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HIV prevention strategies among couples include condom use, HIV testing, and mutual monogamy. Research suggests that condom use is more likely with new or casual partners and tends to decline as relationships become more intimate and steady over time. Little is known, however, about HIV testing and explicit mutual monogamy agreements within heterosexual couples. This study used data from 435 young heterosexual couples at increased risk of HIV/STIs to assess 1) couple concordance on perceptions of HIV testing and monogamy; and 2) the associations of demographic, communication and relationship factors with HIV protective behaviors. Overall, 29% of couples agreed that they had both been tested for HIV and 52% agreed they had an explicit agreement to be monogamous. Thirty percent of those who said they had a monogamy agreement had not kept it. Communication about sexual risk behavior was positively associated with HIV testing and a monogamy agreement, but not with monogamous behavior. Commitment was associated with both monogamy agreement and monogamous behavior; however, couples in relationship longer than 18 months were half as likely to be mutually monogamous than other couples.

High-risk heterosexual contact was the second largest route of HIV transmission in the United States in 2006, accounting for 31% of new infections, with the largest number of new cases in the 13-29 year-old age group (Hall, et al., 2008). In 2006, women accounted for nearly 80% of new HIV infections attributed to heterosexual contact among 20-24 year olds. The impact of HIV on women of color is especially severe. The rate of HIV infection among African American women was 15 times that of White women in 2006 (55.7 versus 3.8 per 100,000). Among Hispanic women, the rate

(14.4 per 100,000) was nearly four times that of White women. HIV incidence trends among Hispanics over time have mirrored those among African Americans (Centers for Disease Control and Prevention [CDC], 2008).

Because many women infected with HIV are infected by their primary partners, research on safer sex behavior has begun to recognize the role of relationship dynamics and focus on the role of sexual partners in risk behavior. Two behavioral strategies are recommended for the prevention of HIV and other sexually transmitted infections (STIs)—condom use and mutual monogamy between uninfected partners (CDC, 2006; Donovan, 2000; Gavey & McPhillips, 1997; Shelton, Halperin, Nantulya, Potts, & Gayle, 2004). Research has largely focused on condom use. Among the more robust findings is that condom use is more likely with new or casual partners and tends to decline as relationships become more intimate and steady over time (Comer & Nemeroff, 2000; Macaluso, Demanda, Artza, & Hook, 2000). As trust within a relationship and the perception of safety increases, the perceived vulnerability to harm from a partner and, therefore, the perceived need to protect against STIs, including HIV, decreases (Crosby, Yarber, & Meyerson, 1999; Misovich, Fisher, & Fisher, 1997; Riesen & Poppen, 1999).

A significant percentage of individuals in close relationships, however, appear to misjudge their partners' risk behaviors and, as a consequence, their own vulnerability to infection. For example, among heterosexual patients with gonorrhea or Chlamydia infection recruited from clinics in Seattle, underestimates of partners' total number of sex partners in the previous 3 months were common (Stoner, Whittington, Aral, Hughes, Handsfield, & Holmes, 2003). In a study of a more general, urban population, 28% of respondents reported that they or their partner had had concurrent sex partners in their

most recent heterosexual relationship (Manhardt, Aral, Holmes, & Foxman, 2002). In another clinic-base study, sixteen percent of male adolescent patients and 37% of female patients misperceived their partner's sexual exclusivity (Lenoir, Adler, Borzekowski, Tschann, & Ellen, 2006). Furthermore, mistaken assumptions about overlapping or concurrent partnerships were associated with the transmission of HIV and other STIs (Drumright, Gorbach, & Holmes, 2004).

Although studies such as those cited above have assessed assumptions about partner behavior, few studies have examined the extent to which young adults in heterosexual relationships make and keep explicit agreements to be sexually exclusive or monogamous. Studies of sexual agreements within gay couples are more common, including studies of monogamy agreements (Hoff & Beougher, in press) and negotiated safety, in which partners agree either to be monogamous or to practice safe sex outside the primary relationship (Kippax & Race, 2003). Neilands and colleagues (2010) note that sexual agreements appear to be widespread among gay couples in which both partners are HIV-negative and that such agreements may play a critical role in HIV prevention. Whether heterosexual couples at risk of HIV make such agreements is less clear. One exploratory study of 25 high-risk heterosexual couples found that many of the couples used strategies other than condom use to mitigate their STI risk, including HIV/STI testing and monogamy. The strategies employed were not always used consistently and individuals often put emotional needs ahead of health concerns (Corbett, Dickson-Gómez, Hilario, & Weeks, 2009). It is unknown, however, whether explicit sexual agreements and other strategies such as HIV testing are common among young adult heterosexual couples or whether agreements are maintained over time.

Couple communication and relationship factors may be particularly salient in understanding whether couples make and keep sexual agreements. Communication and negotiation of safer sex with one's partner play a major role in theories of HIV preventive behavior such as the Information-Motivational-Behavioral skills model (Fisher, Fisher, Misovich, Kimble, & Malloy, 1996) and the AIDS Risk Reduction Model (Catania, Coates, & Kegeles, 1994). Noar and colleagues (2006) concluded in their meta-analysis of 55 studies of safer sex behavior that safer sex communication, particularly communication about condom use and sexual history, was an important determinant of condom use. The role of health protective communication may be at least as salient for mutual monogamy, in which both partners must explicitly agree to, as well as practice, sexual monogamy. Sexual communication within young adult couples may encompass other topics besides safer sex and sexual histories, including sexual pleasure and preferences (Faulkner & Lannutti, 2010), however, the relationship between general sexual communication and STI or pregnancy prevention is not clear. For example, a longitudinal study of adolescent women found that only contraceptive-specific communication was related to contraceptive use (Tschann & Adler, 1997) while a study of adolescent dating couples found that more open sexual communication (unrelated to contraceptive use) within couples was positively related to increased contraceptive use (Widman, Welsh, McNulty, & Little, 2006). Furthermore, communication between partners about sex may be influenced by social and cultural norms, particularly those that discourage open and frank communication or that endorse traditional gender roles. Research has suggested that Hispanic/Latino cultural concepts of masculinity and femininity have created inequalities in relationship power that have been linked to low

condom use (Amaro & Raj, 2000; Marín, 2003). However, little is known about whether Hispanic couples discuss and practice other safer sex behaviors.

Unlike communication, the role of relationship factors in mutual monogamy is likely to be very different from its association with condom use. Previous research has shown that condom use is more likely with new or casual partners and tends to decline as relationships become more intimate and steady over time (Comer & Nemeroff, 2000; Macaluso, et al., 2000). The introduction of condoms in a steady relationship, for example, may be perceived as a lack of trust in one's partner (Corbett, et al., 2009). The agreement to forego condoms, however, and depend on a partner's sexual fidelity for HIV protection is itself a pledge of trust and one that is expected to be reciprocated. Thus, the likelihood of a mutual monogamy agreement within a couple would be expected to increase with increasing intimacy and commitment within a relationship over time and may be related to significant changes in a relationship, such as deciding to live together or be married.

The current study had two aims. The first aim was to evaluate the extent to which young heterosexual partners at increased risk of HIV made explicit agreements about sexual exclusivity and condom use and the extent to which partners concurred that they had made and kept such agreements. We also examined the extent to which partners were tested for HIV and shared test results with each other. The second aim of the study was to examine whether couple communication and relationship factors were associated with HIV testing, with the agreement to be monogamous, and with monogamous behavior within a couple. We included both health protective communication and general sexual communication in analyses. We also included two relationship factors, perceived

vulnerability to HIV and STI from one's partner and relationship commitment. Finally, we included couple characteristics that may moderate the influence of communication and relationship factors on the outcomes, including Hispanic ethnicity, relationship duration, and marital and cohabitation status.

Methods

Participants

Data for this study come from the PARTNERS Project, a couple-based HIV/STI and unintended pregnancy prevention intervention to increase protective behaviors among heterosexual couples at increased risk for HIV/STI transmission (Harvey, Kraft, West, Taylor, Pappas-DeLuca, Beckman, & Huszti, 2009). The intervention was designed to address individual as well as relationship factors that are associated with increased condom use. Women were recruited from community sites in Los Angeles and Oklahoma City. To be eligible, a woman had to be 18-25 years old, have a male sexual partner over 18 years old, had sex without a condom at least once in the previous 3 months, and meet one or more of the following criteria: (1) knew or thought her partner had had sex with someone else in the past year; (2) suspected her partner might have sex with someone else in the next year, while they are still involved; (3) knew or thought her partner had had an STI in the past year; (4) knew or thought her partner had ever been in prison; (5) knew or thought her partner had ever used IV drugs; (6) knew or thought her partner had ever had sex with another man; (7) had sex with someone besides her current partner during the past year; (8) thought she might have sex with someone else while still involved with her current partner; (9) had an STI in the past year; or (10) had ever used IV drugs. Women who were pregnant, who intended to become pregnant in the next

year, or who were HIV-positive were not eligible. Also, women in Los Angeles had to self-identify as Latina or Hispanic to be eligible, while women in Oklahoma could be of any race/ethnicity. Eligible women were asked to invite their main partners (defined as a spouse or boyfriend) to participate. Both members of a couple had to agree to participate for the couple to be enrolled in the study.

Procedures

This study uses data from individual baseline interviews conducted with 434 couples between January 2000 and June 2002. Interviews were approximately 60-minutes long and members of each couple were interviewed separately but concurrently. Participants received $30 for their participation in the baseline interviews and compensation for travel and child care costs. This research was approved by the institutional review boards of the institutions responsible for each site and by the CDC. Written informed consent was obtained from all participants.

Participants and interviewers were matched by gender at both sites and by race/ethnicity in Los Angeles. Interviewers recorded participants' responses using a computer-assisted survey interview (CASI) system. The CASI administration allowed for the insertion of participant-specific data (such as the name of a partner or a calendar date). Participants were given the option of completing the section containing the most sensitive sexual and risk behavior questions on their own, using audio CASI, so that their responses were masked to the interviewer.

Measures

Participants were asked a series of questions regarding whether they had made an explicit agreement with their partner about monogamy in the relationship, whether they

had been tested for HIV and shared the results with their partner, and whether they had agreed to use condoms with each other if either had sex with someone else. An agreement was defined as "something you've both talked about and both agreed on." Participants were asked, "Have you and [*partner's name*] made a clear agreement about whether or not you will have other sexual partners while you are together?" and "Did you agree not to have sex with anyone else while you are together?" Participants who responded in the affirmative to both questions were asked additional questions about whether they had kept the agreement and whether they thought their partner had kept the agreement. We created dichotomous measures of monogamy agreement and monogamous behavior from the questions above. Monogamy agreement was coded as 1 if both partners concurred that they had made an explicit agreement to be monogamous (otherwise, coded as 0). Monogamous behavior was coded as 1 if both partners said they had kept the monogamy agreement (otherwise, coded as 0). Likewise, HIV testing was coded as 1 if both partners agreed that they had been tested for HIV and shared the test results with their partner.

Other measures included demographic characteristics and measures of couple communication and relationship factors. Demographic characteristics included Hispanic ethnicity, relationship duration, and marital status and whether the couple lived together. We included two measures of couple communication—health protective communication and sexual communication. Health protective communication measured the extent to which the couple had discussed issues related to safer sex. We used 15 dichotomous items (0 = *no*, 1 = *yes*) adapted from van der Straten and colleagues (1998). A score was created by summing the number of items both members of the couple endorsed. Higher scores corresponded to communication on a greater number of safer sex topics. Sexual

communication assessed how often the participant discussed with his or her partner what he or she enjoys sexually and how often they talk about sex. Eight items created specifically for this study were rated on a seven-point response scale from 1 (never) to 7 (always). Individual scale scores were creating by taking the average of the items (α = .79 for men; α =.81 for women) and a couple score was created by averaging partner scores within each couple.

Relationship factors included perceived vulnerability to HIV and other STIs from the partner and commitment. Perceived vulnerability to HIV/STIs measured perceptions of risk for acquiring HIV and other STIs by having sex with one's partner without using a condom (Reisen & Poppen, 1999). Two items were rated on a five-point response scale ranging from 1 (not at all likely) to 5 (extremely likely). We created individual scale scores by taking the average of the items (α = .90 for men; α =.89 for women) and couple measures were created by averaging the partner scores within each couple. Higher scores indicated greater perceived vulnerability. We adapted five items from the commitment subscale of Sternberg's (1997) Triangular Love scale to assess relationship commitment. Examples of commitment questions were: "Even when [*partner's name*] is hard to deal with, you remain committed to your relationship" and "You view your relationship as permanent." Participants rated items on a scale from 1 (not at all) to 5 (extremely). We created individual scale scores by averaging the items (α =.79 for men, α =.79 for women) and created a couple scale score by averaging scale scores within each couple.

Data Analysis

We report two sets of analyses. In the first set, we used the kappa (κ) statistic and percentage agreement indices to assess concordance on HIV testing, monogamy and

condom use agreements and the extent to which individuals accurately perceive their partner's fidelity to the monogamy agreement. The kappa statistic is a measure of concordance for categorical data beyond what would be expected by chance. By convention, kappa values between 0 and 0.2 indicate slight agreement, 0.21 to 0.40 indicate fair agreement, 0.41 to 0.60 indicate moderate agreement, 0.61 to 0.80 indicate substantial agreement and 0.81 and above indicate excellent agreement (Fleiss, 1981; Landis & Koch, 1977). The kappa statistic does not provide information about the direction of agreement; therefore percentage agreement is used to support its interpretation. The percentage agreement was calculated as the number of couples with concordant responses divided by the number of couples in the sample. Concordant responses included couples in which both members reported yes (positive agreement) and couples in which both members reported no (negative agreement).

In the second set of analyses, we used binary logistic regression to identify the demographic, communication, and relationship factors that predict 1) HIV testing within a couple (both partners said they were tested and shared their results); 2) a monogamy agreement within a couple (both partners said they have an explicit agreement); and 3) monogamous behavior within a couple (both partners said they have kept the agreement). In these analyses, the couple is the unit of analysis and all outcomes were couple-level outcomes. Associations between the outcomes and demographic, communication and relationship factors were assessed in univariable and multivariable logistic regression models. Factors that exhibited some association with the outcomes ($p<.25$) were included in the multivariable models (Hosmer & Lemeshow, 2000). Odds ratios and their

associated 95% confidence intervals are reported. Data were analyzed using Stata version 10 (Stata Corp., College Station, TX).

Results

In 227 (52%) of the 434 couples, partners concurred that they had explicitly agreed to be sexually monogamous (Figure 1). Of these, both partners in 162 couples (71%) said they had kept the monogamy agreement. In 32 couples (14%), only the female partner had kept the agreement and in 24 (11%) only the male partner had kept the agreement. In 9 couples (4%), neither partner kept the agreement.

The kappa statistic indicated only slight to fair agreement within couples on measures of HIV testing, monogamy, and condom use (Table 1). In over half of the couples (54%), there was disagreement about whether the male partner had maintained the monogamy agreement. Fewer couples but still a substantial proportion (49%) disagreed about whether the female partner had maintained monogamy. The kappa statistics were somewhat more robust for HIV testing reports; however, information from the percentage agreement scores indicates that higher kappas were driven by negative agreement (e.g., both partners agreed that the male partner had *not* been tested for HIV). Far fewer couples (16%) concurred that they had agreed to use condoms if either of them had sex with someone else.

About half the sample was either married or living together, fewer than half the relationships were longer than eighteen months and 43% of the couples were Hispanic (Table 2). On average, couples discussed 8 of 15 health protective topics. Demographic, communication, and relationship factors were associated with both couple HIV testing and the agreement to be monogamous; however, while demographic and relationship

factors were associated with monogamous behavior, communication variables were not (Table 3). In the adjusted analysis, couples who lived together and those in longer relationships were more likely to have been tested for HIV and to have shared the results with each other. Hispanic/Latino couples were less than half as likely to have an explicit monogamy agreement as other couples; however, among couples with an agreement, there were no differences between Hispanic and other couples in monogamous behavior. Couples in longer relationships were about half as likely to have kept a monogamy agreement as those in shorter relationships.

With respect to the communication factors, health protective communication was positively associated in the adjusted analyses with both HIV testing and monogamy agreement. Sexual communication was not associated with any of the outcomes in adjusted analyses. Relationship factors were significant in each outcome. In adjusted analyses, increasing commitment was positively associated with both monogamy agreement and monogamous behavior. Perceived vulnerability, however, was negatively associated with HIV testing. Although this may seem counterintuitive, the finding is likely explained by the cross-sectional nature of the data, that is, couples that have shared HIV test results likely have, as a consequence, lower perceived vulnerability to HIV and other STIs.

Discussion

We assessed the extent to which young heterosexual adults in close relationships and at increased risk of HIV discussed monogamy, agreed to be monogamous, and sustained a monogamy agreement. We also examined whether partners shared HIV test results and agreed to use condoms with each other if the monogamy agreement was not

kept. About a third of couples disagreed that they had discussed monogamy and 30% of those who said they had a monogamy agreement had not kept it. More women than men had kept the monogamy agreement; however, agreement within couples about partner fidelity was low. Thus, perceptions of an explicit monogamy agreement among these young adult couples do not appear to be more accurate than assumptions about monogamous behavior noted in previous studies (Drumwright, et al., 2004; Harvey, Bird, Henderson, Beckman, & Huszti, 2004; Lenoir, et al., 2006; Riehman, Wechsberg, Francis, Moore, & Morgan-Lopez, 2006). Furthermore, HIV testing and reporting were low and few couples had agreed to use condoms in the case of monogamy failure.

We also examined whether demographic, communication, and relationship factors were associated with protective behaviors other than condom use, specifically, HIV testing, the agreement to be monogamous, and keeping a monogamy agreement. Consistent with previous research (Beadnell, Baker, Gillmore, Morrison, Huang, & Stielstra, 2008), we found that the importance of the factors differed across outcomes. HIV testing, though low overall, was more likely among couples who lived together and those in longer relationships. However couples in longer relationships were less likely to keep a monogamy agreement. Hispanic/Latino couples were less likely to make a monogamy agreement in the first place, but no more or less likely to keep one or to have been tested for HIV than other couples.

Results indicated that health protective communication was positively associated with both HIV testing and the agreement to be monogamous, but that sexual communication was not. These findings are consistent with studies that have found that only communication specific to sexual risk was related to an individual's protective

behavior, specifically condom use (Noar, Carlyle, & Cole, 2006; Tschann & Adler, 1997). Neither communication variable, however, was related to monogamous behavior. A monogamous agreement is not itself protective against HIV and, without monogamous behavior, may increase the risk of HIV or other STIs by providing a false sense of security (Crosby, Yarber, & Meyerson, 1999).

Our findings suggest that relationship factors play an important role in both monogamy agreement and sustaining a monogamy agreement. Increasing commitment within couples was positively associated with monogamy agreement and with keeping a monogamy agreement. The relative importance of relationship factors and the low incidence of HIV testing among our sample suggest that monogamy agreements had more to do with intimacy and relationship bonding than with disease prevention. A qualitative study of sexual agreements among gay couples found that the nature of sexual agreements varied widely but that none of the agreements were motivated primarily by concerns about HIV (Hoff & Beougher, in press). This study was limited to mutual monogamy and did not assess motivations for agreeing to monogamy. Further research is needed to understand sexual agreements within heterosexual couples, the motivations for making such agreements, and whether behavioral counseling could improve communication as well as HIV testing and monogamous behavior within couples.

Because the study is cross-sectional, other interpretations of the results are possible. For example, pledging to be monogamous and practicing monogamy may have led to greater relationship commitment in couples. The strengths of this study include the collection of data from a large number of couples and from both members of each couple, as well as the use of partner-specific measures rather than more general measures. A

limitation of our study is that couples were recruited from community locations in two cities and both partners had to agree to participate in the study. For these reasons and because the female participant had to meet eligibility criteria, couples in this study may not have been representative of young adult couples in the general population. Another limitation is that participants' reports of sexual behavior may reflect a social desirability bias. To minimize bias, we conducted confidential interviews with trained interviewers and participants were given the option to complete some sections of the interview on their own. Finally, as noted above, the study is cross-sectional. Future studies should examine how communication and relationship factors affect sexual agreements and behavior over time among young adults. The findings do point to the potential opportunities for intervention among this population, including strengthening monogamy agreements by increasing HIV/STI testing and improving couple communication about sexual risk behavior (Witte, El-Bassel, Gilbert, Wu, & Chang, 2010). Research is also needed to identify the factors most salient to maintaining monogamy over time and whether interventions can make monogamy a viable HIV prevention practice.

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Figure 1: Monogamy agreements among Sample

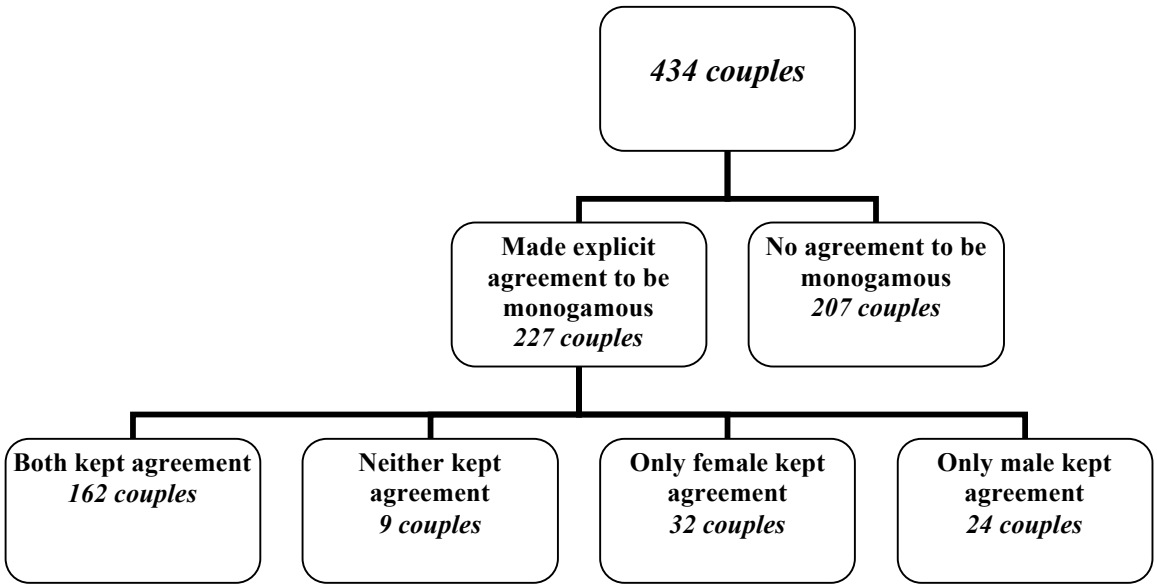

Table 1: Concordance of Couple's Reported Monogamy

Category	Agreement (%)	kappa
Male tested for HIV and shared results		0.33
Both report yes	120 (27.65)	
Both report no	154 (35.48)	
Discordant	160 (36.87)	
Female tested for HIV and shared results		0.25
Both report yes	133 (30.65)	
Both report no	114 (26.27)	
Discordant	187 (43.09)	
Agreed to be monogamous		0.18
Both report yes	227 (52.30)	
Both report no	6 (11.75)	
Discordant	156 (35.95)	
Male kept monogamy agreement*		0.19
Both report yes	160 (42.11)	
Both report no	15 (3.95)	
Discordant	205 (53.95)	

Female kept monogamy agreement*		0.18
Both report yes	184 (48.42)	
Both report no	8 (2.11)	
Discordant	188 (49.47)	
Agreed to use condoms if sex with other partners		0.17
Both report yes	71 (16.36)	
Both report no	197 (45.39)	
Discordant	166 (38.25)	

Note: Agreement % is the number of matching responses divided by number of couples.

*The number of couples is reduced in these categories because partners who concurred they have not agreed to be monogamous (n=54) were not included.

Table 2: Demographic, Communication, and Relationship Characteristics of Sample (N=434)

	Couples N=434 (% or SD)
Demographic	
Married	68 (15.67%)
Live together	159 (36.64%)
Relationship duration >18 months	208 (47.93%)
Hispanic	185 (42.63%)
Communication	
Health protective communication	7.97 (3.84)
Sexual communication	5.02 (.97)
Relationship Factors	
Perceived Vulnerability	1.71 (.75)
Commitment	4.05 (.65)

Table 3: Odds ratios (and 95% confidence intervals) from logistic regression analyses assessing the associations between selected factors and the likelihood of couple agreement on HIV testing, monogamy agreement and monogamous behavior

	HIV Testing (N=434)		**Monogamy Agreement (N=434)**		**Monogamous Behavior (N=227)**	
Variable	Unadjusted	Adjusted	Unadjusted	Adjusted	Unadjusted	Adjusted
Demographic						
Married	1.31 (1.14, 3.00)	--	1.11 (0.66, 1.86)	--	1.30 (0.58, 2.93)	--
Live together	1.83 (1.20, 2.80)	1.85 (1.14, 3.00)*	0.99 (0.67, 1.47)	--	1.18 (0.65, 2.16)	--
Longer relationship	1.77 (1.16, 2.69)**	1.88 (1.15, 3.08)*	0.61 (0.42, 0.90)*	0.81 (0.53, 1.25)	0.52 (0.29, 0.93)*	0.52 (0.29, 0.95)*
Hispanic/Latino	0.67 (0.43, 1.02)	0.70 (0.43, 1.16)	0.33 (0.22, 0.49)***	0.40 (0.26, 0.62)***	1.17 (0.62, 2.20)	--
Communication						
Health protective communication	1.26 (1.18, 1.35)***	1.29 (1.20, 1.39)***	1.15 (1.09, 1.22)***	1.10 (1.03, 1.17)**	1.00 (0.92, 1.09)	--
Sexual communication	1.22 (0.98, 1.52)	0.97 (0.74, 1.27)	1.50 (1.22, 1.85)***	1.15 (0.90, 1.47)	1.02 (0.73, 1.43)	--
Relationship Factors						
Perceived vulnerability	0.59 (0.43, 0.82)**	0.51 (0.35, 0.75)**	0.86 (0.67, 1.10)	--	0.93 (0.62, 1.39)	--

Commitment	1.25 (0.90, 1.74)	0.79 (0.54, 1.17)	3.11 (2.20, 4.40)***	2.61 (1.82, 3.74)***	2.66 (1.59, 4.45)***	2.65 (1.57, 4.46)***

* $p<.05$; ** $p<.01$; *** $p<.001$. Notes: factors significant at $p<.25$ in unadjusted models included in adjusted models; longer relationships were those of at least 18 months.