., Morgan W. M., Starcher E. T., Hardy A. M. and Jaffe H. W. Epidemiological trends of AIDS in the United States. *Cancer. Res.* **45**, 4602s–4604s, 1985.
10. Marwick C. AIDS-associated virus yields data to intensifying scientific study. *J. Am. Med. Ass.* **254**, 2865–2870, 1985.
11. Mays V. M., Cochran S. D. and Roberts V. Heterosexuals and AIDS. In *Nursing Care of Patients with AIDS/ARC* (Edited by Lewis A.), pp. 31–37. Aspen Publications, Maryland, 1988.
12. World Health Organization. *Control of Sexually Transmitted Diseases*. World Health Organization, Geneva, 1985.