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Sexual Risk for HIV among Gay Male Couples: A Longitudinal Study of the Impact of Relationship Dynamics

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Abstract

While the relationship context itself is increasingly being examined to understand sexual risk behavior among gay male couples, few studies have examined relationship dynamics and HIV risk longitudinally. We aimed to investigate relationship dynamics and psychosocial predictors of unprotected anal intercourse (UAI) with outside partners of serodiscordant or unknown HIV serostatus (UAIOUT) over time as well as UAI with primary partner in serodiscordant couples (UAIPP). We recruited a sample of 566 ethnically diverse, seroconcordant and serodiscordant couples and interviewed them six times over the course of three years. The surveys encompassed relationship dynamics between the partners and sexual behavior with primary and outside partners. We fit generalized linear mixed models for both the UAI outcomes with time and relationship dynamics as predictors while controlling for relationship length. Analyses of the longitudinal data revealed that, in both categories of couples, those with higher levels of positive relationship dynamics (e.g., commitment, satisfaction) were less likely to engage in UAIOUT. Higher investment in sexual agreement and communication were among the factors that significantly predicted less UAI for seroconcordant couples, but not for serodiscordant couples. For serodiscordant couples, greater levels of attachment and intimacy were associated with greater odds of UAIPP while increased HIV-specific social support was associated with lower odds of UAIPP. These results underscore the importance of creating and tailoring interventions for gay couples that help maintain and strengthen positive relationship dynamics as they have the potential to produce significant changes in HIV risk behavior and thereby in HIV transmission.

Keywords

relationship dynamics; HIV risk; gay male couples; sexual risk behavior

INTRODUCTION

HIV infection rates among gay men in the U.S. remain high and, among gay couples, primary partners have been shown to be a leading source of infection (Sullivan, Salazar, Buchbinder, & Sanchez, 2009). Most HIV prevention research involving gay men continues to focus on individuals, irrespective of relationship status (Hoff & Beougher, 2008; Hoff,

Beougher, Chakravarty, Darbes, & Neilands, 2010; Hoff et al., 2009; Karney et al., 2010). A growing body of research has examined the influence relationship dynamics exert on sexual behavior and on HIV risk among gay male couples (Eaton, West, Kenny, & Kalichman, 2009; Elford, Bolding, Maguire, & Sherr, 1999; Hays, Kegeles, & Coates, 1997; Hoff et al., 2009, 2010; Kippax et al., 2003; Moreau-Gruet, Jeannin, Dubois-Arber, & Spencer, 2001; Prestage et al., 2008; Sullivan et al., 2009). While relationship dynamics and sexual behavior change over the course of a relationship, little research has linked these factors over time to behaviors which may place one at risk for HIV infection. For example, Kurdek (2008) compared the course of gay and lesbian relationships to heterosexual relationships and found that relationship quality for gay couples remained relatively stable over time. Kurdek also found fewer barriers to ending unsatisfactory relationships for gay couples, thereby leading to higher rates of relationship dissolution (see also Kurdek, 1998). Frequency of sexual intercourse has been found to decrease over time for gay couples (Peplau & Fingerhut, 2007) and agreements regarding outside partners may change as well (e.g., couples once monogamous may at some point allow sex with outside partners or vice versa) (Hoff & Beougher, 2008).

None of the research to date on sexual risk among gay male couples, however, documents how these changes over time link to behaviors that could be modified to prevent HIV infection. Since the relationship itself may present a context for potential HIV risk, the importance of examining gay men within their relationships as well as their sexual behavior with primary and outside partners over time becomes clear (Hoff, Chakravarty, Beougher, Neilands, & Darbes, 2013; Karney et al., 2010; Lewis, Gladstone, Schmal, & Darbes, 2006a; Mustanski, Newcomb, & Clerkin, 2011). In order to reduce HIV infection rates among all gay men, it is imperative that those who are in relationships be not only included in prevention research, but be included with efforts and messages tailored specifically to them.

Investigations of sexual behavior among gay male couples have consistently documented high rates of unprotected anal intercourse (UAI) with primary and outside partners, with UAI occurring more frequently with primary partners (Brady, Iantaffi, Galos, & Rosser, 2013; Elford et al., 1999; Frost, Stirratt, & Ouellette, 2008; Hays et al., 1997; Jin et al., 2009). Among couples in which both partners are HIV-negative ("seroconcordant negative couples"), UAI may present less HIV risk, depending on whether either partner has engaged in UAI with an outside partner. For couples in which one partner is HIV-negative and the other is HIV-positive ("serodiscordant couples"), engaging in UAI with one another may result in HIV transmission, the chances of which depend on factors such as the HIV-positive partner's viral load or who penetrates whom (i.e., seropositioning) (Hallett, Smit, Garnett, & de Wolf, 2011; Jin et al., 2009; Vernazza, Hirschel, Bernasconi, & Flepp, 2008).

Relationship dynamics (e.g., intimacy, trust, investment in sexual agreement, commitment) have been found to be associated with less condom use with primary partners (Frost et al., 2008; Hoff, Chakravarty, Beougher, Neilands, & Darbes, 2012; Prestage et al., 2008; Remien, Carballo-Diequez, & Wagner, 1995; Theodore, Duran, Antoni, & Fernandez, 2004). Relationship dynamics may also impact sexual behavior with outside partners. For example, higher levels of HIV-specific social support provided by one's primary partner have been found to lessen the likelihood of engaging in UAI with outside partners of

serodiscordant or unknown serostatus (UAIOUT) among gay male couples (Darbes, Chakravarty, Beougher, Neilands, & Hoff, 2012). HIV-specific social support from one's partner indicates an alignment between partners and support for safer sex behavior as well as the presence of communication between partners regarding sex and HIV.

Interdependence theory (Kelley, 1984; Rusbult & Van Lange, 2003) provides a useful framework for understanding behaviors and emotional responses in the context of intimate relationships. Interdependence theory posits that partners engage in patterns of mutual influence, which lead to products such as motives, emotions or behavior (Lewis et al., 2006). Different couples can express their interdependence in different ways--one partner may express their commitment through displays of emotion while another may demonstrate it by their actions. The outcomes may not always be positive--for a relationship or for an individual. For example, an individual may sacrifice some of their autonomy in order to forge a commitment.

Interdependence theory has most frequently been used to explore how relationship dynamics influence relationship outcomes (e.g., longevity, divorce, infidelity) in heterosexual and gay couples (Allen et al., 2008; Kurdek, 1998). Other relationship dynamics, such as attachment and autonomy, also contribute to the degree of interdependence in a couple (Lewis et al., 2006a) which, in turn, can contribute to the likelihood of the relationship continuing or to how much influence partners have on one another. Lewis et al. (2006b) extended interdependence theory to examine both the initiation and maintenance of health-enhancing behaviors. Their model proposed that engaging in health-enhancing behaviors is the end result of relationship dynamics, such as relationship satisfaction and commitment, which are essential predisposing factors for a "transformation of motivation." This transformation produces a shift in each partner from an individually-centered perspective to one that is more relationship-oriented. Lewis et al. proposed that once this shift occurs, a couple engages in joint efforts and cooperative action to achieve or maintain positive outcomes, such as communal coping. For example, both partners could choose to engage in less sexual risk with outside partners in order to lessen the chances of HIV transmission between them as opposed to only one partner choosing to do so.

This theory has been used to examine predictors of HIV risk among gay male couples by positing that gay men in relationships make decisions regarding their sexual behavior with primary and outside partners based on relationship dynamics such as commitment and relationship satisfaction (Davidovich, de Wit, & Stroebe, 2004, 2006; Mitchell, Champeau, & Harvey, 2013; Mitchell & Petroll, 2013). For example, Mitchell et al. (2013) found that trust, commitment, and the quality of alternatives to the current relationship were associated with decreased likelihood of engaging in UAIOUT. In a sample of individual gay men in relationships in the Netherlands, factors such as relationship satisfaction were found to be associated with decreased UAI with primary partners while higher relationship investment was found to be associated with increased UAI with primary partners (Davidovich et al., 2006). These studies represent an important extension of interdependence theory to sexual behavior--previously, the theory had been used to predict relationship dissolution, not behavior change or frequency. While these studies make important contributions to HIV prevention efforts, their findings remain limited because they either included data from only

one partner (Davidovich et al., 2006) or they only included seroconcordant negative gay couples (Mitchell et al., 2013).

Finally, most studies of HIV risk among gay male couples have been cross-sectional in nature and few have followed couples over time. In contrast, early in the epidemic, the drastic reduction in risk among individual gay men was documented in several large longitudinal studies (Becker & Joseph, 1988; Calzavara et al., 1991; Ekstrand, 1992; McKusick, Coates, Morin, Pollack, & Hoff, 1990; Stall, Coates, & Hoff, 1988). Had these longitudinal studies not followed behavior over time, patterns or predictors of change might not have been identified and targeted in HIV prevention efforts. Cohort studies at that time contributed to reducing HIV risk among gay men (Kippax & Race, 2003; McKusick et al., 1990; Stall, Ekstrand, Pollack, McKusick, & Coates, 1990), yet we know of no longitudinal studies of gay male couples that focus on relationship dynamics associated with HIV risk and include data from both partners.

Longitudinal studies of heterosexual married couples identified predictors of divorce and conflict, which subsequently were addressed in intervention programs to lessen conflict and the likelihood of divorce (Gottman, 1993; Gottman & Levenson, 1992). Kurdek (2008) examined changes in relationship quality and satisfaction over time in studies of gay and lesbian couples, but did not examine sexual behavior or risk for HIV. In order to tailor HIV prevention efforts for gay male couples, it is crucial to understand how changing relationship dynamics exert their influence on partners over time. This may facilitate an understanding of critical points, along the course of a relationship, which are more or less amenable to intervention due to their proximity to important events, such as a couple's first HIV test, their initial negotiations about whether to be monogamous or their first experience of a broken agreement about sex with partners outside the relationship.

Interdependence theory (Rusbult & Van Lange, 2003) has been utilized to provide a framework for understanding behaviors and emotional responses in the context of relationships. In addition to more traditional components, such as relationship satisfaction and commitment, we have also included agreement investment. This construct refers to the level of satisfaction, commitment, and value that gay couples have in their agreements about whether to allow sex with outside partners. Building upon the negotiated safety literature, Hoff and Beougher (2008) found that agreements about sex with outside partners were ubiquitous and integral to nearly all gay male couples regardless of couple serostatus. They also found that agreements about sex served as a framework for couples who decided to engage in, or refrain from, sexual behaviors that may increase their risk for HIV. These agreements can also be thought of as a relationship factor—an expression of the many decisions that most gay couples make about their relationship (Hoff et al., 2012). However, relatively few studies have examined sexual agreements in gay couples and how their negotiation relates to other factors in the relationship (Parsons, Starks, DuBois, Grov, & Golub, 2013). Adding a focus on agreements and on the couple's investment in those agreements reflects an approach which takes the relationship context into account and incorporates decisions about sexual behavior.

Lewis et al.'s (2006b) interdependence model of couple communal coping and behavior change posits that the use of communal coping (Lyons, Michelson, Sullivan, & Coyne, 1998) impacts the likelihood of couples engaging in positive health behaviors. Communal coping is present when partners exhibit a joint response to a health threat, in both the consideration of the level of risk and how best to respond. In addition to communal coping, positive relationship dynamics, such as commitment and/or communication, can also foster positive health behaviors by the couple. This conceptual framework suggests that couples who report higher levels of positive relationship dynamics would be more likely to display similar positive behavioral outcomes (e.g., both partners engage in similar behaviors).

In sum, despite the increasing attention to examining the role of the relationship itself in understanding HIV risk among gay male couples, gaps remain in the literature. There have been too few studies that have collected data from both partners, included all three couple serostatus groups (i.e., seroconcordant negative, seroconcordant positive, serodiscordant), were theoretically grounded, included relationship-oriented and psychosocial factors, and followed couples over time. Thus, the present study aimed to examine how relationship dynamics and psychosocial factors were associated with HIV risk for gay male couples over time. For these analyses, we utilized our conceptual framework to hypothesize predictors of UAIOU for gay men in seroconcordant negative and seroconcordant positive couples ("seroconcordant couples") as well as serodiscordant couples and UAIPP for gay men in serodiscordant couples, as these scenarios represent the highest risk for HIV transmission for gay men in relationships. The separation between seroconcordant and serodiscordant was due to our previously documented differences in associations between relationship dynamics and sexual risk outcomes for these couples. We hypothesized that the associations between our variables of interest would remain consistent over longitudinal observation, (e.g., the same patterns would be found between positive relationship dynamics and sexual risk over time) as we have found previously in cross-sectional examinations behavior. Further, we anticipated that relationship dynamics and psychosocial factors would display different patterns in seroconcordant and serodiscordant couples due to their unique configurations and experiences of living—or not living—with HIV. Specifically, we hypothesized that:

1. For seroconcordant couples, higher levels of positive relationship dynamics (e.g., intimacy, satisfaction) would be associated with lower odds of UAIOU over time.
2. For serodiscordant couples, higher levels of positive relationship dynamics (e.g., intimacy, satisfaction) would be associated with lower odds of UAIOU over time.
3. For serodiscordant couples, increased positive relationship dynamics (e.g., intimacy, attachment) would be associated with higher odds of UAIPP over time.

In addition, for each hypothesis, we also investigated whether the effects differed when comparing couples in which neither partner engaged in UAIOU, in which only one partner engaged in UAIOU, and in which both partners engaged in UAIOU.

METHOD

Participants

For this longitudinal study, we recruited 566 gay male couples from the San Francisco Bay Area from June 2005 to February 2007. We utilized both active and passive recruitment strategies aimed at attracting a sample that reflected the area's diverse demographics in terms of race/ethnicity and serostatus. Field research staff reached potential participants either by handing out study postcards or placing flyers and postcards in gay-identified social venues such as bars, clubs, and cafes, as well as in community health and HIV and AIDS service organizations and by placing advertisements in gay-oriented publications, Web sites, and listservs. Field research staff reached out specifically to community-based agencies whose constituents were Asian-American and Pacific Islander, Latino, and African-American gay men, as well as HIV-positive gay men.

Eligibility criteria required participants be at least 18 years old, be in their relationship at least three months, know their own and their partner's HIV-status, and identify as gay/bisexual. Couples were eligible to participate if both partners met all of the eligibility criteria. Over the course of data collection, couples had to continue to meet all baseline eligibility requirements. Additionally, couples who broke up, couples in which one partner passed away, and couples who moved away from the San Francisco Bay Area were ineligible for future visits. Eligible couples were surveyed in the study office in downtown San Francisco where, after providing informed consent, each partner independently completed an audio computer-assisted self-interview (ACASI) at each visit. Details about recruitment, screening, and data collection are reported elsewhere (Hoff & Beougher, 2008; Hoff et al., 2009, 2010; Neilands, Chakravarty, Darbes, Beougher, & Hoff, 2010).

Including baseline, couples were surveyed a total of six times over a period of three years. The second survey (T2) was conducted one year after baseline, while the third through sixth surveys (T3 through T6) were conducted every six months thereafter. Surveys took between 70–90 minutes to complete and partners were paid \$40 each as incentive at each visit.

Measures

Sample Characteristics—Participants reported their age, race/ethnicity, and relationship length during the baseline interview. Time-varying characteristics such as agreement type, employment status, annual income, and cohabitation status were recorded at each visit.

HIV-status—At each visit, participants reported the result of their most recent HIV test. They also reported their primary partner's HIV-status. Based on both partners' reports, we categorized the sample into HIV-seroconcordant and HIV-serodiscordant couples for the purpose of these analyses.

Sexual Risk Behavior—At each visit, participants reported the number of times they engaged in specific sexual behaviors in the past three months. A three-month recall period is common in sexual behavior research because it has been shown to provide the most accurate data on sexual behavior in the recent past (Kauth, St. Lawrence, & Kelly, 1991; Schroeder, Carey, & Vanable, 2003). Participants were asked about the frequency of each behavior

under different scenarios: used/did not use condoms, with primary/outside partners, and HIV-status of the sex partners. The resulting data were sufficiently detailed to determine receptive versus insertive anal sex, with and without ejaculation. Based on the participant's own HIV-status as well as that of his primary and outside partners, we used the sum of the number of insertive and receptive UAI acts to create two couple-level measures of risk at each visit. The first was a binary variable denoting the presence or absence of UAI with primary partner in serodiscordant relationships (UAIPP) in the past three months (0 = reported zero such acts, 1 = reported at least one such act). The second was a three-level categorical variable measuring the involvement of partners within a couple in UAIOUT of serodiscordant or unknown serostatus in the past three months (0 = both partners reported zero such acts, 1 = only one of the two partners reported at least one such act, 2 = both partners reported at least one such act).

Positive Relationship Dynamics—A number of standardized measures were used to assess positive relationship dynamics. Many of them have been previously used in studies of gay men and found to generate reliable responses (Boesch, Cerqueira, Safer, & Wright, 2007; Darbes & Lewis, 2005; Kurdek, 2000).

Investment in sexual agreement (Neilands et al., 2010). The Sexual Agreement Investment Scale (SAIS) assessed investment in one's agreement about sex with outside partners on three domains: value of the agreement, commitment to the agreement, and satisfaction with the agreement. It is a 13-item measure ($\alpha = 0.94$) with a 5-point response scale ranging from "not at all" to "extremely." A sample item: "How satisfied are you with your current agreement?"

Mutually constructive communication (Heavey, Larson, Christensen, & Zumtobel, 1996). This is one of the subscales of the Communication Patterns Questionnaire and assesses the level of constructive communication among partners. It is a 7-item measure ($\alpha = 0.80$) with a 9-point response scale: "very unlikely" to "very likely." A sample item: "During a discussion of a relationship problem, both of us suggest possible solutions and compromises."

Intimacy (Miller & Lefcourt, 1982). The Miller Social Intimacy Scale assesses level of emotional intimacy and connection with one's partner. It is a 17-item measure ($\alpha = 0.91$) with a 10-point response scale: "very rarely" to "almost always" or "not much" to "a great deal," depending on the question. A sample item: When you have leisure time, how often do you choose to spend it alone with your partner?"

Dyadic consensus (Spanier, 1976). The Dyadic Consensus subscale of the Dyadic Adjustment Scale (DAS) assesses level of agreement for couples regarding several aspects of their relationship. It has 14 items ($\alpha = 0.88$), ranging in a 6-point scale from "always agree" to "always disagree." A sample item: "Handling family finances."

Dyadic satisfaction (Spanier, 1976). The Dyadic Satisfaction subscale of the DAS assesses general relationship satisfaction ($\alpha = 0.85$). The response items are the same as for Dyadic consensus. A sample item: "How often do you and your partner quarrel?"

Kansas Marital Satisfaction (Schumm et al., 1986). This scale measures general relationship satisfaction. It is a 3-item scale ($\alpha = 0.95$) with a 7-point response set ranging from “extremely dissatisfied” to “extremely satisfied.” A sample item: “How satisfied are you with your primary relationship?”

Commitment (Sternberg, 1988). This scale measures the level of commitment to a relationship. It is an 8-item scale (0.94) with a 9-point response set: “not at all true” to “extremely true.” A sample item: “Because of my commitment to my partner, I would not let other people come between us.”

Attachment (Kurdek, 1995). This scale assesses the degree of emotional attachment to one’s partner. It is an 8-item scale (0.80) with a 9-point response ranging from “not at all true” to “extremely true.” A sample item: “I can never get too close to my partner.”

Trust (Rempel, Holmes, & Zanna, 1985). This scale assesses the level of trust in a relationship. It is a 17-item scale (0.89) with a 7-point response set ranging from “strongly disagree” to “strongly agree.” A sample item: “I can rely on my partner to react in a positive way when I expose my weaknesses to him.”

HIV-specific social support (Darbes & Lewis, 2005). This scale assesses the level of HIV-specific social support from one’s partner or specifically support received and given around HIV risk and/or coping with being HIV-positive. It is a 24-item scale ($\alpha = 0.89$) with 4-point response ranging from “strongly disagree” to “strongly agree.” A sample item: “My partner depends on me for help when it comes to practicing safe sex.”

General social support (Cutrona & Russell, 1987). The Social Provisions Scale-Partner assesses level of emotional support from one’s partner (as opposed to general social support from all sources). It is a 24-item scale (0.93) with a 4-point response set ranging from “strongly disagree” to “strongly agree.” A sample item: “I can talk to my partner about important decisions in my life.”

Data Analysis

Over the course of the study, eight couples seroconverted—either from being an HIV-negative seroconcordant couple to a serodiscordant couple or from being a serodiscordant couple to an HIV-positive seroconcordant couple—and were excluded from the present analyses.

We calculated initial statistics to describe the sample at baseline. These included the frequencies for categorical variables (e.g., race, income, agreement type) and measures of central tendency and range for continuous variables (e.g., age, relationship length).

Model selection—The present couple-level longitudinal analyses explored two types of sexual risk outcomes: UAIPP among serodiscordant couples at each visit and UAIOUT of serodiscordant or unknown serostatus at each visit. The predictors of interest were relationship dynamics and psychosocial factors and the models were fitted separately for seroconcordant and serodiscordant couples.

We used random effects model to investigate the trend in sexual behavior over time. These models, which are also known as random coefficient models (Longford, 1993), multilevel models (Kreft & de Leeuw, 1998), or hierarchical linear models (HLMs) (Bryk & Raudenbush, 2002), are regression models in which a dependent or outcome variable (UAI in this case) is regressed onto one or more explanatory variables, similar to the usual multiple regression framework. What differentiates the random effects regression approach from standard regression methods is the inclusion of one or more random effects which quantify subject-to-subject variability across repeated measurements in the longitudinal analysis context. In the analyses presented below, the random effects models estimate the variability of subjects' starting UAI levels via a random intercept term and, where feasible, the variability of the subjects' trajectories of UAI over time via random slopes. When modeling binary outcomes, as is the case in the present analyses, closed form solutions for estimating parameters are not available and so estimation occurs via numerical integration, which is computationally demanding (Rodriguez & Goldman, 1995). Occasionally, models containing both random intercepts and slopes do not converge, which is possibly symptomatic of overfitting, in which case models with random intercepts only are substituted.

For the predictor side of the models, we generated two measures from each of the relationship and psychosocial factors. The first was the couple's grand mean for the factor over all visits. This measures the average level of the relationship/psychosocial construct for each couple and aids in studying the associations of between-couple differences with the outcome. The second was the deviation score of the visit-specific couple-level mean from the couples' grand mean over all visits for a given factor. This score measures the extent to which each couple varied around their overall average score for a given time-varying predictor variable and aids in studying the associations of within-couple differences over time with the outcome (Neuhaus & Kalbfleisch, 1998). For each relationship dynamic and psychosocial factor, the model contained the following predictors: the visit number (as a proxy for time), the couples' grand mean score, the couples' deviation score, and the length of the relationship.

We used PROC GLIMMIX in SAS V9.3 for modeling the outcomes. For the categorical outcome UAIOUT, we fitted for each relationship and psychosocial factor a generalized linear mixed model with a multinomial distribution, and a generalized logit link function. The UAIOUT models were fitted separately for the seroconcordant couples and the serodiscordant couples. The visit number was entered as a proxy for time as a fixed effect in all models predicting UAIOUT. For these models, the couples in which both partners reported UAIOUT were coded as the reference category because that scenario represented the highest level of HIV risk possible for the couple. Subsequently, couples in which neither partner reported UAIOUT were compared to couples in which only one partner reported UAIOUT in a second set of analyses. While modeling UAIOUT, models with random slopes did not converge, so the UAIOUT models estimated random intercepts only. The outcome UAIPP was studied only for the serodiscordant couples in the sample. For this binary outcome, we fitted a generalized linear mixed model with a binomial distribution and a logit link function for each relationship dynamic and psychosocial factor. While modeling UAIPP, random intercepts, slopes, and their covariance were estimated, following the usual

practice in multilevel growth modeling. The visit number (time) was entered as a fixed effect as well as a random effect in all models predicting UAIPP. We report the odds ratios and their 95% confidence intervals; all odds ratios are for one unit increase in the predictor variable. For all models, Morel's variance adjustment was used to guard against possible misspecification of the covariance structure of random effects (Morel, Bokossa, & Neerchal, 2003).

In comparing couples who came in for all six waves of interviews against those who missed one or more waves, we found that these two groups did not differ significantly on agreement investment, attachment, and autonomy. For all other relationship variables, the groups differed significantly in the expected direction, such that couples with higher levels of positive relationship dynamics at baseline had higher odds of participating in all six waves.

RESULTS

Across all six visits, 56% of couples were seroconcordant negative, 18% were seroconcordant positive, and 26% were serodiscordant. The sample was racially/ethnically diverse, with the largest proportions of couples being either interracial (47%) or White (45%). At baseline, the median age of the men in the sample was 42 years (M, 42; range, 18–83), the median relationship length was 4 years (M, 6.9; range, 0.25–48), individual incomes were less than \$60,000 annually for most men and, in the majority of couples, both partners were employed. Further, at baseline, 77% of couples lived together and seroconcordant couples and serodiscordant couples had similar rates for sexual agreement type: approximately half of the sample had either a closed or an open agreement, with a small number of couples reporting discrepant agreements. At baseline, 20% of individuals said they had ever participated in individual therapy while 5% of couples had participated in couples therapy in the past 6 months.

Over the course of the study, 269 couples became inactive or ineligible for future waves, of whom 60% became so before T2 and the remaining 40% over the next two years. The breakdown of these 269 couples by reason of inactivity/ineligibility included 46% break-ups, 20% declines, 18% lost to contact, 10% relocations, and 4% deaths.

Table 1 shows the percentages of couples in various categories that reported UAI over the course of the study. For instance, at baseline, 81% of seroconcordant couples reported that neither partner engaged in UAIOUT in the past three months. This number increased to 86% at T6. In contrast, the percentage of seroconcordant couples in which only one partner reported UAIOUT fell over the six visits from 16% at baseline to 12% at T6. Among serodiscordant couples, while 70% reported that neither partner had UAIOUT at baseline, this number increased steadily to 77% at T6. Further, while approximately 8% of serodiscordant couples had both partners engaging in UAIOUT at baseline, only 2.5% did so at T6. At baseline, 47% of couples in serodiscordant relationships reported at least one episode of UAIPP and this number fell steadily over three years to 28% at T6.

In performing multinomial logistic regression analyses for the outcome UAIOUT, couples in which neither couple reported UAIOUT and couples in which one partner reported

UAIOUT were each compared with couples in which both partners reported UAIOUT, who were treated as the reference category. A second set of analyses treated couples in which only one partner reported UAIOUT as the reference category and compared them to couples in which neither partner reported UAIOUT. The findings from these models are explained in discrete sections below by hypothesis.

Positive Relationship Dynamics and UAIOUT in Seroconcordant Couples

Table 2a shows the results of the multinomial logistic regression analyses for the outcome UAIOUT for seroconcordant couples. The odds ratio for time ranged from 1.04 to 1.29 for the various models and was not statistically significant in any of the models (the 95% confidence intervals all included 1). Therefore, for clarity of presentation, these numbers have been omitted from the table. In these couples, several relationship dynamics were significantly associated with their odds of engaging in UAIOUT.

We first compared seroconcordant couples in which neither partner reported UAIOUT to seroconcordant couples in which both partners reported UAIOUT (the reference category). In studying between-couples differences for these two subgroups, higher grand mean levels of several positive relationship dynamics over time were associated with greater odds of neither partner engaging in UAIOUT (Table 2a, column a). These dynamics were investment in sexual agreement, constructive communication, intimacy, dyadic consensus, dyadic satisfaction, relationship satisfaction, commitment, attachment, equality, trust, and both general and HIV-specific social support. As a specific example, controlling for other variables in the model, relative to couples with lower HIV-specific social support, couples who had higher HIV-specific social support during the study had higher odds of neither partner reporting UAIOUT--for every one unit increase in a couple's grand mean score on HIV-specific social support, there was an 18% greater odds that neither partner reported UAIOUT (AOR: 1.18; 95% CI: 1.10, 1.26). Similarly, couples with greater levels of relationship satisfaction had 36% higher odds of neither partner engaging in UAIOUT (AOR: 1.36; 95% CI: 1.16, 1.60).

Within-couple differences in a subset of these positive factors--investment in sexual agreement, constructive communication, intimacy, dyadic consensus, dyadic satisfaction, relationship satisfaction, commitment, equality, and trust--were also found to have significant associations with UAIOUT when comparing these two subgroups of couples (Table 2a, column c). For instance, on average, over the course of the study, within-couple increases in trust were associated with higher odds of neither partner engaging in UAIOUT (AOR: 1.10; 95% CI: 1.05, 1.15).

We next compared seroconcordant couples in which only one partner reported UAIOUT to seroconcordant couples in which both partners reported UAIOUT (the reference category). In these two subgroups of seroconcordant couples, the only statistically significant association for between-couple differences with UAIOUT was for mutually constructive communication (Table 2a, column b). Specifically, couples with higher grand mean levels of mutually constructive communication over the course of the study had 5% greater odds of being a couple in which only one partner engaged in UAIOUT (AOR: 1.05; 95% CI: 1.00, 1.09). Within couples, dyadic consensus, dyadic satisfaction, autonomy, and trust, were

found to be associated with UAIOUT over time (Table 2a, column d). On average, during the course of the study, within-couple increases in consensus were associated with higher odds of only one of them engaging in UAIOUT (AOR: 1.13; 95% CI: 1.03, 1.24). Dyadic satisfaction, autonomy and trust showed significant trends in the same upward direction.

Finally, we compared seroconcordant couples in which neither partner reported UAIOUT to seroconcordant couples in which only one partner reported UAIOUT (the reference category). There were several significant associations between relationship variables and UAIOUT for these analyses. Higher grand means of sexual agreement investment intimacy, dyadic satisfaction, attachment, trust, and HIV-specific social support were all associated with greater odds of neither partner reporting UAIOUT, compared to couples in which only one partner reported UAIOUT (Table 2a, column e). For example, controlling for other variables in the model, couples with higher levels of sexual agreement investment had higher odds of neither partner reporting UAIOUT--for every one unit increase in a couple's grand mean score on sexual agreement investment, there was a 14% greater odds that neither partner reported UAIOUT (AOR: 1.14; 95% CI: 1.09, 1.20). Within couples, sexual agreement investment and intimacy were found to be associated with UAIOUT over time (Table 2a, column f). On average, during the course of the study, within-couple increases in sexual agreement investment were associated with higher odds of neither partner engaging in UAIOUT (AOR: 1.06; 95% CI: 1.00, 1.11). Intimacy showed a significant similar trend.

Positive Relationship Dynamics and UAIOUT in Serodiscordant Couples

Table 2b shows the results of the multinomial logistic regression analyses for the outcome UAIOUT for serodiscordant couples. The odds ratio for time ranged from 0.93 to 1.25 for these models and was not statistically significant in any of the models (the 95% confidence intervals all included 1). Therefore, for clarity of presentation, these numbers have been omitted from the table. Akin to the seroconcordant couples, in these couples too, several relationship dynamics were significantly associated with their odds of engaging in UAIOUT.

First, we compared serodiscordant couples in which neither partner reported UAIOUT to serodiscordant couples in which both partners reported UAIOUT (the reference category). Similar to seroconcordant couples, several relationship dynamics showed significant between-couple differences over time for UAIOUT in serodiscordant couples. Among these, higher grand mean levels of the positive dynamics--commitment, attachment, equality, and HIV-specific social support--were associated with greater odds of neither partner reporting UAIOUT (Table 2b, column a). One instance was commitment, in which, relative to couples with lower commitment, couples with higher commitment had higher odds of neither partner engaging in UAIOUT--for every one unit increase in a couples grand mean score, there was a 19% higher odds of neither partner reporting UAIOUT (AOR: 1.19; 95% CI: 1.04, 1.36). In the case of within-couple differences, increasing levels over the course of the study of commitment and attachment were associated with greater odds of neither partner engaging in UAIOUT (Table 2b, column c). On average, over the course of the study, within-couple increases in commitment were associated with higher odds of neither partner engaging in

UAIOUT, such that for every increase in a couples' commitment over time there was an 11% greater odds of neither partner reporting UAIOUT (AOR: 1.11; 95% CI: 1.03, 1.19).

Next, we compared serodiscordant couples in which only one partner reported UAIOUT to serodiscordant couples in which both partners reported UAIOUT (the reference category). For this comparison, there were no statistically significant associations for between-couple differences with UAIOUT. Within couples, over time, commitment was the only dynamic with a significant association with UAIOUT (Table 2b, column d); couples with increasing commitment over the course of the study had greater odds of being a couple in which only one partner engaged in UAIOUT such that for every one unit increase in a couple's commitment over time, there was an 10% greater odds that only one partner reported UAIOUT and not both partners (AOR: 1.10; 95% CI: 1.02, 1.19).

Finally, we compared serodiscordant couples in which neither partner reported UAIOUT to serodiscordant couples in which only one partner reported UAIOUT (the reference category). Higher grand mean levels of commitment and equality were significantly associated with higher odds of neither partner reporting UAIOUT (Table 2b, column e). For example, relative to couples with lower commitment, couples with higher commitment had higher odds of neither partner engaging in UAIOUT--for every one unit increase in a couple's grand mean score, there was a 17% higher odds of neither partner reporting UAIOUT (AOR: 1.17; 95% CI: 1.03, 1.32). Within couples, over time, relationship satisfaction was the only dynamic with a significant association with UAIOUT (Table 2b, column f); couples with increasing satisfaction over the course of the study had greater odds of being a couple in which neither partner engaged in UAIOUT such that, for every one unit increase in a couple's satisfaction over time, there was an 19% greater odds that neither partner reported UAIOUT compared to one partner (AOR: 1.19; 95% CI: 1.01, 1.40).

Positive Relationship Dynamics and UAIPP in Serodiscordant Couples

We also examined the association between relationship dynamics and UAIPP among serodiscordant couples. In every model we fit for this outcome, we found that time was a significant predictor of UAIPP; over time, the odds of UAIPP declined significantly (Table 3). Also, between couples, controlling for other variables in the model, attachment and HIV-specific social support were found to have significant associations with UAIPP--though in different directions. Specifically, a one unit increase in a couple's grand mean level of attachment across time was associated with 12% higher odds of engaging in UAIPP (AOR: 1.12; 95% CI: 1.000, 1.26). Conversely, a one unit increase in a couple's grand mean level of HIV-specific social support across time was associated with 16% lower odds of engaging in UAIPP (AOR: 0.84; 95% CI: 0.74, 0.95). Over the course of the study, within-couple increases in intimacy were associated with UAIPP. A one unit increase in a couple's grand mean level of intimacy across time was associated with 6% higher odds of engaging in UAIPP (AOR: 1.06; 95% CI: 1.01, 1.12).

DISCUSSION

Our findings both replicate and build upon prior literature examining the role of relationship dynamics on sexual behavior with primary and outside partners among gay male couples.

Overall, couples with higher levels of positive relationship dynamics were more likely to report that neither partner or only one partner engaged in UAIOU, a finding that was consistent for both seroconcordant couples and serodiscordant couples. There were significant findings for overall levels of several relationship dynamics (e.g., taking into account report of these dynamics from all six study visits) and for increases in levels of certain relationship dynamics over the course of the study. We also found more significant associations between positive relationship dynamics and neither partner engaging in UAIOU, as opposed to only one partner engaging in UAIOU, for both seroconcordant couples and serodiscordant couples.

The pattern of couples who reported higher levels of positive relationship dynamics engaging in lower rates of potentially risky UAI replicated prior findings (Hoff et al., 2009, 2010, 2012; Mitchell et al., 2013; Mitchell & Petroll, 2013). Our findings also extended the extant literature by demonstrating that these patterns remained consistent longitudinally. Our results lend support to prior findings that the relationship, as a context in and of itself, is crucial in understanding the sexual behavior of gay men in relationships and that fostering positive relationship dynamics can provide additional benefits for HIV prevention. This speaks to the urgent need for interventions targeting gay male couples which could provide support for relationship issues such as communication and intimacy. There is currently a dearth of HIV-focused interventions which target gay male couples (Burton, Darbes, & Operario, 2010). Prior interventions for gay male couples pertaining to HIV focused on HAART medication adherence (Remien et al., 2005) and reducing sexual risk behavior for methamphetamine-using African-American MSM couples (Wu, El-Bassel, McVinney, Fontaine, & Hess, 2010). Our findings speak to the potential of interventions that aim to improve positive relationship dynamics as a means of reducing sexual risk behavior of gay men in relationships.

Positive relationship dynamics exerted a stronger influence on both partners as opposed to only one partner, such that as couples' levels of positive dynamics increased, both partners were less likely to report UAIOU. This was the case in both seroconcordant couples and serodiscordant couples. There were fewer significant findings when comparing couples in which only one partner reported UAIOU to couples in which both partners reported UAIOU. These two observations together could be an indication of "transformation of motivation" (Lewis et al. 2006b; Rusbult & Van Lange, 2003) occurring in the couple. The occurrence of transformation of motivation may indicate a shift from an "I" perspective to a "we" perspective. In our results, those couple-level factors found to be significant for the comparison of the "neither partner engaged in UAIOU" (that exerted an influence on both partners) group with the "both partners had UAIOU" group were not found to have as significant an impact for the comparison of the "only one partner engaged in UAIOU" group with the "both partners had UAIOU." It appears that dynamics that occur within a relationship that represent dyadic exchanges are more likely to subsequently impact both partners as opposed to only one. These findings thus underscore the necessity to intervene and examine HIV prevention issues at the couple-level. Couples-based interventions to improve relationship dynamics have been found to be effective for heterosexual couples (Halford & Moore, 2002). For example, the PREP intervention (Markman, Stanley, & Blumberg, 2001) has been shown to improve relationship functioning and outcomes (e.g.,

lower rates of divorce) by providing relationship skills training to couple (e.g., communication and problem-solving skills). Future research should explore whether implementing similar approaches provides similar relationship benefits for gay male couples.

Although there were many similarities between seroconcordant couples and serodiscordant couples with regard to how relationship dynamics influenced UAIOUT, there were differences. For example, satisfaction, commitment, attachment, equality, and HIV-specific social support exhibited similar patterns in both groups. For all of these positive relationship dynamics, couples with higher levels were less likely to engage in UAIOUT, some via their aggregate levels of these dynamics and others via increases in these levels over time. However, investment in sexual agreements about outside partners was a significant predictor for seroconcordant couples, but not for serodiscordant couples. It is possible that seroconcordant couples are more invested in their agreement about sex with outside partners, which is where the potential for HIV transmission occurs in these couples. For serodiscordant couples, their agreements about sex with outside partners may not have as much salience due to the potential for HIV transmission being present within the relationship. Other dynamics that were significant for seroconcordant couples, but not serodiscordant couples, as being associated with UAIOUT included trust, communication, and general social support.

We also examined relationship dynamics as predictors of UAIPP for serodiscordant couples. Similar to prior studies (Remien et al., 1995; Theodore et al., 2004), we found that increased intimacy and attachment were associated with increased likelihood of UAI with one's primary partner over time. Condom use has often been seen as a barrier to intimacy and condom use has been seen to be more prevalent among outside or casual partners than with primary partners (Cusick & Rhodes, 2000). However, serodiscordant couples with overall greater overall levels of HIV-specific social support were less likely to engage in UAI with each other. This finding extends prior research which found HIV-specific social support to be a significant predictor of less UAIOUT (Darbes et al., 2012; Hoff et al., 2012). HIV-specific social support indirectly assesses the level of communication about sex within a couple (Darbes et al., 2012), so this finding indicates that serodiscordant couples who report this kind of support can talk with their primary partners about the risk that stems from engaging in UAI with each other and choose to engage in less UAI. Improving a couples' ability to provide support within the relationship, specifically towards managing HIV risk with primary and outside partners, should be a component of future interventions with gay male couples. Finally, the odds of UAIPP among serodiscordant couples reduced over time. This reflects prior research for both heterosexual and gay male couples regarding the decrease in frequency of sexual intercourse over the course of a relationship. In prior examinations of frequency of sexual intercourse among gay male couples, length of relationship has been shown to be a significant predictor of a decrease in frequency, over and above the effect of increasing age (Blumstein & Schwartz, 1983). The highest rates of sexual activity have been found in couples in relationships of one year or less in duration (Bryant & Demian, 1994; McWhirter & Mattison, 1984). Other possible explanations for this finding could include an increase in condom use over time or engaging in oral sex as opposed to anal sex.

In sum, our findings indicated that couple-level dynamics were important influences on risky sexual behavior with outside partners for gay men in relationships. The consistency of findings that increased levels of positive relationship dynamics were associated with less risky sexual behavior speak to the importance of intervening with couples to maintain and/or improve positive relationship dynamics. The longitudinal nature of the findings speak to the need to maintain positive dynamics over time, since changes over time can produce significant changes in sexual behavior with outside partners of serodiscordant or unknown serostatus.

This study had several strengths. It represented a large longitudinal sample of gay male couples, which was diverse in terms of race/ethnicity and HIV serostatus. The data were collected via ACASI and past sexual behaviors were asked about within a three month window, which minimizes potential reliability issues of self-reported data of sexual behavior. The study also included reports from couples over six waves across three years. Thus, the findings were representative of relationship dynamics that can change and accumulate over time. To our knowledge, this was the first longitudinal study specifically examining relationship-based predictors of UA/IOU among both seroconcordant couples and serodiscordant couples.

Limitations of the study include a modified convenience sample that was from a limited geographic area. This poses issues for the generalization of findings to all gay couples or to gay couples from other geographical regions. As with any longitudinal study, participant loss to follow-up is a concern since self-selected retention has the potential to influence results. Indeed, couples who completed all six study visits differed from couples who missed one or more study visits on various relationship measures in the expected directions. This may have been due to the first measurement point being part of a cross-sectional study, with participants who participated in the first wave not necessarily signing up to return for follow-up visits, exacerbated by the second measurement point taking place a full year after the first measurement. While this was a limitation, it is important to note that our mixed models analyses accounted for missing data under the relatively mild conditionally missing-at-random (MAR) assumption, where observed values of outcomes at earlier time points aid the meeting of the MAR assumption for subsequent missing outcomes, thereby ensuring that the resulting inference space applies to all couples, not just those who completed all six measurement waves. Further, the mixed models methodology employed in this study enables generalization of results to all couples who participated due to its inclusion of data from both couples with all measurements and couples with some but not all measurements. Another possible limitation stems from our 3-month measurement period for sexual behavior, which is different from our assessment intervals (one instance of a 1-year period, five instances of 6 months). However, this time frame for sex behavior recall was chosen for the very reason that it is widely used in sexual behavior research- it has been shown to provide the most accurate data on sexual behavior in the recent past. Finally, the HIV status of participants was self-reported—no actual testing occurred. We forwent testing because we were interested in how one's perception of serostatus guided one's sexual behavior.

Exploring the relationship context for gay men in relationships has been identified as a priority for the field of HIV prevention. The current findings illustrate that positive

relationship dynamics, such as the level of intimacy, satisfaction, commitment and attachment, are keys to reducing HIV risk among gay male couples. Since relationships are not static entities, it is imperative to capture change and fluctuation as levels of closeness, communication, and sexual risk taking behavior with primary and outside partners wax and wane over time. Future studies might wish to control for overall level of sexual activity both with primary and outside partners to further clarify the effects found in this investigation. In addition, these findings are not applicable purely to couples-based interventions--aspects of primary relationships which could benefit from improved interpersonal skills can be addressed when intervening with individuals who could then apply the new skills with their partners. These skills could then positively impact both their relationships and their ability to engage in behavior which lessens the likelihood of HIV infection. Future HIV prevention efforts would be well served by incorporating and promoting positive relationship dynamics, as well as addressing how they may change over time, in their efforts to reduce HIV infection among gay men.

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Table 1

Percentage of Couples Reporting UAIOUT and UAIPP at the Six Visits

	Visit 1	Visit 2	Visit 3	Visit 4	Visit 5	Visit 6
Total sample size (N)→	566	365	339	320	305	291
UAI-partner type: Couple-serostatus						
UAIOUT: Seroconcordant						
Outcome Category						
Subsample size →	434	271	252	234	224	212
Neither partner reported UAIOUT	80.7	83.8	83.7	82.9	84.4	86.8
Only one partner reported UAIOUT	15.9	15.3	13.5	15.0	13.8	11.8
Both partners reported UAIOUT	3.5	0.7	2.8	2.1	1.8	1.4
UAIOUT: Serodiscordant						
Subsample size →	132	94	87	86	81	79
Neither partner reported UAIOUT	69.7	74.5	75.9	76.7	80.3	76.0
Only one partner reported UAIOUT	22.7	21.3	18.4	14.0	13.6	21.5
Both partners reported UAIOUT	7.6	4.3	5.8	9.3	6.2	2.5
UAIPP: Serodiscordant						
Subsample size →	132	94	87	86	81	79
Reported UAIPP	47.0	38.3	34.5	32.6	27.2	29.1

Note. UAIOUT: At least one instance of UAI with outside partner of discordant or unknown serostatus in the past 3 months. UAIPP: At least one instance of UAI with primary partner in serodiscordant relationships in the past 3 months.

Table 2

^a

Odds Ratios and 95% Confidence Intervals from Longitudinal Multinomial Logistic Regression Models for UA/OUT among Seroconcordant Couples

Predictor	Ref: Both partners reported UA/OUT			Ref: One partner reported UA/OUT		
	Neither partner reported UA/OUT		Only one partner reported UA/OUT	Neither partner reported UA/OUT		Only one partner reported UA/OUT
	(a)	(b)		(c)	(d)	(e)
	Couple Mean	Couple Deviation		Couple Mean	Couple Deviation	
Sexual Agreement Investment	1.15 (1.07, 1.23) [*]	1.01 (0.95, 1.06)	1.12 (1.03, 1.21) [*]	1.14 (1.09, 1.20) [*]	1.06 (0.97, 1.15)	1.06 (1.004, 1.11) [*]
Constructive Communication	1.10 (1.03, 1.16) [*]	1.05 (1.002, 1.09) [*]	1.11 (1.01, 1.23) [*]	#	1.09 (0.98, 1.21)	#
Intimacy	1.05 (1.02, 1.08) [*]	1.01 (0.99, 1.03)	1.06 (1.01, 1.12) [*]	1.04 (1.01, 1.06) [*]	1.02 (0.97, 1.08)	1.04 (1.02, 1.07) [*]
Dyadic Consensus	1.11 (1.03, 1.20) [*]	1.04 (0.98, 1.10)	1.13 (1.03, 1.24) [*]	#	1.13 (1.03, 1.24) [*]	#
Dyadic Satisfaction	1.15 (1.06, 1.24) [*]	1.03 (0.97, 1.10)	1.23 (1.08, 1.39) [*]	1.11 (1.05, 1.18) [*]	1.15 (1.01, 1.31) [*]	1.06 (0.99, 1.14)
Kansas Marital Satisfaction	1.36 (1.16, 1.60) [*]	1.08 (0.96, 1.22)	1.28 (1.03, 1.61) [*]	#	1.16 (0.92, 1.46)	#
Commitment	1.10 (1.04, 1.16) [*]	1.02 (0.98, 1.07)	1.14 (1.04, 1.24) [*]	#	1.09 (0.997, 1.19)	#
Attachment	1.07 (1.02, 1.13) [*]	0.996 (0.96, 1.04)	1.04 (0.93, 1.17)	1.07 (1.03, 1.12) [*]	1.002 (0.89, 1.13)	1.04 (0.99, 1.09)
Autonomy	1.01 (0.96, 1.07)	0.996 (0.96, 1.04)	1.06 (0.995, 1.13)	#	1.08 (1.01, 1.16) [*]	#
Equality	1.10 (1.05, 1.16) [*]	1.03 (0.99, 1.07)	1.07 (1.002, 1.14) [*]	#	1.05 (0.98, 1.12)	#
Trust	1.06 (1.02, 1.10) [*]	1.02 (0.99, 1.05)	1.10 (1.05, 1.15) [*]	1.04 (1.01, 1.06) [*]	1.07 (1.02, 1.13) [*]	1.03 (0.99, 1.06)
HIV-specific social support	1.18 (1.10, 1.26) [*]	1.02 (0.97, 1.08)	1.06 (0.96, 1.18)	1.19 (1.13, 1.25) [*]	1.03 (0.93, 1.13)	1.04 (0.99, 1.09)
General social support	1.11 (1.04, 1.18) [*]	1.02 (0.98, 1.07)	1.09 (0.99, 1.21)	#	1.05 (0.95, 1.16)	#

b

Odds Ratios and 95% Confidence Intervals from Longitudinal Multinomial Logistic Regression Models for UAI/OUT among Seroconcordant Couples

Outcome category →	Ref: Both partners reported UAI/OUT				Ref: One partner reported UAI/OUT	
	Neither partner reported UAI/OUT	Only one partner reported UAI/OUT	Neither partner reported UAI/OUT	Only one partner reported UAI/OUT	Neither partner reported UAI/OUT	Only one partner reported UAI/OUT
Predictor	(a)	(b)	(c)	(d)	(e)	(f)
Kansas Marital Satisfaction	1.42 (0.95, 2.11)	1.08 (0.78, 1.51)	1.15 (0.98, 1.35)	0.95 (0.80, 1.14)	1.30 (0.99, 1.71)	1.19 (1.01, 1.40)*
Commitment	1.19 (1.04, 1.36)*	1.02 (0.92, 1.14)	1.11 (1.03, 1.19)*	1.10 (1.02, 1.19)*	1.17 (1.03, 1.32)*	1.01 (0.95, 1.08)
Attachment	1.11 (1.004, 1.24)*	1.02 (0.94, 1.10)	1.10 (1.01, 1.19)*	1.04 (0.97, 1.12)	1.07 (0.99, 1.16)	1.05 (0.97, 1.14)
Equality	1.16 (1.05, 1.29)*	1.07 (0.99, 1.15)	1.05 (0.97, 1.13)	1.03 (0.94, 1.11)	1.08 (1.01, 1.17)*	1.02 (0.96, 1.08)
HIV-specific Social Support	1.22 (1.10, 1.36)*	1.03 (0.94, 1.13)	1.05 (0.91, 1.22)	1.02 (0.89, 1.17)	1.20 (1.08, 1.32)	1.03 (0.93, 1.15)

Notes: UAI/OUT: At least one instance of UAI with outside partner of serodiscordant or unknown serostatus in the past 3 months. Only predictors with a statistically significant result in at least one column are displayed. The odds ratio for the fixed effect 'time' was not statistically significant in any of the above models and ranged from 1.04 to 1.29 (not displayed). Each model included the relationship length as a control (regression coefficients not displayed). "Couple Mean" = Grand mean of a couple's means for the relationship dynamic across all visits. "Couple Deviation" = Couple's mean for the relationship dynamic at a specific study visit – Grand mean of a couple's means for the relationship dynamic across all visits.

* $p < .05$

: Model did not converge.

Note. UAI/OUT: At least one instance of UAI with outside partner of serodiscordant or unknown serostatus in the past 3 months. Only predictors with a statistically significant result in at least one column are displayed. The odds ratio for the fixed effect 'time' was not statistically significant in any of the above models and ranged from 0.93 to 1.25 (not displayed). Each model included the relationship length as a control (regression coefficients not displayed). "Couple Mean" = Grand mean of a couple's means for the relationship dynamic across all visits. "Couple Deviation" = Couple's mean for the relationship dynamic at a specific study visit – Grand mean of a couple's means for the relationship dynamic across all visits.

* $p < .05$

Table 3

Odds Ratios and 95% Confidence Intervals from Longitudinal Logistic Regression Models for UAIPP among Discordant Couples

Predictor	Time	Couple Mean	Couple Deviation
Intimacy	0.65 (0.46, 0.90)*	1.01 (0.95, 1.07)	1.06 (1.01, 1.12)*
Attachment	0.63 (0.45, 0.87)*	1.12 (1.0001, 1.26)*	1.02 (0.93, 1.11)
HIV-specific Social Support	0.57 (0.39, 0.83)*	0.84 (0.74, 0.95)*	0.92 (0.83, 1.02)

Note. UAIPP: At least one instance of UAI with primary partner in serodiscordant relationships in the past 3 months. Only predictors with a statistically significant result in at least one column are displayed. Each model included the relationship length as a control (regression coefficients not displayed). "Couple Mean" = Grand mean of a couple's means for the relationship factor across all waves. "Couple Deviation" = Couple's mean for the relationship factor at a specific wave–Grand mean of a couple's means for the relationship factor across all waves.

*
 $p < .05$