Patterns of sexual partnerships and their effects on STI screening and infection rates in the U.S.

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ABSTRACT

Context: The impact of concurrent (or simultaneous) sexual partnerships on HIV screening in the heterosexual population has not received adequate attention, even though a few (or several) investigations have shown concurrency to be a dominant factor in the spread of sexually transmitted infections.

Methods: We used data from 3,880 unmarried men and women aged 20 to 40 who participated in the 2002 National Survey of Family Growth to examine antecedents and correlates of sexual relationship patterns over a 12-month observation period. We used logistic regression models to test the likelihood of reporting multiple serial or concurrent relationships relative to a single relationship, controlling for socioeconomic status and other demographic factors. In subsequent models we tested the likelihood associated with partnership patterns of: 1) high risk behaviors for STD transmission; and 2) infection screening and treatment.

Results: Factors associated with elevated risk for serial and concurrent relationships were younger age at interview and younger age at first sex; inhibiting factors were regular church attendance and children living in the household. For women, lower income was associated with increased likelihood of serial relationships, while higher income increased this likelihood for men. Respondents reporting serial or concurrent partnerships were more likely to report high-risk behaviors than those with a single partner; they were also more likely to report screening, diagnosis and treatment for sexually-transmitted infections.

Conclusions: Having serial or concurrent partnerships is associated with increased risk for high-risk behaviors and poor health outcomes. Public health interventions should reemphasize use of contraceptive methods that protect against infection and the risks associated with certain behaviors.

Introduction

Until recently, the explanations for the variation in the spread of HIV infections among heterosexual populations have focused on three major factors: (a) the rate of sexual partner acquisition (or number of partners per a specific unit of time); (b) the impact of core groups; and (c) the presence of other sexually transmitted infections (STIs) that may facilitate HIV transmission. The potential impact of another crucial factor, concurrent (or simultaneous) sexual partnerships has not received adequate attention, even though both theoretical and empirical investigations have shown it to be a dominant factor in the spread of STIs (Morris & Kretzschmar 1997, 2000; Chick et al. 2000; Koumans et al. 2001; Potterat et al. 1999).

Concurrency is an alternative pattern of partner acquisition to sequential monogamy, even though the rate of partner acquisition may not be different. Mathematical models of the spread of disease epidemic suggest that concurrent partnerships greatly amplify the spread of an infectious agent, such as HIV (Watts and May 1992; Chick et al. 2000). This is primarily because, following an infection there is no time lost in waiting for the current relationship to dissolve and a new relationship to begin, as is the case in the sequential monogamy pattern. Further, under sequential monogamy each subsequent partner may increase the risk of infection to a certain individual, but unlike in the concurrent partnerships, earlier partners are not likely to be at risk of being infected. In other words, the protective effect of sequential partnerships is lost in concurrent partnerships because earlier partners remain connected to the individual and they can still be exposed when the individual is infected by a subsequent concurrent partner.

Prior studies have estimated the rate of sexual concurrency among women at 12% over an approximate four-year observation period (Adimora, et al. 2002) and among men at 11% over a one-year period (Adimora, Schoenbach & Doherty 2007). Factors found to be important predictors of sexual concurrency included marital status, income, age at interview and age at first sexual intercourse.

In this paper we examine the antecedents and correlates of sexual concurrency over a one-year period in a nationally representative sample of men and women in the United States. We first focus on the pattern of sexual partnerships as a function of individual characteristics (e.g., age, race/ethnicity, education, religion), and we consider not only concurrent partnerships but also multiple serial partnerships in contrast with a single monogamous relationship. Subsequently we examine the association of sexual partnership pattern with high risk behaviors for transmission (e.g., HIV/STD-risk behaviors, alcohol and/or drug use prior to sex), and then the effects of partnership patterns and high-risk behaviors simultaneously on the likelihood of being screened for, treated for or diagnosed with an STI.

Methods

Data. The National Survey of Family Growth (NSFG) has been conducted by the National Center for Health Statistics since 1973, with cross-sectional national samples of 15-44 year old women. The last round of NSFG (Cycle 6) was conducted in 2002, and included 15-44 year old men in addition. The survey was conducted by the Survey Research Center of the University of

Michigan, based on an area probability sample of households in the U.S. (including Alaska and Hawaii), and represents the non-institutionalized male and female population aged 15 to 44 (Groves et al. 2005). Computer-assisted in person interviews (CAPI), and audio computer-assisted self interviews (ACASI) for more sensitive items, were conducted with 7,643 women and 4,929 men (response rate: 79%, similar to previous cycles). NSFG Cycle 6 also included complete marital, cohabiting and noncohabiting relationship histories for opposite-sex partners, and STI/HIV risk behaviors and screening.

Exclusions. Men and women aged 20 to 40 who were unmarried at the time of interview were included in the analysis (2,254 men and 3,023 women). For women, 97 apparent duplicate relationships were excluded; however, the respondents and their valid relationships were retained in the analyses. Respondents were excluded if they did not have a complete date record for their sexual relationship history. Missing dates for first sex were estimated using the respondent's reported age at first sex with each partner, and missing dates for last sex were replaced with the date of interview if the relationship was reported as current. There were 47 men for whom the date of last sex came before the date of first sex for at least one relationship; in each case the reported date of first sex was consistent with reported age at first sex, and no data existed for independently establishing the correct date of last sex. These apparently incorrect last dates were coded as missing. In cases where one or more dates remained missing after imputation, the respondent was excluded because of the impossibility of determining overall pattern of sexual partnerships (57 men and 27 women). Respondents with no eligible relationship were also excluded (538 men and 692 women). Finally, because women had the opportunity to report up to 20 relationships in the sexual history portion of the questionnaire, and men only 3 or 4 (depending on their marital status), we restricted the analyses to respondents with no more than three eligible sexual relationships (1 man and 82 women). Relationships were counted as eligible if they ended no more than 12 months prior to the interview. These exclusions yielded an analytic sample of 1,658 men and 2,222 women.

Concurrent Relationships. Respondents' sexual relationship patterns were categorized based on their eligible sexual relationships over an observation period of 12 months preceding the interview: a single sexual relationship (continually monogamous); two or more non-overlapping relationships (serial monogamy); and two or more sexual relationships overlapping in time (concurrent). Individuals with two concurrent relationships and a nonconcurrent third relationship were placed in the concurrent category. Relationships were counted as concurrent if the second relationship began before or in the same month another relationship ended. The beginning of a relationship was defined as the month in which the respondent reported that s/he first had intercourse with her/his partner, and the end of a relationship as the month when the respondent stopped having sex with his or her partner. Our measure of relationship pattern includes only opposite-sex partnerships.

Individual Characteristics. Attributes found by previous studies to be important predictors of sexual concurrency are gender, age, age at first sexual intercourse, marital status, educational attainment, employment status and income. The same characteristics were examined here: gender; age at interview (20-24; 25-29; 30-34; 35+); age at first sexual intercourse (14 and under; 15-16; 17-18; 19-20; 21+); whether the respondent was previously married (yes/no); educational attainment (less than high school; high school; some college; college graduate or more);

employment status (full time; other than full time; not working); and income. Several income variables were tested, including two dichotomies: whether the respondent's household was above 200% of the poverty level; whether the respondent's household had $60,000 or more in annual income; and a categorical income variable (< $25,000; $25,000 to < 50,000; $50,000 to < 75,000; $75,000+). Other individual characteristics examined were race/ethnicity (Hispanic; nonhispanic white; nonhispanic black; other), religion (Catholic; protestant; other; none), church attendance (at least once/month; less than once/month; never), whether children lived in the respondent's household (yes/no), and whether the respondent lived in an intact household until age 18 (yes/no).

High-risk Behaviors for Transmission. High risk behaviors fall into two categories: partner choice and substance use. The survey provides several measures of each, collected in the ACASI portion of the interview. Partner-related behaviors reported within the 12 months prior to interview included: sex with a partner who used intravenous (IV) drugs; paying for sex; being paid for sex; sex with someone who is infected with HIV; sex with a nonmonogamous partner; and having one or more same-sex partners. Having a high-risk partner was defined as having reported at least one of the first four behaviors listed; having a nonmonogamous partner and having a same-sex partner are presented as separate outcomes. Substance-related behaviors reported in the observation period included: binge drinking; smoking marijuana; using cocaine; using crack; using IV drugs; and having sex while under the influence of drugs or alcohol. Binge drinking, marijuana use and sex while high are presented separately. Because of the small number of responses, and due to the typically more committed nature of their use relative to marijuana, use of cocaine, crack or IV drugs are presented grouped as "other illegal drug use".

Health Behaviors and Outcomes. These outcomes include being tested for, diagnosed with, or treated for an STI within 12 months prior to the interview. Specific outcomes used were: being tested for any STI; being tested for HIV; being treated for any STI; and if treated, a diagnosis of gonorrhea or Chlamydia. In the case of HIV, the date of the test was used to determine whether testing occurred within the observation period.

Analytic Plan. We calculated descriptive statistics to examine the distribution of individual characteristics, high-risk behaviors, and health behaviors and outcomes with respect to sexual relationship pattern. Then, multivariate logistic models were estimated for: 1) single monogamous partner vs. serial monogamy; and 2) single monogamous partner vs. concurrent partnerships as a function of individual characteristics. In these models, potential interactions between gender and other individual characteristics were explored systematically. Factors that were not significant at the $p < .05$ level in either model were dropped from both models; in all cases, the coefficients of remaining factors did not change appreciably. Next, multivariate logistic models were estimated for each high-risk behavior as a function of relationship pattern (single monogamous, multiple serial, multiple concurrent) and individual characteristics. Finally, we estimated multivariate logistic models for each health behavior/outcome as a function of 1) relationship pattern, and 2) significant high-risk behaviors, also adjusting for individual characteristics. All analyses were conducted in Stata 9.0 (Stata Corp, College Station, TX), using survey procedures that adjusted standard errors for the complex sample design.

Results

The unadjusted, overall prevalence of multiple concurrent sexual relationships over a 12 month period among unmarried persons aged 20 to 40 was 15.2%, and for multiple serial relationships was 11.0%; 78.3% reported a single relationship (Table 1). Men were half again as likely to engage in concurrent relationships as women (18.0% vs. 12.1%); the rates at which they reported serial relationships were similar for men and women. Hispanics and respondents of other races reported a single relationship (79.5% and 81.1%, respectively) more often then than the mean, while whites were disproportionately more likely to report multiple serial relationships (13.4%) and blacks, multiple concurrent relationships (18.5%). The prevalence of serial relationships was higher for those with some college or higher education (13.4% and 13.5%, respectively), and prevalence of a single relationship was highest for those with high school or less education (77.5% and 77.3%, respectively). Respondents not working full time were disproportionately more likely to report serial relationships (15.2%) and less likely to report a single relationship (68.2%). Those with income of $75,000 or more were most likely to report multiple serial relationships of all income groups (16.9%), and those making $50,000 or more were disproportionately more likely to report concurrent relationships ($50,000 to < 75,000, 17.3%; $75,000+, 16.1%).

Catholic respondents were the group most likely to report a single monogamous relationship (78.4%), while those with no religion or some other religion reported concurrency more often than the mean (18.1% and 17.4%, respectively). Those attending church less than once a month or never reported higher rates of concurrency (17.0% and 16.6%, respectively). Having children present in the household was associated with a single relationship (83.2%), while having no children present was associated with higher prevalence of serial and concurrent relationships (13.7% and 17.9%, respectively). Finally, older age at first sexual intercourse was associated with higher rates of a single relationship (86.9% for those 21 and over), and younger age at first sex was associated with very high rates of concurrency (23.3% for those 14 and younger).

In unadjusted analyses, respondents with multiple serial or multiple concurrent relationships were 30-60% more likely than those reporting a single monogamous relationship to engage in substance-related high risk behaviors for STI transmission (Table 2). 58.5% of respondents with a single relationship reported at least one alcoholic binge; however, 80.5% and 78.2% of those with concurrent and serial patterns, respectively, reported bingeing. Using marijuana and having sex while high were highest among respondents in concurrent relationships (46.1% and 72.2%, respectively) and second highest among respondents in serial relationships (43.0% and 68.3%, respectively). Using illegal drugs other than marijuana was especially frequent for respondents with concurrent partners, at 19.9% compared with only 6.9% of respondents with a single relationship. Results were similar for partner-related behaviors. Those with concurrent partnerships were five times more likely, and those with serial partnerships over three times more likely than respondents with a single partnership to report having had a nonmonogamous partner in the past year. They were also more likely to report a high risk partner (9.2% and 6.5%, respectively) or a same-sex partner (7.9% and 3.0%, respectively) than single-partnership respondents (high-risk partner, 5.1%; same sex partner, 2.4%).

Unadjusted distributions of STI-related health behaviors and outcomes also varied by sexual partnership pattern (Table 3). Those reporting multiple serial or multiple concurrent partnerships

were more likely to report having been tested for HIV or another STI in the past year than respondents with a single partner However, the group most likely to report being tested for HIV were those with serial partners (30.7%, compared with 27.0% of concurrent and 20.8% of single). Nine percent of respondents in concurrent relationships reported being treated for an STI, compared with 6.9% of those with serial relationships, and only 3.4% of those with a single relationship. Among respondents treated for an STI, those in concurrent partnerships were three times more likely than respondents in single relationships and two times more likely than respondents in serial relationships to be diagnosed with gonorrhea (36.1% vs. 11.4% and 18.1%, respectively). Those in serial and concurrent partnerships were also more likely than respondents in single partnerships to be diagnosed with Chlamydia (41.8% and 41.4%, respectively, compared with 28.0%) if treated for an STI.

In the multivariate model predicting multiple serial relationships relative to a single monogamous relationship (Table 4), respondents aged 20 to 24 at the time of interview were 1.7 times more likely to have serial relationships than those in the oldest age group ($p < .01$). Whites were 1.5 times more likely than Hispanics to report serial relationships ($p < .05$). Church attendance at least once monthly was associated with an only 70% chance of serial partnerships compared to those who attended less often or never ($p < .05$), and respondents sharing the household with children were only 40% as likely to have serial partnerships as those with no children present ($p < .001$). Respondents who had their first sexual intercourse at age 14 or younger were 2.5 times more likely to have serial partnerships than those aged 21 or older at first sex ($p < .01$); odds ratios for those 15 to 16 and 17 to 18 were similar and statistically significant. An interaction between gender and income was a highly significant predictor of serial partnerships ($p < .001$).

Table 4 presents odds ratios for the main terms and interaction term, as well as reparamaterized odds ratios for each interaction category. Women reporting $60,000 or more in household income were half as likely to have serial partnerships as women reporting less income. Men reporting household income of $60,000 or more were 1.4 times more likely to have serial relationships than women earning less than $60,000, while men earning less than $60,000 were only 70% as likely as similar women to have serial relationships. In other words, the respondents most likely to report serial partnerships were men above the income threshold of $60,000; this group was nearly three times more likely to report a serial pattern than the group least likely to report it, women of the same income level.

In the model predicting multiple concurrent partnerships relative to a single monogamous partnership (Table 4), neither gender, income, nor the interaction were significant. Those aged 20 to 24 at interview were 1.5 times more likely than those aged 35 and over to report concurrency ($p < .05$). Blacks were 1.5 times more likely than Hispanics to report concurrency ($p < .05$). Effects for church attendance and children in household were similar in magnitude and significance to the same effects predicting serial partnerships. The effects of age at first sexual intercourse were even stronger at younger ages for concurrency; those aged 14 and under at first sex were 4.7 times more likely to have a concurrent pattern ($p < .001$), and those aged 15 to 16 were 3.0 times more likely ($p < .001$) than those 21 and over.

In the multivariate analyses, respondents in multiple serial relationships were 2.0 times more likely ($p < .001$), and those in multiple concurrent relationships were 2.5 times more likely ($p < .001$) than individuals in single relationships to report at least one alcoholic binge (Table 5). The associations between sexual partnership pattern and other high risk behaviors were similar. Use of illegal drugs other than marijuana was 3.0 times more likely for concurrent ($p < .001$) and 2.0 times more likely for serial ($p < .01$) than for the single-relationship pattern, and the effects of partnership pattern on having sex while high were nearly identical to its effects on binge drinking. With respect to sexual behaviors, having a sex partner the respondent believed to be nonmonogamous was very strongly associated with both concurrent (OR=9.6, $p < .001$) and serial (OR=4.6, $p< .001$) partnership types relative to having a single relationship. Having a same-sex partner was 3.6 times more likely for those in concurrent relationships relative to a single relationship ($p < .001$). Having a high-risk partner was not significantly associated with sexual partnership pattern in multivariate models.

The effect of sexual partnership pattern on STI-related health outcomes and behaviors generally held up in adjusted analyses. Screening for an STI was significantly associated with having multiple serial (OR=1.4, $p < .05$) or multiple concurrent partnerships (OR=1.5, $p < .01$) after controlling for individual characteristics and risk behaviors (Table 6). Respondents reporting at least one nonmonogamous sex partner were also 1.5 times more likely than those without to report being tested ($p < .01$). Reporting an alcoholic binge or marijuana use approached significance for STI screening ($p = .087$ and $p = .055$, respectively). Those in serial partnerships were almost twice as likely as single-partner individuals to report being tested for HIV ($p < .001$); having concurrent partnerships approached significance relative to a single partner ($p = .058$). Both serial and concurrent partnership types were associated with about twice the odds of being treated for an STI (1.8 and 2.0, respectively). Other significant predictors of STI treatment were marijuana use (OR=1.6, $p<.05$) and having a nonmonogamous sex partner (OR=1.7, $p < .05$). If treated for an STI, those in concurrent relationships were 6.1 times more likely to have been diagnosed with gonorrhea than respondents with a single partner ($p < .05$), and having a same-sex partner was associated with a nearly 12-fold increase in risk of being diagnosed with gonorrhea ($p < .01$). Having serial partnerships had a large and nearly significant effect on gonorrhea diagnosis (OR = 4.3, $p = .062$). Neither sexual partnership pattern nor any of the risk behaviors were significantly associated with Chlamydia diagnosis in multivariate models.

Discussion

Engaging in multiple sexual relationships concurrently is an important risk factor for contracting an STI (Potterat et al. 1999; Rosenberg et al. 1999), and may accelerate the spread of STIs relative to serial monogamy (Watts & May 1992; Morris & Kretzschmar 1997). This is because with concurrent partnerships, an individual is at risk for simultaneously acquiring and dispersing infections throughout a network of partners, rather than exposure through repeated simple dyads. Other behaviors associated with concurrency may also increase risk for STIs.

Background factors that were strongly predictive of concurrent partnerships relative to having a single relationship in multivariate analysis were younger age, African American race, infrequent or no church attendance, having a childless household, and younger age at first sexual

intercourse. The higher rate of concurrency among African Americans may be related to economic instability and other sources of relationship uncertainty; this uncertainty may lead individuals to begin a new relationship before a prior relationship ends. Adimora, Schoenbach and Doherty (2007) found African American men to have an elevated risk of concurrent relationships. A shortage of black male partners in the mate pool may allow them greater opportunity for concurrent partnerships. However, race-gender interactions we tested in our analyses did not significantly predict concurrency.

Having children present may be an inhibiting factor for concurrency, but it may also simply indicate the existence of a committed relationship. Being a parent was not significantly associated with concurrency in adjusted analyses. Regular church attendance may signal a commitment to monogamy, if not marriage, however, religious affiliation was not significant. Young age at first sexual intercourse was a powerful predictor of concurrency; an early sexual debut implies a longer exposure, potentially leading to higher rates of concurrency. Another background factor, whether the respondent's family was intact until age 18 was not significant, and had no influence on the effect of age at first sexual intercourse. Married persons were excluded from the study because of the strong association between marriage and monogamy observed in preliminary analyses and in other studies (Adimora, et al. 2002; Adimora, Schoenbach and Doherty 2007). Sexual concurrency among married persons might be expected to follow very different patterns than concurrency among the unmarried, and this dataset did not provide enough observations to support any detailed analysis. Whether the respondent was previously married, however, was not significant.

Factors predicting serial partnerships relative to a single partnership in multivariate analysis were similar to those predicting concurrency, except for white race, and with the addition of a strong, differential effect of income by gender. For men, increasing income was associated with a greater likelihood of multiple serial partnerships, while for women the opposite was true. Perhaps higher incomes enable men to sample more liberally from a pool of potential partners; for women, higher incomes may either diminish the pool of prospective partners, or it may free them from the need to pursue male partnership as a strategy for economic security. We also tested an interaction of race and income (both with and without the gender-income interaction), but these interactions were not significant predictors of multiple serial or multiple concurrent relationships.

The risk behaviors for transmission of sexual infections that we investigated were generally more prevalent among individuals with multiple serial or multiple concurrent partnerships relative to those with a single relationship, even when adjusted for age, gender and other personal characteristics. Especially noteworthy was the very strong tendency for individuals reporting concurrent relationships to also report having at least one partner who was nonmonogamous and at least one same-sex partner over the observation period. Particularly for men, having a same-sex partner indicates the presence of a bridge for transmitting infections between homosexual and heterosexual populations.

Both concurrency and having a nonmonogamous partner were significantly associated with STI testing and treatment in multivariate analyses, indicating independent effects for both factors. This finding is consistent with a finding among African Americans (Adimora et al. 2006). In

addition, respondents with serial partners were screened and treated for STIs at about the same rate as those with concurrent partners.

We were struck by the result that HIV tests were most prevalent among those in serial partnerships; in fact, respondents in concurrent partnerships were not significantly different from those with a single partner in the rate at which they underwent HIV screening. This finding might be attributable to a perception among persons involved in multiple concurrent, primarily *heterosexual* relationships that HIV testing is unnecessary because HIV/AIDS is a disease that only homosexual men are vulnerable to. However, this would not explain why persons in serial partnerships were so much more likely to be tested. It could be that individuals practicing sexual concurrency perceive no value in getting tested for the disease when a relationship that may potentially expose them is still in progress, as it would not provide lasting protection to other concurrent partners. Or, perhaps the difficulty in tracing the origin of the disease to any one partner is an inhibiting factor.

Limitations of the study include its reliance on self-report, especially for sexual and high-risk behaviors, however, the use of ACASI for the most sensitive questions helped alleviate some of the bias associated with self-report. Problems with accurate recall in this retrospective study may have influenced findings. Missing dates for sexual relationships are one indication of this, and our choice of imputation technique could have affected estimates of sexual concurrency. Moreover, the use of only month and year for determining concurrency also lends some uncertainty to our estimates. Because the study is retrospective rather than longitudinal, causality between concurrency, risk behaviors and STI outcomes cannot be established using these data. Finally, generalizability of the findings to a larger population is potentially impaired if non-respondents differ significantly from respondents in ways not accounted for by post-stratification weighting procedures.

Next steps include a study that would examine concurrency patterns by race and gender, and how race and gender might differentially influence sexual networks and transmission patterns. Another study could consider the role of condom use simultaneously with risk behaviors on STI outcomes as a function of sexual partnership pattern. More comprehensive analyses would ideally make use of a prospective, longitudinal study design, with baseline and follow-up surveys, coital diaries, and a longer observation period giving a more representative view of the respondents' sexual partner trajectories. This survey would include detailed data for each partner, or even partner surveys, which would allow for an examination of sexual mixing patterns and potential bridging partners.

In conclusion, higher prevalence of concurrency is likely to lead to dense sexual networks within certain groups, a greater degree of mixing between high-risk groups, and the possibility of establishing bridges to low-risk groups. All are important factors in the epidemiology of HIV and other STIs.

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Table 1. Percent distribution of relationship pattern by personal characteristics, U.S. 2002

	Relationship Pattern				
Characteristic	Monogamous	Serial	Concurrent	Total	N
Total	73.8	11.0	15.2	100.0	3,880
Sex					
Male	70.5	11.6	18.0	100.0	1,658
Female	77.5	10.4	12.1	100.0	2,222
Age					
20-24	69.1	13.9	17.0	100.0	1,406
25-29	73.8	10.5	15.7	100.0	936
30-34	75.8	9.8	14.5	100.0	765
35+	80.9	7.4	11.7	100.0	773
Race/Ethnicity					
Hispanic	79.5	7.7	12.8	100.0	858
Non-Hispanic white	71.4	13.4	15.2	100.0	1,852
Non-Hispanic black	74.0	7.5	18.5	100.0	996
Other	81.1	8.3	10.6	100.0	174
Education					
Less than high school	77.3	7.4	15.3	100.0	857
High school	77.5	9.2	13.3	100.0	1,016
Some college	70.2	13.4	16.4	100.0	1,266
College or more	71.2	13.5	15.3	100.0	741
Labor force status					
Working full time	75.5	10.1	14.4	100.0	2,218
Working, other	68.2	15.2	16.6	100.0	765
Not working	74.4	9.9	15.8	100.0	897
Income					
< $25K	74.7	11.1	14.2	100.0	1,726
$25K to < 50K	75.2	9.6	15.2	100.0	1,252
$50K to < 75K	73.6	9.1	17.3	100.0	498
$75K or above	66.9	16.9	16.1	100.0	404
Religion					
None	70.7	11.2	18.1	100.0	840
Catholic	78.4	8.3	13.3	100.0	1,110
Protestant	73.7	11.9	14.4	100.0	1,665
Other	66.4	16.2	17.4	100.0	265
Church attendance					
At least once a month	80.4	8.0	11.6	100.0	1,326
Less than once a month	71.3	11.8	17.0	100.0	1,268
Never	70.2	13.2	16.6	100.0	1,279

Table 1. Percent distribution of relationship types by personal characteristics, U.S. 2002 (cont.)

	Relationship Type				
Characteristic	Monogamous	Serial	Concurrent	Total	N
Ever been married?					
Yes	74.3	11.3	14.4	100.0	894
No	73.7	11.0	15.4	100.0	2,986
Any kids in household?					
Yes	83.2	6.5	10.4	100.0	1,447
No	68.4	13.7	17.9	100.0	2,433
Intact family until 18?					
Yes	74.7	11.3	14.0	100.0	2,295
No	72.3	10.6	17.1	100.0	1,585
Age at first sex ever					
14 and under	67.1	9.6	23.3	100.0	851
15 to 16	71.9	11.9	16.3	100.0	1,329
17 to 18	76.0	12.4	11.6	100.0	1,037
19 to 20	80.4	10.2	9.4	100.0	381
21 and over	86.9	6.2	6.8	100.0	282

Table 2. Percent of U.S. adults engaging in high-risk behaviors by relationship pattern, 2002

	Relationship Pattern			
Behaviors	Monogamous	Serial	Concurrent	Total
Substance Related:				
Alcohol binge	58.5	78.2	80.5	64.0
Smoked pot	28.7	43.0	46.1	32.9
Used other illegal drugs	6.9	14.9	19.9	9.7
Had sex while high	46.7	68.3	72.2	53.0
Partner Related:				
Had nonmonogamous partner	11.3	37.4	57.3	21.1
Had high risk partner	5.1	6.5	9.2	5.9
Had same sex partner	2.4	3.0	7.9	3.3

Table 3. Percent of U.S. adults reporting STD outcomes by relationship pattern, 2002

	Relationship Pattern			
Outcome/Behavior	Monogamous	Serial	Concurrent	Total
Last 12 months tested for:				
STD	18.5	27.2	31.7	21.5
HIV	20.8	30.7	27.0	22.8
Last 12 months treated for any STD	3.4	6.9	9.0	4.7
If treated, last 12 months diagnosed with:				
Gonorrhea	11.4	18.3	36.1	19.8
Chlamydia	28.0	41.8	41.4	34.2

Table 4. Logistic models: odds ratios and p-values for relationship pattern outcomes relative to monogamous, U.S. adults, 2002

Factor	Serial	Concurrent
Age (refcat 35+)		
20 to 24	1.7 **	1.5 *
25 to 29	1.4	1.4
30 to 34	1.3	1.3
Race/ethnicity (refcat hispanic)		
nonhispanic white	1.5 *	1.2
nonhispanic black	1.0	1.5 *
other	1.0	0.8
Attends church at least once a month	0.7 *	0.7 *
Children under 18 living in household	0.4 ***	0.5 ***
Age at first sex ever (refcat 21+)		
14 and under	2.5 **	4.7 ***
15 to 16	2.6 **	3.0 ***
17 to 18	2.2 *	1.9 *
19 to 20	1.7	1.4
Male	0.7 *	1.2
Income $60,000 or more	0.5 **	0.8
Gender-Income Interaction	4.3 ***	1.6
Interaction parameters		
female, < $60k	1.0	1.0
female, $60k or more	0.5	0.8
male, < $60k	0.7	1.2
male, $60k or more	1.4	1.4

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

Table 5. Logistic models: odds ratios and p-values for high-risk behavior outcomes by relationship pattern, U.S. adults, 2002 §

Outcome	Serial	Concurrent
Substance Related:		
Alcohol binge	2.0 ***	2.5 ***
Smoked pot	1.4 *	1.6 **
Used other illegal drugs	2.0 **	3.0 ***
Had sex while high	2.0 ***	2.6 ***
Partner Related:		
Had nonmonogamous partner	4.6 ***	9.6 ***
Had high risk partner	1.4	1.5
Had same sex partner	1.1	3.6 ***

* p < .05; ** p < .01; *** p < .001

§ Models are adjusted for gender, age, race/ethnicity, income, church attendence, presence of children in household, age at first sexual intercourse and gender*income interaction.

Table 6. Logistic models: odds ratios and p-values for STI outcomes by relationship type and high-risk behavior, U.S. adults, 2002 §

Factor	STI Test		HIV Test		Treated for STI		Gonorrhea †		Chlamydia	
Relationship Pattern (refcat monogamous)										
Serial	1.4	*	1.9	***	1.8	*	4.3		1.3	
Concurrent	1.5	**	1.4		2.0	*	6.1	*	1.6	
Risk Behaviors										
Alcohol binge	1.2		1.0		0.9		1.0		0.7	
Used pot	1.3		1.1		1.6	*	1.5		1.2	
Used other illegal drugs	1.1		1.1		1.4		0.8		2.8	
Had sex while high	0.9		0.9		0.8		0.6		0.4	
Had nonmonogamous partner	1.5	**	1.1		1.7	*	0.6		0.7	
Had same sex partner	1.3		1.2		1.3		11.8	**	0.9	

* p < .05; ** p < .01; *** p < .001

§ Models are adjusted for gender, age, race/ethnicity, income, church attendence, presence of children in household, age at first sexual intercourse, and gender*income interaction.

† Fourteen observations dropped from analysis due to perfect prediction of the outcome in missing categories of control variables.