Sexually Transmitted Infection Risk Reduction Strategies Among US Adolescents and Adults With Multiple Opposite-Sex Sex Partners or Perceived Partner Nonmonogamy, 2011–2017

Casey E. Copen, PhD,

Jami S. Leichliter, PhD,

Ian H. Spicknall, PhD,

Sevgi O. Aral, PhD

Centers for Disease Control and Prevention, Division of STD Prevention, Atlanta, GA

Abstract

Background: This study examined condom use and sexually transmitted infection (STI) testing among unmarried, non-cohabiting women and men who had multiple past-year partnerships or perceived their partner's involvement in another sexual relationship.

Methods: We identified 5868 and 5330 unmarried, non-cohabiting sexually active women and men aged 15 to 44 years using National Survey of Family Growth data for 2011 to 2017. To measure multiple partnerships, we created 4 dichotomous variables that included both past-year number of opposite-sex sex partners (1, 2 or more) and perceived partner nonmonogamy (PPNM) (yes, no). Results were stratified by relationship type at last sex ("steady" vs "casual").

Results: Overall, 39.4% of women and 48.3% of men reported multiple partnerships and 23.4% and 24.0% reported PPNM. Lower condom use was seen for women and men who had 2 or more partners in the past year and PPNM than those with only 1 partner and no PPNM (women, 28.5%; 95% confidence interval [CI], 24.1–32.9 vs 39.3%; 95% CI, 36.6–41.9) (men, 37.7%; 33.5–41.8 vs 54.9%; 51.9–57.9). STI testing was higher for groups with PPNM. Men with a steady sex partner had higher prevalence of past-year STI testing if they reported PPNM than not (adjusted prevalence ratio, 2.00; 95% CI, 1.63–2.45).

Conclusions: Screening practices that include a standardized sexual risk assessment could identify those with multiple sex partners or PPNM and improve linkage to STI services. Availability of point-of-care tests and expedited partner therapy could provide targeted strategies that prioritize rapid diagnosis and effective partner treatment which may prevent further STI spread.

Correspondence: Casey E. Copen, PhD, Centers for Disease Control and Prevention, 1600 Clifton Rd, MS US12-2, Atlanta, GA 30329-4027. ccopen@cdc.gov.

Higher numbers of sex partners can accelerate the spread of sexually transmitted infections (STI), including chlamydia, gonorrhea, syphilis and human immunodeficiency virus.[1] The duration of time between sexual partnerships can facilitate bacterial STI spread if it is less than the infectivity period of the STI, which can be short for some STIs and longer for others.[2,3] As STIs are often asymptomatic, individuals may not know they are infected with an STI before transmitting to a new sex partner. Data from nationally representative samples indicate that short gaps between sequential sexual partnerships are common. Using AddHealth, Kelley et al. found that 35% of sexually active adolescents had more than 1 partner in the past 18 months.[4] An analysis from the 2006 to 2010 National Survey of Family Growth (NSFG) estimated that 63% of sequential sexual partnerships among women aged 21 to 44 years were separated by less than 3 months.[5]

Distinct from an individual's own concurrent sexual behavior, a partner's concurrency (i.e., overlapping sex partners) can amplify the risk of STI infection because of the potential link to a larger sexual network. Perceived partner nonmonogamy (PPNM), as it is referred to in this study, has shown to be a clinically useful indicator for STI risk because it motivates preventative health behavior such as condom use.[6] Similarly, individuals may initiate alternative safe sex strategies, such as STI testing, if they believe their partner had sex outside of the relationship. Decisions to use condoms or seek STI testing differ markedly by how people define their relationships with a sex partner. Individuals may trust a steady partner and be less likely to use condoms compared to a casual partner with whom they feel less emotional connection.[7] Moreover, frequent STI testing may be used in committed relationships as "protection" against STI in lieu of condoms or to assess if an STI was acquired after unprotected sex with a casual partner.[8,9] Monitoring STI risk-reduction strategies among sub-populations with multiple partners or PPNM is important because these risk behaviors may facilitate STI acquisition or transmission due to overlapping, or short, gaps between sex partners. However, the most recent study to examine condom use and STI testing behaviors among individuals with concurrent sexual partnerships[10] did not focus specifically on unmarried, non-cohabiting, primarily younger, persons where STI burden is highest.

The goals of this study were to: 1) report the prevalence of multiple past-year sexual partnerships and PPNM in a national sample of unmarried, non-cohabiting men and women aged 15–44 years; and 2) explore how multiple partnerships and PPNM in this sample were associated with recent condom use and STI testing. In recognition of the complex and dynamic motivations that drive STI risk-reduction behavior within relationships, we stratified results by the type of relationship the respondent reported at last sexual intercourse ("steady" vs. "casual") to describe the influence of PPNM on condom use and STI testing within these 2 groups.

MATERIALS AND METHODS

Data Source and Sample

We used data from the 2011–2015 and 2015–2017 National Survey of Family Growth (NSFG) for this analysis. The NSFG is a multistage household probability sample, representative of women and men aged 15 to 44 years in the United States. Since

September 2015, eligibility of NSFG respondents increased to age 49 years; however, given combination of 2015 to 2017 data with earlier NSFG data, these analyses are restricted to those aged 15–44 years. Sample sizes and response rates included 11,300 (72%) women and 9321 (70%) men in 2011 to 2015 and 4891 (67%) women and 3999 (64%) men aged 15 to 44 years in 2015 to 2017.[11,12] The NSFG collected demographic, health-related, and sexual behavior data. Hispanics, African Americans and teenagers were oversampled to produce reliable estimates for these groups. Trained female interviewers conducted in-person interviews in respondents' homes with Computer Assisted Personal Interview (CAPI) technology. Some of the more sensitive survey questions relating to sexual behaviors, including sexual activity other than vaginal intercourse, were collected using Audio Computer Assisted Self-Interviewing (ACASI) to give respondents greater privacy when reporting this information. A 6-year (2011–2017) case weight was used for the 2011 to 2015 and 2015 to 2017 files that represents population totals at the midpoint of data collection in July 2014. More detailed information about the study design, weighting methodology, and variance estimation have previously been published.[13]

We limited data analyses to respondents aged 15 to 44 years who (1) had 1 or more vaginal, oral, or anal partners of the opposite-sex (i.e., females were asked about male partners; males were asked about female partners) in the past 12 months (referred to as "sexually active" based on ACASI data) and were (2) neither married nor cohabiting with an opposite-sex partner at the time of interview (including those who were currently separated, divorced or widowed). Respondents were categorized into 4 groups according to the number of opposite-sex sex partners they had in the past year (1, 2 or more) and whether they had sex with any opposite-sex partners in the past year who "were also having sex with other people at around the same time" (yes, no). Both of these questions were asked in the ACASI portion of the survey. These sexual partnering groups allow for comparisons of behaviors by both an individuals' number of partners in the past year and the reported presence of PPNM in a sexual relationship. We also performed a sensitivity analysis in which we expanded the definition of PPNM to include those who "don't know" if their partner was having sex with other people concurrently (63 women, 76 men). The main analytic sample included 5868 women and 5330 men.

Subsample Analysis

To examine relationship type, we examined a subset from the main analytic sample (i.e., sexually active, unmarried and non-cohabiting) of 3483 women and 3079 men aged 15 to 44 years. Respondents in the subsample were included if they had (1) applicable data on the relationship with their most recent sex partner at last sex, a variable in the interviewer-administered portion of the NSFG interview (CAPI) and (2) were interviewed in 2013 to 2015 and 2015 to 2017. In CAPI, sex is defined solely as vaginal intercourse; hence, relationship type was not asked of 189 women and 219 men who reported they had never had sex but then went on to report any type of sexual contact, whether vaginal, oral or anal, in ACASI. Two questions capturing new information about recent sex partners and relationship type were added in 2013; thus, subsample analyses for both women and men were limited to the 2013 to 2015 and 2015 to 2017 fieldwork periods. Coding strategy for relationship type matches that in a previous report.[14] A 4-year case weight for 2013 to

2017 NSFG data was used for subsample analyses. Over half of women (64.4%) and men (57.6%) reported their last sex was with a steady partner (Supplemental Digital Content 1, http://links.lww.com/OLQ/A407).

Measures

Outcomes for this analysis included 2 separate questions about condom use at most recent vaginal or anal sex act and STI testing in the past year. Participants who had both vaginal and anal sex and answered "no" to either question were classified as not using a condom at last sex. We used this method to categorize condom use because it is not possible to determine if vaginal and anal sex occurred at the same time, or at different times. For women, STI testing in the past year was measured using the question: "In the last 12 months, have you been tested for chlamydia?" followed by, "In the past 12 months, have you been tested for any other sexually transmitted disease like gonorrhea, herpes, or syphilis?" Men were asked only the second question that included chlamydia testing. Covariates included age at interview, race/ethnicity and poverty income ratio (household income as a percentage of the US federal poverty level according to the NSFG). Because poverty status did not show significant differences within sexual partnering groups, it was dropped from multivariable analyses.

Statistical Analysis

Statistical analysis was conducted using SAS version 9.4 (SAS Institute Inc., Cary, NC) and SUDAAN 11.0.1 (Research Triangle Institute, Durham, NC). SAS survey procedures were used to calculate percent of sexually active unmarried, non-cohabitating men and women in the United States ages 15 to 44 years in 4 sexual partnering groups. We used the Rao-Scott χ^2 statistic to compare demographic and behavioral characteristics across groups. Multivariable logistic regression models were used to estimate adjusted prevalence ratios (aPRs), along with 95% confidence intervals (CI), to determine the association between sexual partnering groups, condom use and STI testing. These models were adjusted for age at interview and race/ethnicity. In multivariable analyses, all sexual partnering groups were compared with those who had only 1 partner in the past year and no PPNM. To assess the association between PPNM and STI risk reduction behaviors for women and men with multiple past-year partnerships, we also ran these models using those with 2 or more partners in the past year and no reported PPNM as the reference group. We do not show these results in a table; however, we report all significant differences below. All analyses accounted for the complex sampling design and weighting of the NSFG.

RESULTS

About half of the sample (women, 54.2%; men, 47.2%) had 1 opposite-sex partner in the past year and no PPNM (Tables 1 and 2). Overall, 39.4% of women and 48.3% of men reported multiple partnerships and 23.4% and 24.0% reported PPNM. Of those who reported 2 or more partners in the past year and no PPNM, a higher percentage were aged 15 to 24 years, whereas the percentages of those with 2 or more partners and PPNM did not differ across age groups (approximately 50%). Men and women who reported 2 or more partners

and PPNM were more likely to be non-Hispanic white than the other race/ethnic groups shown.

Overall, women and men with PPNM reported lower condom use at last sex (Table 3). Women who reported 1 partner in the past year and PPNM were less likely to use condoms at last sex than women who had 1 partner and no PPNM (29.3%; 95% CI, 22.5–36.2 vs 39.3%; 95% CI, 36.6–41.9) even after adjustment for covariates (aPR, 0.78; 95% CI, 0.62–0.98). Lower condom use was also seen for women and men who had 2 or more partners in the past year and PPNM than those with only 1 partner and no PPNM (women aPR, 0.71; 95% CI, 0.60–0.85; men aPR, 0.68; 95% CI, 0.59–0.78). When treating 2 or more partners and no PPNM as the reference group, results were similar (data not shown, women aPR, 0.64; 95% CI, 0.48–0.87; men aPR, 0.70; 95% CI, 0.60–0.81).

Having had 2 or more sex partners in the past year or PPNM were both associated with past-year STI testing (Table 3). Compared with those with 1 partner in the past year and no PPNM, women and men who had 2 or more partners and PPNM were 1.5 times (95% CI, 1.34–1.56) and 2 times (95% CI, 1.81–2.35) more likely to seek STI testing in the year prior to interview. Similar, but attenuated, results were seen when those with 2 or more partners in the past year and no PPNM was used as the reference group (data not shown, women aPR, 1.24; 95% CI, 1.12–1.37; men aPR, 1.30; 95% CI, 1.11–1.52). When expanding the definition of PPNM to include those who reported they "don't know" if their partner had other sex partners during their sexual relationship, associations between sexual partnering groups, condom use and STI testing were similar (data not shown).

The above associations were similar when stratifying by type of partner at last sex ("steady" vs. "casual") (Table 4). In both relationship strata, condom use at last sex was lower among women and men who reported PPNM compared with those who did not. Similarly, STI testing in the past year was higher for women with PPNM regardless of whether last sex partner was steady (aPR, 1.29; 95% CI, 1.15–1.43) or casual (aPR, 1.23; 95% CI, 1.05–1.45). Among men, the relationship between PPNM and past-year STI testing varied by relationship with their last sex partner. Men who reported their last sex was with a steady partner were more likely to test for STI in the past year if they reported PPNM than not (aPR, 2.00; 95% CI, 1.63–2.45). In contrast, PPNM was not associated with past-year STI testing among men whose last sex partner was casual (aPR, 1.10; 95% CI, 0.85–1.43).

DISCUSSION

Our study updates estimates of multiple past-year partnerships and PPNM previously presented using NSFG among all those sexually active,[15] but to our knowledge, is the first study to show the prevalence of these behaviors in an unmarried and non-cohabiting reproductive-aged population. For most groups, PPNM was associated with lower condom use at last sex. Nasrullah et al[16] reported similarly low rates of condom use at last sex using the NSFG among unmarried, non-cohabiting sexually active adults with HIV-related risk factors, including PPNM (32.3% for women and 46.4% for men). Moreover, a recent study using the National Youth Risk Behavior Surveys showed declines in self-reported condom use from 2003 to 2015 among male and female high school students.[17] Of particular note,

these declines were statistically significant among female students who engaged in other sexual risk behaviors (e.g., 2 or more sex partners in past 3 months).

One possible explanation for the finding of lower condom use among those reporting PPNM than those who did not is that these individuals were more likely to have anal sex without a condom. Because our condom use estimates included use of a condom during both vaginal and anal sex acts (if they had both types of sex), prevalence of condom use was lower for individuals, mostly reporting PPNM, who reported they used a condom during most recent vaginal sex, but not during anal sex (data not shown). Using NSFG, Habel et al[18] found that having PPNM was commonly associated with anal sex and having had multiple vaginal, oral and anal sex partners in the past year. Low condom use partnered with increased anal sex practice, potentially with multiple sex partners, as found in the previous study, may facilitate STI acquisition or transmission.

We also found that STI testing was higher among women and men with 2 or more partners or PPNM compared with those with only 1 partner and no PPNM. Interaction with a health care provider may elicit patient-provider communication about the STI risks associated with having multiple sex partners and prompt education about correct and consistent use of condoms during sexual activity. However, many women and men of reproductive age who may be at increased risk of STI acquisition due to their, or their partner's, sexual behavior may not be receiving recommended STI screening.[19] A Centers for Disease Control and Prevention report using NSFG data indicated that levels of STI testing were suboptimal for individuals for persons aged 15 to 24 years and for those with sexual risk factors for STI infection.[20] In our study, stratifying the STI testing results by age (15–24, 25–44) indicated higher STI testing among those with multiple partnerships or PPNM in both age groups (data not shown).

Although we found no significant difference by relationship type in condom use at last sex among individuals who reported PPNM, results showed men who reported PPNM had a 2-fold increase in STI testing in the past year if their last sex was with a steady sex partner. This finding provides some evidence that STI testing may be used as risk reduction strategy for STI in steady relationships where sex outside the relationship is perceived. Although the cross-sectional design of the NSFG does not allow for a formal test whether STI testing was in lieu of condom use, research has detailed the decline in condom use over time in committed relationships.[21]

Limitations in the present study should be noted. First, NSFG is a cross-sectional survey so it is not possible to determine a temporal association between sexual intercourse, condom use and STI testing during the time frame for these survey items (i.e., condom use at most recent sex, STI testing in past 12 months). Second, social desirability may have affected women and men's responses about their number of sex partners in the past year, their partner's nonmonogamous behavior, their (or partner's) use of condoms or receipt of STI testing, although the placement of these questions in ACASI may help to minimize these biases. Third, reports of PPNM may be inaccurate and may cause under- or overestimation regarding the partner's concurrency. Fourth, the question on PPNM is not partner-specific; it asks the respondent whether any of their sex partners in the past year had concurrent

sex partners. In other words, the last partner reported about (whether concerning condom use or type of relationship they had) may not match the partner referred to when asked about PPNM. Future studies that incorporate direct information from the respondent's sex partners can extend beyond self-reported number of sex partners as the main indicator of STI exposure and can explore variation in STI risk with greater precision.

In general, condom use was lower, and STI testing higher, among sexually active persons aged 15 to 44 years with multiple past-year partnerships and/or reported PPNM. Short, or overlapping, gaps between sex partners increase the opportunity for STI acquisition and transmission. Screening practices that include a standardized sexual risk assessment could identify women and men with multiple sex partners and improve linkage to STI services. Messages directed at sexually active persons should continue to emphasize condoms as the best STI prevention approach whether a sexual relationship is new or well established.

The STI testing among individuals with multiple partners or PPNM could be improved by further investment in point-of-care tests (POC) that facilitate earlier notification of STI results and navigation to treatment. For example, confidential self-testing, whether at home or in a clinic setting, has proven successful in reducing the time from diagnosis to treatment.[22] Availability of rapid POC tests is particularly important for individuals in short or overlapping partnerships where STI transmission potential may be high. EPT (i.e., expedited partner therapy) is another potential strategy to address STI transmission because it is typically acceptable to patients and has been shown to increase the proportion of partners treated.[23] However, EPT continues to be underused,[24] nor has it been clearly shown to decrease the transmission of chlamydia and gonorrhea at the population level.[25] The STI programs and interventions that can maximize testing and treatment of individuals and their sex partners may help control the increasing rates of STIs nationwide.

Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

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TABLE 1.

Demographic Characteristics in Past Year Among Unmarried, Non-Cohabiting Sexually Active Women Aged 15–44 Years by Number of Partners in the Past Year and Perceived Partner Nonmonogamy, 2011–2017

Characteristics	1 Partner, no PPNM		1 Partner, PPNM		2 or more Partners, no PPNM		2 or more Partners, PPNM		P*
	Unweighted n	Weighted Percent (95% CI)	Unweighted n	Weighted Percent (95% CI)	Unweighted n	Weighted Percent (95% CI)	Unweighted n	Weighted Percent (95% CI)	
Total†	n = 3247	54.2 (52.1–56.2)	n = 384	6.4 (5.4–7.4)	n = 1277	22.4 (20.6–24.2)	n = 960	17.0 (15.4–18.6)	
Age									
15–24	1388	48.2 (45.5–50.9)	115	31.0 (23.8–38.1)	636	54.3 (50.2–58.3)	427	49.7 (45.0–54.4)	<0.0001
25–44	1859	51.8 (49.1–54.5)	269	69.0 (61.9–76.2)	641	45.7 (41.7–49.8)	533	50.3 (45.6–55.0)	
Hispanic origin and race									
Hispanic	780	22.5 (19.4–25.7)	74	21.4 (14.6–28.1)	248	18.5 (15.1–22.0)	175	17.1 (13.0–21.3)	0.0266
Non-Hispanic white	1139	44.3 (40.5–48.0)	128	42.1 (33.4–50.8)	517	49.3 (44.6–54.2)	407	49.0 (43.6–54.4)	
Non-Hispanic black	1045	23.5 (20.2–26.8)	158	31.6 (24.2–39.0)	400	21.0 (17.1–24.9)	300	24.7 (20.0–29.3)	
Poverty income ratio									
Below poverty level	1381	34.8 (31.7–37.8)	158	36.4 (28.7–44.1)	566	39.9 (35.8–44.1)	335	31.8 (27.3–36.3)	0.0746
Above poverty level	1866	65.2 (62.2–68.2)	226	63.6 (55.9–71.3)	711	60.1 (55.9–64.2)	625	68.2 (63.7–72.7)	

Percentages may not add to 100 due to rounding.

*
Results based on Rao-Scott modified χ^2 tests. Bold indicates $P < 0.05$.

†
Includes persons of other or multiple race and origin groups, not shown separately.

TABLE 2.

Demographic Characteristics in Past Year Among Unmarried, Non-Cohabiting Sexually Active Men Aged 15–44 Years by Number of Partners in the Past Year and Perceived Partner Nonmonogamy, 2011–2017

Characteristics	1 Partner, no PPNM[†]		1 Partner, PPNM		2 or more Partners, no PPNM		2 or more Partners, PPNM		P[*]
	Unweighted n	Weighted Percent 95% CI	Unweighted n	Weighted Percent 95% CI	Unweighted n	Weighted Percent 95% CI	Unweighted n	Weighted Percent 95% CI	
Total[†]	n = 2421	47.2 (45.2–49.3)	n = 235	4.4 (3.6–5.2)	n = 1619	28.7 (26.9–30.6)	n = 1055	19.6 (18.0–21.3)	
Age									0.0322
15–24	1262	53.7 (50.9–56.7)	102	46.5 (36.4–56.6)	881	57.7 (54.2–61.2)	451	50.0 (44.8–55.2)	
25–44	1159	46.2 (43.3–49.1)	133	53.5 (43.4–63.6)	738	42.3 (38.8–45.7)	604	50.0 (44.8–55.2)	
Hispanic origin and race									<0.0001
Hispanic	543	19.8 (16.7–22.8)	52	21.3 (13.1–29.6)	392	22.3 (18.6–26.0)	165	15.1 (11.5–18.7)	
Non-Hispanic white	1147	56.3 (52.6–60.0)	97	44.7 (35.2–54.2)	651	49.1 (44.9–53.3)	506	56.3 (51.1–61.6)	
Non-Hispanic black	448	12.2 (10.1–14.3)	64	21.3 (13.7–28.9)	448	19.7 (16.2–23.2)	318	21.1 (17.1–25.1)	
Poverty income ratio									0.3533
Below poverty level	600	21.9 (19.5–24.2)	73	28.2 (19.4–37.0)	406	22.2 (19.4–25.0)	239	20.6 (17.1–24.2)	
Above poverty level	1821	78.1 (75.8–80.5)	162	71.8 (63.0–80.6)	1213	77.8 (75.0–80.6)	816	79.4 (75.8–82.9)	

Percentages may not add to 100 due to rounding.

[*] Results based on Rao-Scott modified χ^2 tests. Bold indicates $P < 0.05$.

[†] Includes persons of other or multiple race and origin groups, not shown separately.

TABLE 3.

Percentages and APRs of Condom Use and STI Testing Among Unmarried, Non-Cohabiting Sexually Active Women and Men Aged 15–44 Years by Number of Partners and Perceived Partner Nonmonogamy, National Survey of Family Growth, 2011–2017

| | Past-year Behaviors | | | | |
| | Condom Use at Last Sex | | STI Testing | |
Partner Number/PPNM	Weighted Percent	aPR (95% CI)	Weighted Percent	aPR (95% CI)
Women				
One partner, no PPNM	39.3 (36.6–41.9)	Referent	43.3 (40.6–46.1)	Referent
One partner, PPNM	29.3 (22.5–36.2)	0.78 (0.62–0.98)	57.5 (49.5–65.6)	1.24 (1.09–1.42)
2 or more partners, no PPNM	38.2 (33.6–42.8)	0.95 (0.82–1.11)	52.4 (48.2–56.5)	1.20 (1.10–1.32)
2 or more partners, PPNM	28.5 (24.1–32.9)	0.71 (0.60–0.85)	64.3 (60.0–68.6)	1.45 (1.34–1.56)
Men				
One partner, no PPNM	54.9 (51.9–57.9)	Referent	16.0 (14.1–17.8)	Referent
One partner, PPNM	52.9 (43.4–62.3)	0.96 (0.80–1.14)	22.0 (15.0–29.1)	1.21 (0.93–1.57)
2 or more partners, no PPNM	55.8 (51.8–59.7)	0.98 (0.89–1.07)	29.0 (25.7–32.3)	1.62 (1.39–1.89)
2 or more partners, PPNM	37.7 (33.5–41.8)	0.68 (0.59–0.78)	37.2 (33.1–41.4)	2.06 (1.81–2.35)

Adjusted models control for age and race/ethnicity.

TABLE 4.

APRs of Condom Use and STI Testing Among Unmarried, Non-Cohabiting Women and Men Aged 15–44 Years by Perceived Partner Nonmonogamy, Stratified by Relationship Type at Last Sex, National Survey of Family Growth, 2013–2017

	Past-year Behaviors	
	Condom Use at Last Sex	STI Testing
Reported PPNM in Past Year	**aPR, 95% CI**	**aPR, 95% CI**
Women		
Steady Partner		
Reported PPNM	0.73 (0.55–0.98)	1.29 (1.15–1.43)
Did not report PPNM	Referent	Referent
Casual partner		
Reported PPNM	0.74 (0.57–0.96)	1.23 (1.05–1.45)
Did not report PPNM	Referent	Referent
Men		
Steady partner		
Reported PPNM	0.57 (0.42–0.77)	2.00 (1.63–2.45)
Did not report PPNM	Referent	Referent
Casual Partner		
Reported PPNM	0.65 (0.55–0.77)	1.10 (0.85–1.43)
Did not report PPNM	Referent	Referent

Adjusted models control for age and race/ethnicity.