

Open, Closed, or In Between: Relationship Configuration and Condom Use Among Men Who Use the Internet to Seek Sex with Men

Sonya S. Brady · Alex Iantaffi · Dylan L. Galos ·
B. R. Simon Rosser

Published online: 25 September 2012
© Springer Science+Business Media, LLC 2012

Abstract Nearly 70 % of HIV+ men who have sex with men (MSM) are estimated to have contracted HIV from a main partner. We examine whether condom use varies by relationship configuration, including open relationships with and without cheating. 656 MSM in committed relationships were recruited through a sexually explicit social networking website. Of the 55 % of MSM who had anal sex with a non-main partner in the past 90 days, two-thirds did not use a condom. Adjusting for covariates, MSM in relationships characterized as open with cheating versus monogamous were more likely to have unprotected anal sex with both main and non-main partners. MSM who perceived that their partner played around or cheated were more likely to have unprotected anal sex with a non-main partner. Prevention messages should attempt to reduce cheating and increase personal responsibility for protecting partners from HIV. Messages should be tailored to reflect open and monogamous relationships.

Keywords Condom · Men who have sex with men (MSM) · Relationship · Infidelity · Internet

Introduction

After several years of decline followed by stabilization, the incidence rate of HIV in the US began to rise in 2001 [1, 2]. Among men who have sex with men (MSM), however, the

incidence rate has been increasing since the early 1990s [1]. A variety of factors appear to have influenced this trend, including higher prevalence of HIV within the MSM community, fatigue over hearing and complying with messages to use condoms consistently, and underestimation of personal risk [3]. Within a pooled sample of MSM from 5 U.S. cities, 68 % of HIV+ men were estimated to have contracted the virus from a main partner [4]. It is thus critical to understand patterns of sexual behavior among MSM in committed relationships, and to identify the contexts in which condom use and other risk reduction behavior could be successfully promoted.

A broad cultural assumption in the US and other countries is that individuals who seek and have sex outside of a committed relationship are engaging in infidelity or “cheating” [5, 6]. However, this may not be the case. Practitioners recognize that a variety of explicit agreements or implicit arrangements can occur with respect to sexual behavior among couples [7]. Little research has systematically examined sexual agreements and arrangements among gay couples. Hoff and Beougher conducted in depth interviews of gay male couples and described several patterns of behavior [8]. Partners can be monogamous for the duration of their relationship or during periods (i.e., “closed” relationships). They can engage in sex with one or more individuals as a couple (e.g., a “three-way” sexual encounter). One or both partners can engage in sex with others (i.e., an “open” relationship). There may be an explicit agreement or implicit arrangement not to divulge information about sexual experiences outside of the relationship (i.e., “don’t ask, don’t tell”). These patterns of behavior have been reflected in the variety of agreements reported among large samples of MSM recruited via Facebook [9] and during community events in New York City [10]. Partners may also break agreements or arrangements, which could be construed as

S. S. Brady (✉) · A. Iantaffi · D. L. Galos · B. R. S. Rosser
Division of Epidemiology and Community Health,
University of Minnesota School of Public Health,
1300 South Second Street, Suite 300,
Minneapolis, MN 55454, USA
e-mail: ssbrady@umn.edu

infidelity or cheating depending on established or assumed relationship boundaries [11, 12]. These patterns of sexual behavior in the context of a committed relationship are similar to patterns seen in heterosexual couples. The difference, perhaps, is that gay communities are more willing to acknowledge and accept different agreements and arrangements in comparison to heterosexual communities [13–15].

Though couples-based HIV prevention research is an emerging area, the majority of research has focused on heterosexual couples exclusively [16]. Some public health efforts to curb transmission of HIV and other STIs within gay communities have acknowledged MSM in committed relationships [17]. However, these efforts have generally not tailored messages to address specific sexual agreements and arrangements that couples in committed relationships may form. There are several reasons that patterns of sexual behavior among MSM in committed relationships should be a focal point of descriptive, prevention, and intervention research. First, documentation of the variety of agreements and arrangements among MSM in committed relationships would counter heteronormative assumptions that individuals in committed relationships are, by default, monogamous and therefore at lower risk for contracting HIV and other STIs [5, 6]. Second, failure to recognize MSM in committed relationships as an important target of health promotion programs may lead to prevention and intervention material that have little relevance to MSM in relationships. Different messages may be required to encourage condom use among men who form different types of sexual agreements or arrangements with their partners. Third, it is possible that demographic and contextual characteristics linked with HIV and other STIs are differentially distributed among MSM who form different types of sexual agreements and arrangements with their partners. Such information could be of value in designing tailored health promotion programs. Finally, consistency of condom use with main partners and non-main partners may vary depending on the types of agreements and arrangements that men form with their main partners. Such information could be of value in identifying groups of MSM at higher risk for transmission of HIV and other STIs.

For those individuals who choose to have sex outside of a committed relationship, sexually explicit social networking websites can facilitate the identification of desirable partners and planning of sexual encounters. The Internet has become a common venue in which MSM seek sex partners [18]. The anonymity and accessibility of many websites confers benefits within a larger society that has a conflicted attitude towards sexual orientation and discriminates against MSM [19, 20]. Men can privately access sexually explicit media and communicate with potential sexual partners. As within any social network, the potential to contract sexually transmitted infections (STIs) among men who meet partners on sexually explicit websites is

real. Transmission of STIs has been documented within online communities of men who use the Internet to seek sex with men [21–23]. Urban men who use sexually explicit social networking websites may be at particular risk for transmission of STIs, given the greater pool of potential partners in densely populated areas, as well as the relative ease with which one can arrange a sexual encounter after meeting online. The prevalence of people diagnosed with HIV infection or AIDS is also higher within urban regions than within rural regions of the US [24].

In this study, we assess a variety of *relationship configurations*, which we define as patterns of sexual behavior among men in committed relationships who seek sex with other men. We examine whether different relationship configurations are associated with demographic and contextual characteristics that have been linked with HIV risk behavior and transmission among men, including age [3]; ethnicity [3]; education [25]; HIV status [3]; anal sex position preference [24]; and perceived responsibility for protecting partners from HIV [26]. In addition, we examine associations between men's history of relationship configurations with a main partner and their consistency of condom use with the main partner and non-main partners across the past 90 days. At least one other study has examined associations between relationship configuration and consistency of condom use. Utilizing a community-based sample, Parsons and colleagues [10] found that MSM in "monogamish" relationships (the only agreed upon extradyadic sex involved sex with others in the presence of partners) were less likely than MSM in open relationships to have engaged in unprotected anal sex with a casual partner. Open relationships were defined as those in which both partners could have sex with others without the presence of their partner.

Our sample is comprised of men living in 16 metropolitan statistical areas (MSAs) of the US. Men were recruited through one of the most prominent sexually explicit social networking websites geared towards MSM at the time of data collection. Similar to other resources for social networking (e.g., bars, clubs), sexually explicit social networking websites can facilitate encounters that hold the potential for transmission of HIV and other STIs. Men in committed relationships who use such websites are thus an important population of MSM. We view this research as an important initial step in the design of more effective health promotion programs for MSM in committed relationships.

Methods

Procedure

All study procedures were approved by the University of Minnesota Institutional Review Board; a federal Certificate

of Confidentiality was obtained to guard against any potential subpoena of participant data. The present research is part of a larger study examining associations between state laws related to homosexuality, sexual risk behavior, and patterns of alcohol use among MSM.

Participants were recruited from Manhunt.com, a sexually explicit social networking website for MSM. Recruitment occurred over a period of 2 months, between May and July 2009. With assistance from the recruitment site's staff, an initial email about the study was broadcast to all active members in each of the study's 16 selected MSAs in the US. MSAs included: Cleveland (OH), Detroit (MI), Oklahoma City (OK), Omaha (NE), Richmond (VA), Salt Lake City (UT), San Antonio (TX), Tampa (FL), Minneapolis-St. Paul (MN), Albany (NY), Albuquerque (NM), Baltimore (MD), Boston (MA), Hartford (CT), Portland (OR), San Diego (CA). Ten days after the initial email, banner impressions advertising the study were displayed to members who lived in selected areas when they logged onto the site. The banner campaign took place over 4 weeks and was followed by a second email broadcast sent only to new members living in MSAs who joined the site after the first broadcast.

Interested website members could click on a link in the email or the banner, after which they were taken to a secure online screening tool to determine eligibility. Respondents were deemed eligible if they self-identified as male, reported being 18 years of age or older, and reported having had sex with a man at least once. Respondents also needed to report living in one of the identified MSAs, determined through reported zip code, and to not have previously completed the survey, determined mainly via IP address. Once 250 participants were recruited for a selected MSA, the region was considered closed and further individuals were thanked for their interest and told that the study was full. During the recruitment period, only two areas achieved this 'full' status: Minneapolis-St. Paul and Boston.

Before completing the online screening tool, participants viewed a welcome page providing an overview of procedures, information about the study and staff, and contact details for the study team. Ineligible respondents were thanked for their interest and informed that they did not qualify for participation. Eligible respondents were guided through a series of consent pages [27] and given the option to provide or decline consent, ask further questions, or leave the study site. Once a respondent was deemed eligible and provided consent, he was sent an email with a link to the survey. Participants who started the online survey but did not complete it were sent email reminders. Participants had the option to decline to answer any question and to terminate the survey at any point. Automated and manual de-duplication and validation protocols were applied to maximize the likelihood that each survey

represented a unique respondent [28]. Participants were compensated with \$30 for their time.

During the period of recruitment, consent pages were accessed 4,402 times. An e-mail with a link to the survey was sent to 2,370 addresses. After automated and manual de-duplication and validation protocols, surveys from a total of 2,339 participants were available for analysis. The present study examines data from 656 participants (28 % of 2,339) who self-identified as being in a committed relationship with another man.

Measures

The online survey included several sections assessing demographics; Internet use; patterns of sexual behavior and substance use; health indices; and perceptions of social climate towards gay people in the US. Three domains are considered in this study, as detailed below.

Demographics and Contextual Characteristics

Assessed demographic variables included age, race/ethnicity, educational attainment, and HIV status. Assessed contextual characteristics included length of relationship with main partners and the partner's HIV status. The section of the survey assessing involvement in a committed relationship began as follows: *In this next section, we would like to ask you some questions about committed relationships. First, do you have a relationship with a man who you would describe as your long-term boyfriend, domestic partner, or spouse?* Men who answered in the affirmative were asked to indicate the number of years and/or months that they had been in the relationship. They were also asked to indicate if their partner was HIV+, HIV-, or HIV status unknown. In a separate section of the survey, respondents indicated their own HIV status. Among the 627 men who reported a positive or negative status for both themselves and their partner, we created a couple HIV concordance variable (Only Respondent HIV+, Only Partner HIV+, Both HIV+, Both HIV-). Assessed contextual characteristics also included the respondent's expressed preference for position when engaging in anal sex (top, top/versatile, versatile, bottom/versatile, bottom). For analysis, if men indicated having a top or top/versatile online profile and no bottom profiles, they were considered to have a top preference. If men indicated having a bottom or bottom/versatile online profile and no top profiles, they were considered to have a bottom preference. All other men with online profiles indicating anal sex preference were considered to be versatile. Men also rated their perceived responsibility for protecting partners from HIV and other STIs (Likert scale ranging from 1-strongly agree to 7-strongly disagree).

Relationship Configurations

In the section of the survey assessing involvement in a committed relationship, men were asked two questions about relationship configurations. First, men were asked which of the following best described their current relationship: open (we both see other partners for sex); in between; closed (we only have sex with each other). Men were required to select a single descriptor that best fit their current relationship. Second, men were asked which of the following described how they and their partner have had sex with other people during their relationship: (a) We only have had sex with each other and no one else since we started our relationship; (b) We had a period (or periods) of monogamy (sex only with each other); (c) We have had sex with other people together (e.g., 3-ways); (d) I have sex with other men; (e) My partner has sex with other men; (f) We “don’t ask, don’t tell” about having sex with others; (g) I have played around or “cheated” on my partner; (h) My partner has played around or has “cheated” on me. Men could select as many descriptors as applied during the length of their relationship.

Sexual Behavior in the Past 90 Days

In the present study, we examine three sexual behaviors: (1) Unprotected anal sex with main partner; (2) Anal sex with one or more non-main male partner(s); and (3) Unprotected anal sex with one or more non-main male partner(s). These variables were created by considering men’s responses to a set of questions. In the section of the survey assessing involvement in a committed relationship, men were asked if they have anal sex with their partner. If men responded in the affirmative, they were asked about their condom use in the last 3 months with their partner. Men indicated whether they always used a condom during anal sex; had unprotected sex at least once; or had not had anal sex with their partner in the last 3 months. The dichotomous variable, *unprotected anal sex with main partner*, is only examined among participants who reported having anal sex with their main partner in the past 3 months. In a separate section of the survey, men indicated the total number of men with whom they engaged in anal sex in the last 3 months. They also indicated the total number of men with whom they engaged in unprotected anal sex, at least once, in the last 3 months. If participants indicated having anal sex with their main partner in the past 3 months, we subtracted one person from the total number of anal sex partners. Similarly, if participants indicated having unprotected anal sex with their main partner in the past 3 months, we subtracted one person from the total number of unprotected anal sex partners. These new figures were used to create the dichotomous variables, *anal sex with 1 + non-main male*

partner(s), and *unprotected anal sex with 1 + non-main male partner(s)*, respectively. For descriptive purposes, we also consider the number of male sexual partners with whom participants engaged in sex during the past 3 months, excluding their main partner.

Analytic Approach

Distributions of demographic and contextual characteristics are presented to describe the study sample. Chi-square tests were conducted to examine whether the percentage of men reporting different relationship configurations varied by demographic and contextual characteristics. Chi-Square tests were also conducted to examine whether reported sexual behavior in the past 90 days varied by demographic and contextual characteristics, as well as reported relationship configurations. Logistic regressions of sexual behavior on individual relationship configuration items were conducted, adjusting for demographic and contextual variables. All regression models used a robust variance estimate to account for potential participant clustering within geographic area.

A latent class analysis [29] was conducted to identify groups of men with homogeneous response patterns across the eight relationship configuration items assessed as part of the history of a couple’s sexual behavior during the relationship (see Ref. [30] for a similar approach among MSM). We randomly divided the data into training and validation subsamples to replicate the optimal model. In the training set, we estimated iterative latent class models, each containing one additional class. We evaluated absolute fit using the G^2 statistic, with $p > .05$ indicating adequate fit of the model-implied to observed contingency table. We also evaluated relative model fit by comparing the Akaike information criterion (AIC) and the Bayesian information criterion (BIC) across the models, with lower values indicating a superior model. Finally, we used the Lo–Mendel–Rubin likelihood ratio test [31] to identify when a k -class model no longer improved model fit over a $k-1$ -class model. Additional considerations included interpretability of the solution and parsimony. After identifying the optimal model, we used a multi-group latent class model to determine if the class composition and distribution in the training sample replicated in the validation split-half.

Regression analyses of sexual behavior on the identified latent classes were weighted by the inverse probability of assignment to a latent class to adjust for probabilistic uncertainty of classification. Models also adjusted for demographic and contextual variables and used a robust variance estimate. Results are presented for two different reference categories of the relationship configuration latent class variable: monogamous for the duration of the relationship and open without cheating. These classes were

chosen as referents because they are conceptually low in risk. Monogamy, when practiced, confers protection from HIV/STIs. An open relationship—without the breaking of explicit or implicit rules—may be protective as well. Men in these relationships may be more able to adhere to a variety of relationship rules, including condom use.

Results involving individual relationship configuration items and latent classes are interpreted together to allow for a richer understanding of data.

Results

Distributions of Demographic and Contextual Characteristics

Because participants could decline to answer any question, the number of men for whom demographic and contextual characteristics were available varied from the 656 men who provided data about relationships and were included in the study sample (see Table 1). The mean age of participants was 37.4 years ($SD = 10.7$). Ninety participants (14 %) were between the ages of 18 and 24. The racial/ethnic distribution of participants was as follows: White, Non-Hispanic (82 %); Hispanic (8.5 %); Black/African American (4 %); Asian American (2.5 %); American Indian (1 %); Multi-Racial (2 %). In subsequent analyses, we compare White, Non-Hispanic participants to those who reported any other racial/ethnic heritage. The educational attainment of participants was distributed as follows: Less than high school (1 %); High school/GED (11 %); Technical degree or some college (37 %); College degree (32 %); Graduate degree (19 %).

The mean length of participants' relationships with their main partner was 6.7 years ($SD = 6.4$). This variable was positively skewed. A quarter of participants reported relationships of 1.8 years or less, the median length of relationship was 4.5 years, and a quarter of participants reported relationships between 9.6 and 34.8 years. The majority of couples were both HIV– (73 %); among other couples, both were both HIV+ (12 %), the respondent was HIV+ (8 %), or the partner was HIV+ (7 %). In subsequent analyses, we compare participants in a relationship where both members are HIV– to participants in a relationship where one or both are HIV+.

Among those men reporting an anal sex preference in an online profile to seek sex with other men, 41 % reported a top preference (no bottom profiles reported); 31 % reported a bottom preference (no top profiles reported); and 28 % were classified as versatile. Over half of participants reported strongly agreeing that it was their responsibility to protect partners from HIV and other STIs ($M = 1.9$; $SD = 1.5$). In subsequent analyses, we compare men who

strongly agreed that they were responsible (coded 1) to other men (coded 0).

Report of Relationship Configuration Items

Table 1 shows the percentage of men endorsing specific relationship configurations, within the total sample and by demographic and contextual characteristics. Men aged 18–24 years, ethnic minorities, and less educated participants were more likely to report being monogamous for the duration of their relationship. Men were also more likely to report continual monogamy if they and their main partner were both HIV– or the respondent strongly agreed about his responsibility for protecting partners from HIV and other STIs. Age, education, and HIV-related contextual characteristics distinguished between men endorsing different types of “open” relationship configurations. With one exception, demographic and contextual characteristics did not distinguish between men who reported their own or a partner's playing around or cheating. Men who strongly agreed that they were responsible for protecting their partners from HIV and other STIs were less likely to report that their partner had played around or cheated on them.

Greater length of relationship (not shown in Table 1) was associated with less report of a closed relationship or monogamy for the duration of the relationship, and with greater report of all other relationship configurations (r 's between .10 and .35, $p < .01$).

Reported Sexual Behavior in the Past 90 Days

The mean number of sexual partners reported by men during the past 90 days, excluding main partners, was 5 ($SD = 10.5$). This variable was positively skewed. A quarter of participants reported no sexual partners outside of their main relationship, the median number of sexual partners was 2, and a quarter of participants reported having five sexual partners or greater. Within the total sample, 81 % of men who reported having anal sex with their main partner in the past 90 days said that condoms were not used at least once (see Table 2). Nearly 55 % of the total sample reported having anal sex with one or more non-main partners. Of these men, 64 % reported not using condoms with at least one non-main partner. Table 2 shows the percentage of men endorsing anal sex behaviors by demographic and contextual characteristics, as well as relationship configuration variables.

Logistic Regressions of Sexual Behavior on Individual Relationship Configuration Items

Table 3 contains results from three sets of logistic regressions involving men's reported sexual behavior in the past

Table 1 Percentage of men endorsing specific relationship configurations, within the total sample and by selected characteristics ($N = 656$ MSM in committed relationships recruited through a sexually explicit social networking website)

	n	Current relationship configuration ^a		Relationship configuration at any time during relationship (categories not mutually exclusive) ^b								
		Open	In between	Closed	Monogamy for duration	Monogamy for periods	Sex with others as a couple	I had sex with other men	Partner had sex with other men	We “don’t ask, don’t tell”	I played around/ “cheated”	Partner played around/ “cheated”
Total sample	656	23.9	48.2	27.9	20.0	34.1	47.0	44.2	33.5	22.7	27.6	19.8
Age group ^c	641											
18–24	4.8	39.3	56.0***	28.6	46.4***	28.6	26.2***	22.6***	15.5***	6.0***	23.8	14.3
25+	27.1	49.6	23.3	34.8	15.4	34.8	50.1	47.9	36.1	25.5	28.7	20.8
Race/ethnicity	646											
White, non-Hispanic	25.0	48.5	26.5	34.2	17.5**	34.2	47.7	44.9	34.8	23.9	26.5	19.7
Other	18.4	47.4	34.2	33.3	30.7	33.3	45.6	40.4	27.2	16.7	31.6	19.3
Education	656											
College degree or more	25.7	51.8	22.5**	39.2**	15.6**	47.0	48.2*	35.9	26.3*	29.6	20.7	20.7
Less than college degree	22.0	44.4	33.5	28.9	24.5	28.9	46.9	40.1	31.1	18.9	25.5	18.9
HIV status of couple	627											
At least one HIV+	32.2	46.8	21.1**	33.9	11.7**	51.5	53.8**	45.0***	26.3	29.2	24.0	24.0
Both HIV–	21.1	47.8	31.1	23.5	34.0	45.2	40.4	29.2	20.8	28.1	18.2	18.2
Anal sex preference ^d	573											
Top preference	31.2	47.3	21.5	38.0	15.2	51.5	47.7	34.2	22.8	25.7	17.3	17.3
Bottom preference	24.9	54.8	20.3	36.2	14.1	46.3	46.9	40.1	28.8	33.3	26.6	26.6
Versatile	20.1	52.8	27.0	33.3	18.9	52.2	48.4	35.8	21.4	28.9	21.4	21.4
Responsible for protecting partners from HIV, other STIs	655											
Strongly agree	19.3	47.7	32.9***	22.7*	31.7	47.0	38.7***	31.5	20.8	25.1	16.9*	16.9*
Less than strongly agree	32.2	48.7	19.1	15.3	38.6	46.6	53.8	37.3	25.8	31.8	24.6	24.6

* $p < .05$, ** $p < .01$, *** $p < .001$

^a Chi-square tests were conducted to determine whether current relationship configuration (open, in between, closed) varied by individual demographic and contextual characteristics

^b Chi-square tests were conducted to determine whether a single relationship configuration (yes, no) varied by demographic and contextual characteristics. Percentages shown in the table correspond to the percentage of men reporting “yes.”

^c Associations between age group and relationship configuration variables weakened, but remained statistically significant after adjusting for length of relationship

^d Online profiles to seek sex with other men were reported by 594 participants. Of these, 21 men reported listing no anal sex preference on their profiles

Table 2 Percentage of men endorsing specific sexual behaviors, within the total sample and by selected characteristics ($N = 656$ MSM in committed relationships recruited through a sexually explicit social networking website)

	Unprotected anal sex with main partner ^a ($N = 457$)	Anal sex with 1 + non-main partner ($N = 656$)	Unprotected anal sex with 1 + non-main partner ^b ($N = 360$)
Total sample	81.4	54.9	64.2
Age group			
18–24	86.3	45.2*	42.1**
25+	80.7	56.7	66.8
Race/ethnicity			
White, non-Hispanic	84.0*	54.3	66.4
Other	71.6	57.0	56.9
Education			
College degree or more	81.7	56.6	57.1**
Less than college degree	81.1	53.1	71.9
Couple HIV status			
At least one HIV+	72.5**	63.2*	87.0***
Both HIV–	84.4	52.0	54.4
Anal sex preference. ^c			
Top preference	81.6	63.3*	70.0
Bottom preference	81.2	65.5	62.9
Versatile	81.3	52.2	55.4
Resp. for protecting partners from HIV, STIs			
Strongly agree	78.0*	46.5***	50.8***
Less than strongly agree	87.6	69.5	79.9
Relationship configuration variables			
Current			
Open	77.3	75.2***	72.0
In between	85.8	61.4	58.8
Closed	77.3	26.2	66.7
Any time during relationship			
Monogamous for duration			
Yes	74.8*	24.4***	53.1
No	83.4	62.5	65.2
Monogamous for periods			
Yes	86.9*	59.8	60.4
No	78.6	52.3	66.4
Sex with others as a couple			
Yes	87.7**	65.9***	64.0
No	75.1	45.1	64.3
I had sex with other men			
Yes	83.7	69.3***	67.7
No	80.0	43.4	59.7
Partner had sex with other men			
Yes	81.8	69.1***	65.8
No	81.3	47.7	63.0
We “don’t ask, don’t tell”			
Yes	72.0*	61.7	63.0
No	83.5	52.9	64.6
I played around/“cheated”			
Yes	88.1*	61.3*	68.5
No	79.1	52.4	62.2

Table 2 continued

	Unprotected anal sex with main partner ^a (N = 457)	Anal sex with 1 + non-main partner (N = 656)	Unprotected anal sex with 1 + non-main partner ^b (N = 360)
Partner played around/“cheated”			
Yes	88.5	56.9	75.7*
No	79.7	54.4	61.2

* $p < .05$, ** $p < .01$, *** $p < .001$

Chi-square tests were conducted to determine whether sexual behavior (yes, no) varied by demographic, contextual, and relationship configuration characteristics

^a Includes only participants who reported having anal sex with their main partner during the past 90 days

^b Includes only participants who reported having anal sex with at least one non-main partner during the past 90 days

^c Analyses include only those 573 participants who indicated a preference

90 days. Unprotected anal sex with one’s main partner, anal sex with 1 + non-main partner, and unprotected anal sex with 1 + non-main partner were each regressed on individual relationship configuration variables (see Models 2–10). Each model adjusted for demographic and contextual characteristics (for main effects, see Model 1). Of note, men who did not strongly agree that it was their responsibility to protect their partners from HIV and other STIs were more likely to engage in all assessed sexual behaviors.

Column 1 of Table 3 shows that having a relationship configuration that was “in between” versus closed, having sex with others as a couple, and having a history of playing around or cheating were associated with greater likelihood of unprotected anal sex with main partners. In contrast, reporting monogamy for the duration of one’s relationship and having a “don’t ask, don’t tell” arrangement were associated with lower likelihood of unprotected anal sex with main partners.

Column 2 of Table 3 shows that the following relationship configurations were associated with having anal sex with one or more non-main partners: being “open” or “in between” versus closed, *not* being monogamous for the duration of the relationship, having had sex with others as a couple, having had sex with other men, and reporting that one’s partner has had sex with other men.

Column 3 of Table 3 shows that only one relationship configuration item was associated with having unprotected anal sex with one or more non-main partners. Men who reported that their partners had ever played around or cheated on them were more likely to report that they had engaged in unprotected anal sex with at least one non-main partner during the past 90 days.

Latent Class Analysis of Relationship Configuration Items

Latent class modeling identified that a model comprising five or more classes produced a satisfactory approximation of the observed contingency table ($G^2_{\text{five class}} = 216.99$,

$df = 211$, $p = .38$; $G^2_{\text{six class}} = 170.50$, $df = 202$, $p = .95$; $G^2_{\text{seven class}} = 146.68$, $df = 193$, $p = .99$). Both the five- and six-class models yielded likelihood ratio tests with $p < .05$, indicating that the five-class solution was superior to the four-class, and the six-class solution was superior to the five-class. The likelihood ratio test for the seven-class solution was not statistically significant ($p = .58$), indicating that this solution did not improve model fit over the six-class solution. The AIC values became smaller as the number of classes increased, with the difference between the six- and seven-class models being of a relatively small magnitude ($AIC_{\text{five class}} = 2,586.35$, $AIC_{\text{six class}} = 2,557.85$, $AIC_{\text{seven class}} = 2,552.03$). In contrast to the AIC, the BIC value was lowest for the four-class solution (2,752.69), with small increases for both the five- and six-class solutions ($BIC_{\text{five class}} = 2,753.24$, $BIC_{\text{six class}} = 2,758.88$) and a larger increase for the seven-class solution (2,787.20). Given the information across these statistics, and considering interpretability of the solution, we chose the six-class solution as the optimal model.

Table 4 contains (1) the percentage of participants who were categorized into each latent class (see bottom row); (2) the “posterior probabilities,” estimated proportions of men assigned to a latent class who endorsed a specific relationship configuration item; and (3) the observed distribution of sexual behavior outcomes among men assigned to each latent class. Only relationship configuration items were used to determine class membership, however. Nearly 18 % of men were assigned the class, *monogamous for the duration of their relationship*. Roughly three quarters of these men engaged in unprotected anal sex with their main partner. Despite their endorsement of monogamy, 19 % of men reported engaging in anal sex with at least one non-main partner in the past 90 days. Of the men who engaged in anal sex with a non-main partner, half did not use a condom at least once. Roughly 13 % of participants were assigned to the class, *having sex with others only as a couple*, 25 % to the class, *open without cheating*, and 12 % to the class, *open with cheating*. In addition to the high

Table 3 Logistic regressions of sexual behavior on demographic, contextual, and relationship configuration variables ($N = 573$ MSM in committed relationships recruited through a sexually explicit social networking website)

	Unprotected anal sex with main partner ^a			Anal sex with 1 + non-main partner			Unprotected anal sex with 1 + non-main partner ^b		
	B	SE	Exp(B) (95 % CI)	B	SE	Exp(B) (95 % CI)	B	SE	Exp(B) (95 % CI)
Model 1: Demographics and context (entered simultaneously)									
Age 18–24 (vs. 25+)	0.45	0.40	1.56 (0.71, 3.44)	-0.07	0.27	0.93 (0.55, 1.58)	-0.80	0.51	0.45 (0.17, 1.22)
White (vs. racial/ethnic minority)	1.25	0.20	3.49*** (2.34, 5.20)	-0.12	0.16	0.88 (0.65, 1.21)	0.41	0.33	1.50 (0.79, 2.85)
College degree or more	0.02	0.22	1.02 (0.66, 1.58)	0.05	0.17	1.05 (0.76, 1.46)	-0.90	0.32	0.41** (0.22, 0.77)
Both members of couple HIV – Anal sex preference (vs. versatile)	0.96	0.34	2.61** (1.34, 5.06)	-0.14	0.16	0.87 (0.63, 1.19)	-1.53	0.35	0.22** (0.11, 0.43)
Top preference	0.17	0.35	1.18 (0.60, 2.34)	0.35	0.22	1.42 (0.92, 2.18)	0.69	0.37	2.00 (0.97, 4.09)
Bottom preference	0.14	0.31	1.16 (0.63, 2.13)	0.48	0.26	1.61 (0.96, 2.70)	0.52	0.47	1.69 (0.67, 4.29)
Less than strongly agree about responsibility to protect partners	1.14	0.28	3.12*** (1.82, 5.37)	0.87	0.17	2.38*** (1.70, 3.33)	1.20	0.26	3.31*** (1.98, 5.53)
Length of relationship in years	-0.01	0.03	0.99 (0.93, 1.06)	0.01	0.02	1.01 (0.98, 1.05)	-0.01	0.03	0.99 (0.94, 1.04)
Model 2: Current relationship configuration (vs. closed)									
Open	0.06	0.61	1.07 (0.33, 3.50)	1.89	0.37	6.62*** (3.18, 13.76)	-0.04	0.44	0.96 (0.41, 2.27)
In between	0.65	0.32	1.91* (1.03, 3.56)	1.35	0.23	3.85*** (2.46, 6.04)	-0.35	0.47	0.70 (0.28, 1.77)
Model 3: Monogamous for duration	-0.83	0.31	0.44** (0.24, 0.81)	-1.64	0.30	0.19*** (0.11, 0.35)	-0.25	0.40	0.78 (0.35, 1.72)
Model 4: Monogamous for periods	0.54	0.48	1.71 (0.67, 4.41)	0.16	0.21	1.17 (0.78, 1.77)	-0.17	0.31	0.84 (0.46, 1.55)
Model 5: Sex with others as a couple	1.03	0.23	2.82*** (1.79, 4.44)	0.73	0.16	2.08*** (1.51, 2.87)	-0.17	0.24	0.85 (0.53, 1.35)
Model 6: I had sex with other men	0.31	0.36	1.36 (0.68, 2.74)	0.85	0.18	2.33*** (1.63, 3.35)	0.11	0.29	1.12 (0.64, 1.96)
Model 7: Partner had sex with other men	0.13	0.22	1.13 (0.74, 1.73)	0.74	0.25	2.09** (1.28, 3.43)	-0.07	0.27	0.94 (0.56, 1.57)
Model 8: We “don’t ask, don’t tell”	-0.65	0.22	0.52** (0.34, 0.81)	0.07	0.23	1.08 (0.69, 1.68)	-0.20	0.27	0.82 (0.48, 1.40)
Model 9: I have played around or “cheated”	0.87	0.37	2.38* (1.14, 4.94)	0.18	0.18	1.20 (0.84, 1.70)	0.52	0.34	1.68 (0.86, 3.30)
Model 10: Partner played around or “cheated”	0.87	0.51	2.39 (0.88, 6.47)	-0.21	0.22	0.81 (0.52, 1.26)	0.76	0.38	2.14* (1.02, 4.52)

Models 2–10 adjust for demographic and contextual variables shown in Model 1. Exp(B)—the odds ratio—is presented as a measure of effect size. All models used a robust variance estimator that accounted for data collection in 16 defined geographic areas. Because the base rate of outcome variables is not low, the odds ratio cannot be interpreted as a relative risk of the outcome when comparing groups of participants

* $p < .05$, ** $p < .01$, *** $p < .001$

^a This set of analyses includes only those participants who reported having anal sex with their main partner during the past 90 days

^b This set of analyses includes only those participants who reported having anal sex with at least one non-main partner during the past 90 days

Table 4 Posterior probabilities of item endorsement within each assigned latent class and observed distribution of sexual behavior outcomes ($N = 656$ MSM in committed relationships recruited through a sexually explicit social networking website)

Relationship configuration items	Monogamous for duration $N = 116$	Sex with others only as a couple $N = 81$	Open without "cheating" $N = 163$	Open with "cheating" $N = 78$	Extradysadic sex difference $N = 175$	We "don't ask, don't tell" $N = 43$
Monogamous for duration	100.0	7.4	0.6	4.0	3.0	0.0
Monogamous for periods	1.5	18.5	52.1	62.4	40.8	0.0
Sex with others as a couple	0.0	100.0	77.2	68.4	24.2	15.1
I had sex with other men	0.0	0.0	96.9	83.4	35.1	0.0
Partner had sex with other men	0.0	0.0	85.8	93.0	2.6	0.0
We "don't ask, don't tell"	0.8	0.0	25.5	42.8	18.0	100.0
I have played around or "cheated"	0.6	0.0	5.1	81.0	60.0	0.0
Partner played around or "cheated"	2.6	2.1	0.0	100.0	26.5	0.0
Sexual behavior in past 90 days						
Unprotected anal sex with main partner ^a	74.0	87.0	77.6	93.5	86.8	64.0
Anal sex with 1 + non-main partner	19.0	54.2	72.8	65.4	57.2	56.8
Unprotected anal sex with 1 + non-main partner ^b	50.0	53.3	62.7	74.5	68.7	64.0
Percentage of sample within latent class	17.7	12.7	24.7	11.9	26.4	6.7

^a Includes only participants who reported having anal sex with their main partner during the past 90 days

^b Includes only participants who reported having anal sex with at least one non-main partner during the past 90 days

Table 5 Logistic regressions of sexual behavior on relationship configuration latent class, adjusting for demographics and contextual variables ($N = 573$ MSM in committed relationships recruited through a sexually explicit social networking website)

	Unprotected anal sex with main partner ^a			Anal sex with 1 + non-main partner			Unprotected anal sex with 1 + non-main partner ^b					
	B	SE	Exp(B)	(95 % CI)	B	SE	Exp(B)	(95 % CI)	B	SE	Exp(B)	(95 % CI)
Reference category												
Monogamous for duration												
Sex with others only as a couple	1.11	0.49	3.04*	(1.17, 7.88)	1.88	0.35	6.54***	(3.32, 12.92)	0.30	0.50	1.35	(0.51, 3.58)
Open without “cheating”	0.60	0.36	1.81	(0.90, 3.66)	2.41	0.43	11.18***	(4.78, 26.16)	0.60	0.58	1.82	(0.59, 5.64)
Open with “cheating”	2.36	0.69	10.57***	(2.71, 41.10)	1.88	0.33	6.53***	(3.43, 12.46)	1.38	0.70	3.96*	(1.01, 15.52)
Extradyadic sex difference	1.13	0.42	3.11**	(1.35, 7.13)	1.70	0.34	5.45***	(2.79, 10.65)	1.08	0.66	2.94	(0.81, 10.70)
We “don’t ask, don’t tell”	0.08	0.44	1.08	(0.46, 2.55)	1.62	0.37	5.06***	(2.46, 10.44)	1.06	0.72	2.89	(0.71, 11.74)
Reference category												
Open without “cheating”												
Monogamous for duration	-0.60	0.36	0.55	(0.27, 1.11)	-2.41	0.43	0.09***	(0.04, 0.21)	-0.60	0.58	0.55	(0.18, 1.70)
Sex with others only as a couple	0.52	0.51	1.67	(0.61, 4.56)	-0.54	0.37	0.59	(0.28, 1.20)	-0.30	0.56	0.74	(0.25, 2.23)
Open with “cheating”	1.76	0.80	5.82*	(1.21, 28.10)	-0.54	0.35	0.58	(0.29, 1.16)	0.78	0.50	2.18	(0.81, 5.84)
Extradyadic sex difference	0.54	0.29	1.71	(0.97, 3.02)	-0.72	0.30	0.49*	(0.27, 0.87)	0.48	0.33	1.62	(0.85, 3.09)
We “don’t ask, don’t tell”	-0.52	0.37	0.60	(0.29, 1.24)	-0.79	0.30	0.45**	(0.25, 0.81)	0.46	0.59	1.58	(0.50, 5.01)

Models adjust for age, race/ethnicity, college degree status, HIV status of couple, anal sex preference, perceived responsibility for protecting partners from HIV, and length of relationship with main partner. All models were weighted using the inverse probability of latent class assignment to account for classification uncertainty. All models used a robust variance estimator that accounted for data collection in 16 defined geographic areas. Exp(B)—the odds ratio—is presented as a measure of effect size. Because the base rate of outcome variables is not low, the odds ratio cannot be interpreted as a relative risk of the outcome when comparing groups of participants

* $p < .05$, ** $p < .01$, *** $p < .001$

^a This set of analyses includes only those participants who reported having anal sex with their main partner during the past 90 days

^b This set of analyses includes only those participants who reported having anal sex with at least one non-main partner during the past 90 days

proportions of men who reported a history of having sex with others as a couple and on their own during the length of their main relationship, high proportions of men assigned to the *open with cheating* category reported a history of playing around or cheating. Of note, men who were categorized into the *open with cheating* class reported the highest rate of unprotected anal sex with a main partner (94 %), and the highest rate of unprotected anal sex with non-main partners (74 %). Just over a quarter of men fell into the class, *extradyadic sex difference*. Within this group of men, the relationship configuration item with the highest endorsement was the respondent's playing around or cheating (60 %). Only 26 % of men's partners were estimated to have played around or cheated. Similarly, 35 % of men in the extradyadic sex difference category were estimated to have had sex with other men, in contrast to only 3 % of men's partners. Respondents assigned to this class thus appeared to differ from their partner with respect to extradyadic sexual behavior. Of note, rates of unprotected anal sex with one's main partner (87 %) and non-main partners (69 %) were among the highest in this group. The final latent class shown in Table 4 is *don't ask, don't tell*, which described less than 7 % of men. Of note, men in this category reported the lowest rate of unprotected anal sex with their main partners (64 %).

Logistic Regressions of Sexual Behavior on Relationship Configuration Latent Class

Each column of Table 5 shows results from a single regression model, adjusting for demographic and contextual characteristics (not shown in table).

Men who had sex with others as a couple, men in open relationships with cheating, and men in relationships characterized by a respondent-partner difference in extradyadic sex were more likely to have unprotected anal sex with their main partner than men in continually monogamous relationships (see Table 5, Column 1). Men in open relationships with cheating were also more likely to have unprotected anal sex with their main partner in comparison to men in open relationships without cheating.

Not surprisingly, men who were in relationships characterized by continual monogamy were less likely to report anal sex with at least one non-main partner than men in every other relationship configuration latent class (see Column 2). Men in relationships characterized by a respondent-partner difference in extradyadic sex or a "don't ask, don't tell" arrangement were less likely to report anal sex with at least one non-main partner in comparison to men who were in open relationships without cheating.

With one exception, unprotected anal sex with one or more non-main partners did not vary by men's relationship configuration latent class category. In comparison to men

who reported being monogamous for the duration of their relationship, men in open relationships with cheating were more likely to have unprotected anal sex with others (see Column 3).

Discussion

Among the MSM in our sample, all of whom were recruited through a sexually explicit social networking website, only a fifth reported being monogamous for the duration of their committed relationship. Nearly half of participants reported having sex with other men as a couple, highlighting the normative aspect of this behavior among men in relationships who seek sex with others. Over a third of men and their partners had sex with others on their own, highlighting the importance of the sexual decisions individuals make when they are not with their main partners.

Rates of unprotected anal sex were high in our sample of MSM. Over 80 % of MSM had engaged in unprotected anal sex with their main partners in the past 90 days. Of the 55 % who had engaged in anal sex with one or more non-main partners, nearly two thirds reported unprotected anal sex with at least one non-main partner. MSM in committed relationships who seek sex with others are thus an important population to consider in the design of HIV/STI prevention programs.

The Meaning and Function of Monogamy

Our data suggest that reported monogamy may sometimes reflect intent or a non-traditional definition of monogamy rather than engagement in sex with only one partner. Nearly a quarter of men who indicated that they had only had sex with their partner for the duration of their relationship also reported engagement in anal sex with at least one non-main partner in the past 90 days. This supports previous research showing "monogamy" to be an ambiguous term [32]. In our latent class analysis, men categorized as monogamous who engaged in anal sex with at least one non-main partner reported the lowest rate of unprotected anal sex during those encounters (50 %). A quarter of monogamous men reported consistently using condoms with their main partners. Men who had sex with others as a couple, men in open relationships with cheating, and men in relationships characterized by a respondent-partner difference in extradyadic sex were all more likely to engage in unprotected anal sex with their main partners in comparison to men who reported continual monogamy. While reported monogamy cannot be taken to mean that men do not have sex with non-main partners, agreements or arrangements involving continual monogamy do appear to

confer protection. Some men who choose to be in monogamous relationships may do so for health considerations rather than or in addition to potential benefits to the relationship. Monogamous men may have greater perceptions of personal risk for contracting HIV and may therefore feel more comfortable using condoms with any sexual partner. Monogamy and condom use during anal sex may also reflect conformity to expectations in one's social group or the adoption of what others may view as conservative values with respect to sexual behavior.

Demographic and contextual characteristics linked with HIV and other STIs were associated with report of continual monogamy in our sample of MSM. Men aged 18–24 years, ethnic minorities, and less educated participants were more likely to report being continually monogamous. However, individuals who had attained less than a college degree were more likely to engage in unprotected anal sex with a non-main partner compared to individuals who had attained a college degree or more. HIV prevention programs seeking to encourage monogamy may be more effective in segments of the gay community where a larger percentage of individuals already ascribe to this lifestyle. Such programs should highlight the importance of using condoms with main and non-main partners if one veers from being monogamous.

The Meaning and Function of Open Relationships

Not surprisingly, men in open relationships were more likely to engage in anal sex with one or more non-main partners in the past 90 days compared to men who were continually monogamous. This effect was most pronounced for men in open relationships characterized by the absence of cheating. Interestingly, men in open relationships characterized by respondent-partner differences in extradyadic sex or a “don't ask, don't tell” philosophy were less likely to have anal sex with one or more non-main partners in comparison to men in open relationships without cheating. If MSM in relationships wish to have sex with others on a regular basis, balances in extradyadic sex and open communication may facilitate this end.

Other findings suggest that the HIV status of couples is closely intertwined with having an open relationship configuration and sexual behavior in the past 90 days. When one or both members of couples in our sample were HIV+, men were less likely to report being monogamous for the duration of their relationship and more likely to report that they and their partners had sex with other men. When one or both members of the couple were HIV+, men were less likely to report unprotected anal sex with their main partner, but more likely to report unprotected anal sex with a non-main partner. This difference may reflect serosorting, the practice of having sex with partners of concordant HIV status and/or of only using condoms with HIV-discordant partners [33].

Cheating and Personal Responsibility for Protecting Partners from HIV and Other STIs

The breaking of explicit agreements or implicit arrangements—cheating—is a particularly important issue to consider in the design of health promotion programs. Although we did not assess men's perceptions of specific events that constitute cheating, it is conceivable that cheating could occur in the context of a monogamous or open relationship, provided an explicit or implicit rule was broken.

Over a quarter of respondents reported playing around or cheating on their partner during the history of their relationships, and a fifth of respondents said that their partner had played around or cheated on them. Men who reported that their partner had ever played around or cheated on them were less likely to strongly agree that they were responsible for protecting their partners from HIV and other STIs. Adjusting for demographic and contextual characteristics, these men were more likely to report unprotected anal sex with a non-main partner in the past 90 days. Men who were categorized into the *open with cheating* latent class category reported the highest rate of unprotected anal sex with a main partner (94 %) and the highest rate of unprotected anal sex with a non-main partner (74 %) in the past 90 days.

Over half of the MSM in our sample strongly agreed with the statement that they are responsible for protecting their partners from HIV and other STIs. Strongly agreeing with one's responsibility was associated with report of continual monogamy. Adjusting for demographic and contextual characteristics, strong agreement with responsibility was associated with greater likelihood of having protected anal sex with one's main partner, lower likelihood of having anal sex with a non-main partner, and lower likelihood of having unprotected anal sex with a non-main partner.

The consistency of our findings regarding cheating and personal responsibility for protecting partners is striking. Our data suggest that HIV/STI prevention programs may be effective if they attempt to reduce engagement in cheating behavior and enhance perception of personal responsibility for protecting one's partners from HIV/STIs. This approach could be tailored for couples who choose to be in monogamous or open relationships. However, it is also important to acknowledge that third variable explanations may account for observed links between relationship configuration, personal responsibility for protecting partners, and sexual behavior in the present study (e.g., sociosexuality; [34]).

Tailoring Messages to Fit Couples with Different Relationship Configurations

Regardless of a couple's relationship configuration, it is important to promote condom use with both main partners

and non-main partners [35, 36]. Couples-oriented HIV/STI prevention should promote protection of one's partner from disease as a key characteristic of being in a relationship. Messages tailored to relationship configuration may be most effective in increasing condom use. For example, imagine the following messages as part of a tailored online intervention designed for individuals who break explicit or implicit rules: "If I'm going to cheat, I want to be fair. I use a condom to protect myself and my partner." Or, "When I play around, I follow one rule. I use a condom every time." For men in open relationships without cheating, a different approach may be appropriate. For example, "We like to keep our options open. But we always use a condom when we're with other people." Or, "Couples that play together stay together. We also stay safe by making condoms part of our play." Men who don't ask and don't tell, or who have not yet had explicit conversations about sex outside of the relationship, may respond more favorably to yet a different message: "He doesn't ask what I'm doing when I'm not with him. If he did, it would feel good to tell him that I've always used a condom." These messages, which encourage the use of condoms outside of one's main relationship, should be tested among MSM endorsing different relationship configurations and evaluated with respect to potential impact on behavior.

Previous research highlights additional factors that should be taken into account when promoting condom use with one's main partner. Condoms are often not used within relationships perceived as monogamous [4]. Individuals differ in their propensity to use condoms across sexual relationships, including those that are concurrent [37, 38]. The perceived lack of intimacy, lack of trust, and diminishment of pleasure that are attached to condom use [39, 40] may be viewed as particularly problematic with a main partner; such perceptions should be challenged.

Messages should also focus on helping men in same-sex relationships to explicitly discuss the conditions under which partners may have sex with others, if at all. One promising forum to foster explicit discussions is Couples Voluntary HIV Counseling and Testing (CVCT). Sullivan and Stephenson [41] describe this approach as an alternative to individual voluntary HIV counseling and testing, and appropriate for MSM who view testing together as an expression of commitment to their relationship. Our findings suggest that part of counseling should involve the initiation or enhancement of conversations about the conditions under which partners may or may not have sex with others; the types of sexual behaviors with others that may be acceptable; expectations about condom use within and outside of the main relationship; and how partners would address a broken agreement if this was to occur. Periodic discussion about these topics could be framed as a healthy component of committed relationships, rather than something that only

occurs at the beginning of a relationship. Counselors could frame the disclosure of a broken agreement—particularly with respect to unprotected sex—as a way of placing the health of one's partner first. With tact, counselors can avoid leaving the impression that broken agreements are inevitable. They can propose that thoughtful discussion about broken agreements is a way to invest in one's relationship and the health of one's partner.

Sexually Explicit Social Networking Websites and HIV Prevention

Public health professionals must also consider the role of sexually explicit social networking websites in facilitating or curbing the transmission of HIV and other STIs. Sexually explicit social networking websites may present a public health challenge, in that they can facilitate transmission of STIs by linking sexual partners with one another. However, the same websites may also present an ideal public health solution. The Internet allows for delivery of prevention and intervention materials that are closely matched to individual preferences of clients. More nuanced, tailored approaches to health promotion programs may be required in order to encourage widespread condom use among MSM, including those who engage in sex outside of a committed relationship. To the extent that health promotion programs do not interfere with the purpose of existing websites (e.g., delivering sexually explicit material to clients, facilitating connections between clients), sexually explicit social networking websites may be an effective means of delivering health-related content. Technologies utilized by these websites may also be incorporated into more traditional public health programs.

Study Strengths and Limitations

This sample was recruited from a sexually explicit social networking website for MSM, which may be viewed as both a strength and limitation. A primary function of the website is to facilitate the identification of potential sexual partners; the site can also be used for blogging, chatting, networking, and/or flirting with others in the context of a monogamous relationship. Had this study been conducted within a general sample of MSM, the proportion of men reporting various relationship configurations and unprotected anal sex with main and non-main partners may have been different. It is unclear whether associations between various relationship configurations and consistency of condom use would have been different. These are important empirical questions that could be examined in future research. The present findings are novel and important given the popularity of sex seeking websites among segments of MSM. MSM who use sexually explicit networking sites may be viewed as a relatively hidden population at high risk for HIV transmission.

A second limitation is that the present sample does not include MSM who only access the Internet through mobile technology, which is less suited to completing longer surveys online. MSM of lower socioeconomic status and racial/ethnic minorities are likely underrepresented with respect to non-mobile technology use [42]; it is thus possible that some of the observed demographic differences may not generalize to other subsets of MSM. A third and related limitation is that we are unable to gauge differences between MSM who chose to participate and MSM who did not.

A fourth limitation of this research is our reliance on self-report. Although data collection methods allowed for anonymity, some men may have underreported behaviors they considered socially undesirable. The large number of men reporting risk behavior perhaps ameliorates this concern. Collection of data via the Internet has also been demonstrated to reduce under-reporting of socially undesirable behavior [43]. Fifth, we did not ask separate questions about condom use for main and non-main partners. To account for the main partner, we subtracted one person from the total number of individuals with whom a participant reported engaging in anal sex. This method may have led to an underestimate of risk for participants who had already excluded their main partner from their reported tallies. Sixth, our assessment prevents us from knowing whether men had two or more main partners, and whether multiple main partners may have been consecutive instead of concurrent. Only 1.5 % of the sample reported being in a committed relationship for 3 months or less, which lessens the latter concern. Seventh, the majority of our relationship configuration items assessed behavior during the entire relationship, rather than the past 90 days. History of explicit agreements, implicit arrangements, and infidelity may or may not represent current patterns, but they were associated with recent sexual behavior in the present study. Eighth, we did not assess sex with female partners as part of the relationship configuration items.

Finally, associations between relationship configurations and patterns of sexual behavior in our study cannot be assumed to be causal. While our recommendation—that health promotion programs encourage monogamy and open relationships characterized by the absence of cheating—may seem reasonable, it implies a casual relationship. It is important to test whether the adoption of specific relationship configurations by MSM results in increased condom use with main and non-main partners. To date, few studies of the links between relationship characteristics and sexual behavior among MSM have been longitudinal (for an exception, see Ref. [44]).

Despite these limitations, the present research makes a valuable contribution to the literature. Findings can be viewed as an important step in the design of more effective health promotion programs for MSM in committed

relationships who may seek sex with others. The present study documents: (1) variance in *relationship configurations*, patterns of sexual behavior among men in committed relationships who seek sex with other men; (2) differential distribution of demographic and contextual characteristics among MSM who adopt different relationship configurations; and (3) differences in consistency of condom use with main and non-main partners between MSM who adopt different relationship configurations.

Conclusions

Because of the increasing incidence rate of HIV within the MSM community [1], fatigue over hearing and complying with messages to use condoms consistently [3], and high likelihood of contracting HIV from a man with whom one is in a relationship [4], it is critical to develop prevention and intervention materials that are relevant and compelling to MSM in committed relationships. The present set of findings provides information that can be used to tailor and evaluate health promotion messages, particularly for men in committed relationships who use the Internet to seek sex with other men. Messages should attempt to encourage explicit discussion about the conditions under which partners may have sex with others, if at all; reduce cheating behavior (breaking of explicit agreements or implicit arrangements); and enhance perception of personal responsibility for protecting one's partners from HIV and other STIs. These messages should be tailored for MSM who choose to be in monogamous, open, or “in between” relationships, and targeted towards MSM who may or may not openly communicate with their main partners about sexual behavior.

Acknowledgments This study was undertaken as part of “Structural Interventions to Lower Alcohol-related STI/HIV-Risk” (SILAS), grant number R01AA01627001, funded by the U.S. National Institute on Alcohol Abuse and Alcoholism (NIAAA). We gratefully acknowledge the assistance of Daniel Holsinger, SILAS Project Coordinator, and Gudrun Kilian, Program Manager of the HIV/STI Intervention & Prevention Studies (HIPS) Program.

References

1. Hall HI, Song R, Rhodes R, Prejean J, An Q, Lee LM, et al. Estimation of HIV incidence in the United States. *JAMA*. 2008;300:520–9.
2. Kaiser Family Foundation. AIDS at 25: an overview of major trends in the U.S. epidemic. 2006. <http://www.kff.org/hiv/aids/aidsat25.cfm>.
3. Centers for Disease Control and Prevention. HIV among gay, bisexual and other men who have sex with men (MSM). 2010. <http://www.cdc.gov/hiv/topics/msm/pdf/msm.pdf>.
4. Sullivan PS, Salazar L, Buchbinder S, Sanchez TH. Estimating the proportion of HIV transmissions from main sex partners among men who have sex with men in five US cities. *AIDS Behav*. 2009;23:1153–62.

5. Ritchie A, Barker M. 'There aren't words for what do or how we feel so we have to make them up': constructing polyamorous languages in a culture of compulsory monogamy. *Sexualities*. 2006;9:584–601.
6. Barker M, Langdridge D. Whatever happened to non-monogamies? Critical reflections on recent research and theory. *Sexualities*. 2011; 13:748–72.
7. Shernoff M. Negotiated nonmonogamy and male couples. *Fam Process*. 2006;45:407–18.
8. Hoff CC, Beougher SC. Sexual agreements among gay male couples. *Arch Sex Behav*. 2010;39:774–87.
9. Gass K, Hoff CC, Stephenson R, Sullivan PS. Sexual agreements in the partnerships of Internet-using men who have sex with men. *AIDS Care: Psychological and Socio-medical aspects of AIDS/HIV*. Available online.
10. Parsons JT, Starks TJ, DuBois S, Grov C, Golub SA. Alternatives to monogamy among gay male couples in a community survey: Implications for mental health and sexual risk. *Arch Sex Behav*. Available online.
11. Hoff CC, Chakravarty D, Beougher SC, Darbes LA, Dadasovich R, Neilands TB. Serostatus differences and agreements about sex with outside partners among gay male couples. *AIDS Educ Prev*. 2009; 21:25–38.
12. Gomez AM, Beougher SC, Chakravarty D, Neilands TB, Mandic CG, Darbes LA, Hoff CC. Relationship dynamics as predictors of broken agreements about outside sexual partners: Implications for HIV prevention among gay couples. *AIDS Behav*. Available online.
13. Solomon SE, Rothblum ED, Balsam KF. Money, housework, sex, and conflict: same-sex couples in civil unions, those not in civil unions, and heterosexual married siblings. *Sex Roles*. 2005;52: 561–75.
14. Blumstein P, Schwartz P. *American couples: money, work, sex*. New York: William Morrow; 1983.
15. Adam BD. Relationship innovation in male couples. *Sexualities*. 2006;9:5–26.
16. Burton J, Darbes LA, Operario D. Couples-focused behavioral interventions for prevention of HIV: systematic review of the state of evidence. *AIDS Behav*. 2010;14:1–10.
17. Wu E, El-Bassel N, McVinney LD, Hess L, Remien RH, Charania M, Mansergh G. Feasibility and promise of a couple-based HIV/STI preventative intervention for methamphetamine-using, black men who have sex with men. *AIDS Behav*. 2011;15:1745–54.
18. McFarlane M, Bull SS, Rietmeijer CA. The internet as a newly emerging risk environment for sexually transmitted diseases. *JAMA*. 2000;284:443–6.
19. Kaiser Family Foundation. Inside-out: a report on the experiences of lesbians, gays and bisexuals in America and the public's views on issues and policies related to sexual orientation. 2001. <http://www.kff.org/kaiserpolls/upload/New-Surveys-on-Experiences-of-Lesbians-Gays-and-Bisexuals-and-the-Public-s-Views-Related-to-Sexual-Orientation-Report.pdf>.
20. Mays VM, Cochran SD. Mental health correlates of perceived discrimination among lesbian, gay, and bisexual adults in the United States. *Am J Public Health*. 2001;91:1869–76.
21. Klausner JD, Wolf W, Fischer-Ponce L, Zolt I, Katz MH. Tracing a syphilis outbreak through cyberspace. *J Am Med Assoc*. 2000;284: 447–9.
22. Rosser BRS, Oakes JM, Horvath KJ, Konstan JA, Danilenko GP, Peterson JL. HIV sexual risk behavior by men who use the internet to seek sex with men: results of the men's internet sex study-II (MINTS-II). *AIDS Behav*. 2009;13:488–98.
23. Tashima KT, Alt EN, Harwell JI, Fiebich-Perez DK, Flanigan TP. Internet sex-seeking leads to acute HIV infection: a report of two cases. *Int J STD AIDS*. 2003;14:285–6.
24. Centers for Disease Control and Prevention. Cases of HIV infection and AIDS in urban and rural areas of the United States, 2006. HIV/AIDS Surveillance Supplemental Report. 2010. p. 13.
25. Catania JA, Osmond D, Stall RD, Pollack L, Paul JP, Blower S, et al. The continuing HIV epidemic among men who have sex with men. *Am J Public Health*. 2001;91:907–14.
26. Wolitski RJ, Bailey CJ, O'Leary A, Gomez CA, Parsons JT. Self-perceived responsibility of HIV-positive men who have sex with men for preventing HIV transmission. *AIDS Behav*. 2003;7:363–72.
27. Rosser BRS, Gurak L, Horvath KJ, Oakes JM, Konstan J, Danilenko G. The challenges of ensuring participant consent in internet-based sex studies: a case study of the MINTS I & II studies. *J Comput Mediated Commun*. 2009;13:746–56.
28. Konstan JA, Rosser BRS, Ross MW, Stanton J, Edwards WM. The story of subject naught: a cautionary but optimistic talk of internet survey research. *J Comput Mediated Commun*. 2005; 10(2): article 11.
29. Collins LM, Lanza ST. *Latent class and latent transition analysis: with applications in the social, behavioral, and health sciences*. Hoboken, NJ: Wiley; 2010.
30. Grov C, Starks TJ, Rendina J, Parsons J. Rules about casual sex partners, relationship satisfaction, and HIV risk in partnered gay and bisexual men. *J Sex Marital Ther*. in press, Accepted author version posted online: 22 May 2012.
31. Lo Y, Mendell N, Rubin DB. Testing the number of components in a normal mixture. *Biometrika*. 2001;88:767–78.
32. Ross MW, Rosser BRS. Monogamy is *Genitourin Med*. 1988;64:65–6.
33. Golden MR, Stekler J, Hughes JP, Wood RW. HIV serosorting in men who have sex with men: Is it safe? *Epidemiol Soc Sci*. 2008;49:212–8.
34. Penke L, Asendorpf JB. Beyond global sociosexual orientations: a more differentiated look at sociosexuality and its effects on courtship and romantic relationships. *J Pers Soc Psychol*. 2008;95:1113–35.
35. Theodore PS, Duran REF, Antoni MH, Fernandez MI. Intimacy and sexual behavior among HIV-positive men-who-have-sex-with-men in primary relationships. *AIDS Behav*. 2004;8:321–31.
36. Crepez N, Marks G, Liao A, Mullins MM, Aupont LW, Marshall KJ, Jacobs ED, Wolitski RJ. Prevalence of unprotected anal intercourse among HIV-diagnosed MSM in the United States: a meta-analysis. *AIDS*. 2009;23:1617–29.
37. Crossley M. Making sense of "barebacking": gay men's narratives, unsafe sex and the "resistance habitus". *Br J Soc Psychol*. 2004;43:225–44.
38. Lightfoot M, Song J, Rotheram-Borus MJ, et al. The influence of partner type and risk status on the sexual behavior of young men who have sex with men living with HIV/AIDS. *J Acquir Immune Defic Syndr*. 2005;38:61–8.
39. Conley TD, Collins BE. Differenced between condom users and condom nonusers in their multidimensional condom attitudes. *J Appl Soc Psychol*. 2005;35:603–20.
40. Shernoff M. Condomless sex: gay men, barebacking, and harm reduction. *Soc Work*. 2006;51:106–13.
41. Sullivan P, Stephenson R. Couples voluntary HIV counseling and testing for men who have sex with men. *Treatment Issues*. 2011. Gay Men's Health Crisis (GMHC). <http://www.gmhc.org/research/treatment-issues>. Retrieved 17 June 2012.
42. Lenhart A, Horrigan J, Rainie L, Allen K, Boyce A, Madden M, O'Grady E. The ever-shifting Internet population: a new look at Internet access and the digital divide. 2003. Pew Internet & American Life Project. http://www.pewinternet.org/~media/Files/Reports/2003/PIP_Shifting_Net_Pop_Report.pdf. Retrieved 11 Jan 2012.
43. Turner CF, Ku L, Rogers SM, Lindberg LD, Pleck JH, Sonenstein FL. Adolescent sexual behavior, drug use, and violence: increased reporting with computer survey technology. *Science*. 1998;280:867–73.
44. Mustanski B, Newcomb ME, Clerkin EM. Relationship characteristics and sexual risk-taking in young men who have sex with men. *Health Psychol*. 2011;30:597–605.