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# Concurrent Sexual Partnerships Among Young Heterosexual Adults at Increased HIV Risk: Types and Characteristics

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## Abstract

**Background—**The impact of concurrency on STI transmission depends upon coital frequency, condom use, duration of relationship overlap, and number of partners. Previous research has identified distinct concurrency types; however, little is known about their risk characteristics.

**Methods—**Men (n=261) and women (n=275) ages 18-30 years at increased risk of acquiring HIV were recruited from community locations in Los Angeles. Participants completed four in-person interviews over 12 months. Partnership data were used to characterize the prevalence of four types of concurrency: *transitional (*two overlapping relationships in which the first relationship ended before the second); *single day (*a second relationship of one day's duration during the course of another relationship); *contained* (a second relationship longer than 1 day began and ended during the course of another); and *multiple* (three or more overlapping relationships). Multilevel random intercept models were used to estimate mean coital frequency, proportion of condom-protected acts, total duration of overlap, and lifetime sex partners.

**Results—**At baseline, 47% of male and 32% of female participants reported any type of concurrency in the previous 4 months, and 26% of men and 10% of women reported multipleconcurrencies. Condom use ranged from 56% - 64%, with the highest use in transitional concurrency (61% for men, 68% for women) and the lowest in contained (52% for men, 54% for women). Coital frequency, total overlap, and lifetime sex partners also varied by concurrency type.

**Conclusions—**Inconsistent condom use and repeated opportunities for exposure characterize common types of concurrency among high-risk young adults.

## INTRODUCTION

Young adults aged 20-24 have the highest rates of reported chlamydia and gonorrhea infection (2,502 and 520 per 100,000 population, respectively, in 2012)[1] and also have the highest rate of HIV diagnoses of any age group (36 per 100,000 population, in 2011).[2] Concurrent sexual partnerships, or those that overlap in time, are most common in early adulthood[3] and are a risk factor for STI transmission and acquisition.[4,5]

Previous research has suggested wide variations in patterns and characteristics of concurrency, which have important implications for the spread of STIs in a population. Gorbach and colleagues described common types of concurrency in a study of urban, clinic patients.[6] They proposed that some types might be riskier than others. For example, transitional concurrency is an overlap that occurs between two primary partners, as one partnership ends and the other begins. Because condom use in a primary partnership, characterized by trust and commitment, is lower than with casual partners,[7] the risk for introducing STIs is likely higher among transitional concurrency. Among young respondents, transitional concurrency and experimental concurrency (overlapping short relationships with casual partners) were both common; however, the risk associated with experimental concurrency was characterized as low due to higher condom use.

Population-level data also support the characterization of experimental concurrency as lower risk due to higher condom use. In an analysis of 2002 *National Survey of Family Growth* (NSFG) data, of the 11% of U.S. men who had concurrent partners in the previous year, men engaged in experimental concurrency (defined as first and last sex with a second partner in the same month during an ongoing partnership) were less likely than men in concurrent partnerships of longer duration to report no condom use with either partner. [8]

Other characteristics of concurrent partnerships may also increase risk, such as the duration of relationship overlap and coital frequency within partnerships. Morris and colleagues [9] found higher prevalence of concurrency together with longer duration of overlap and higher coital frequency in populations with greater HIV epidemic severity.[8] Although some studies have investigated risk behaviors and other individual factors, such as lifetime number of sexual partners, associated with engaging in concurrency, [10,11,12] only a few studies have characterized types of concurrency by partnership level factors that contribute to STI risk, specifically, condom use, duration of relationship overlap, and coital frequency. Understanding the types of concurrency and their characteristics among young adults at increased risk for HIV/STI may be helpful for developing disease control measures to reduce HIV/STI transmission among this population. This study had two objectives: 1) identify the frequency and types of concurrency during the course of one year in young adults at elevated risk of HIV; and 2) estimate the mean coital frequency, frequency of condom use, duration of overlap, and lifetime number of sexual partners associated with each concurrency type.

## MATERIALS AND METHODS

### Participants

The Project on Partner Dynamics (POPD) is a longitudinal study of relationship dynamics and sexual behavior of young men and women at increased risk for acquiring HIV. Purposive sampling was used to recruit participants directly from community organizations, college campuses, STD and family planning clinics, and indirectly through online and print advertisements in the Los Angeles area between September 2006 and August 2008. Inclusion and exclusion criteria were based on previous research and developed to ensure that recruitment yielded a diverse, high-risk sample. Eligible participants were 18 to 30 years old and reported heterosexual vaginal or anal intercourse without a condom at least once in the previous 3 months. Participants also had to have, or have a current or recent sexual partner who had, one of the following risk factors: more than one sex partner in the previous year; history of STI treatment in the previous two years; sex with a partner who had an STI in the previous year or who was HIV+; or history of injection drug use. Pregnant women and those who were HIV+ or who expected to move from the area within the year were excluded.

### Data Collection

In-person, computer-assisted interviews were administered using Questionnaire Development System (QDS) software (Nova Research Company, Silver Spring, MD), with interviewers matched to participants on gender and, in most cases, race/ethnicity. Participants completed four interviews over one year (baseline, 4-months, 8-months, 12-months) and were compensated $30, $35, $40, and $45, respectively. The Institutional Review Boards of all participating institutions approved the protocol and materials.

Short (four-month) reporting periods were used to improve recall accuracy. At each interview, participants were asked about the number of sexual partners in the previous four months and provided a nickname for each. Nicknames were used to link data about partners across interviews. For each partner, the participant provided the date (day, month, and year) of their most recent sexual intercourse (vaginal or anal). If the partner was new, the date of first sex was also obtained. Additionally, for each sexual partner reported, participants were asked, “How many times have you had vaginal or anal intercourse with [*nickname*] during the past 4 months?” and “During how many of those times did you use a condom?”

We enrolled 536 participants at baseline. At 4 months, 8 months, and 12 months, a total of 435, 377 and 330 individuals were interviewed, respectively, for a retention rate from baseline of 81%, 70% and 62%. We carried out extensive range and consistency checks on reported intercourse dates and identified ones that were missing, out-of-range, or apparently erroneous and made corrections where possible (e.g., for some dates reported in January, the year was misreported as the previous year). A total of 206 partnerships among 147 participants were excluded due to missing or irreconcilable dates.

## Measures

**Concurrency—**We treated all partnerships as continuous between the dates of first sex and most recent sex, and coded concurrency for each 4-month interval for each participant. Concurrency was defined as a participant reporting two or more partnerships for which dates of first and most recent sex overlapped. For quality assurance purposes, concurrency was identified using a computer program and an independently conducted visual review, with differences reconciled through consultation.

**Concurrency Type—**When a participant had concurrent partnerships in a recall period, his/her concurrency status was classified with one of four mutually exclusive designations based on the pattern and duration of partnership overlap (Figure 1). *Transitional concurrency* was defined as two overlapping partnerships in which the first partnership ended before the second partnership. *Contained concurrency* referred to two overlapping partnerships in which a second partnership longer than one day began and ended during the course of another. *Single day concurrency* was defined as a second partnership of one day's duration reported during the course of another partnership. An interval in which a participant's overlapping partnerships involved three or more partners (not necessarily simultaneously) was classified as *multiple concurrencies*.

**Characteristics of Concurrent Partnerships:** Four characteristics of an individual's involvement in concurrent partnerships were examined: coital frequency, proportion of condom use, duration of overlap, and *lifetime number of sex partners*. *Coital frequency* referred to the number of times the participant reported vaginal or anal intercourse in the past 4 months with each sexual partner and the *proportion of condom use* referred to the proportion of times that a condom was used. *Duration of* o*verlap* referred to the number of days in which the participant was involved in two ongoing sexual partnerships: the number of days between first and last intercourse for the “contained” partnership (contained concurrency), between first intercourse with the later partner and last intercourse with the earlier partner (transitional concurrency), 1 (for single-day concurrency), or a sum of all overlaps (multiple concurrencies). Participants reported the *lifetime number of sex partners* at baseline; the number was updated at each interval as new partners were reported.

## Analysis

Analyses were performed using Stata version 12.0 (StataCorp LP, College Station, TX). First, we generated descriptive statistics for the study population at baseline, using T-tests and chi-square tests to assess differences by gender. To describe the longitudinal data, we used the *xttab* command in Stata. For the four concurrency types, we used a series of multi-level random intercept models to estimate mean coital frequency, proportion of condom-protected coital acts, mean duration of overlap, and mean lifetime number of sex partners. The models accounted for clustering (of partnerships within participants and of interviews within participants; some partnerships were reported at multiple interviews). For mean coital frequency and proportion of condom-protected coital acts, we had three distinct levels of data: observations nested in partnerships nested in participants. Duration of overlap and lifetime number of sex partners did not vary by partnership; thus these were estimated using two-level models. Percent condom use and duration of overlap were estimated with linear

regression; coital frequency and lifetime number of sex partners were estimated using Poisson regression. In addition to concurrency type, gender (and its interactions with concurrency type), time interval, age, race/ethnicity, student status, and years of education were included in all models. Predicted values were calculated for each participant, and these values were used to generate means.

## RESULTS

### Baseline Characteristics

At baseline (Table 1), the mean age was 23 years, with similar proportions reporting non-Hispanic White, non-Hispanic African-American, and Hispanic race/ethnicities. On average, women had slightly more education than men (14.4 and 13.9 years, respectively) and were more likely to be current students. The mean age of first sex was higher among women than men (16.6 years versus 15.8 years, respectively), and men reported a higher average lifetime number of sexual partners (19.0 versus 11.7 for women). More women than men reported a previous STI diagnosis (33% versus 17%, respectively). More men than women reported any concurrency in the previous 4 months (47% versus 32%, respectively). Participants who reported single day concurrency at baseline were more likely to be lost to follow up at 4 months, but there were no other significant associations of attrition with demographic characteristics or concurrency.

### Concurrency Type at Baseline

At baseline, multiple concurrencies (46%) followed by contained concurrency (26%) were the most common types (Table 2). A higher proportion of men than women reported multiple concurrencies (56% versus 32%, respectively), and higher proportions of women than men reported all other types.

### Concurrency over Time

Over the course of the study, concurrency was reported at least once by 156 male participants (60%) and by 118 female participants (43%) (Table 3). The *overall* column refers to the total number of concurrent partnership reports in the study, so that partnerships that extended beyond one recall interval were counted for each interval they spanned. Males reported 922 concurrent partnerships and females 503. Within gender, the concurrency type distributions for these partnerships were similar to those at baseline. The *between* column gives the number of participants who reported that type of concurrency at least once and the percentage they comprise among those with any type of concurrency. Contained concurrency was the most common type among women, and multiple concurrencies the most common among men. The *within* column is a measure of stability and indicates, among those with a particular type of concurrency at any interval, what percentage of their partnership intervals are that type of concurrency. Among both men and women who ever reported multiple concurrencies, over 80% of their concurrent intervals were also multiple concurrencies.

### Characteristics of Concurrency Types

Overall, coital frequency for participants in the previous 4 months was highest among those in contained and single-day concurrent partnerships (5.4 and 5.7, respectively) and lowest among those involved in multiple concurrencies (3.6) (Table 4). The proportion of condom-protected coital acts was lowest among those in the contained concurrency group (53%) and did not differ significantly among the other groups. Duration of overlap was highest among transitional concurrency (130 days), followed by contained concurrency (52 days), and multiple concurrencies (26 days). Finally, lifetime number of sex partners was highest among those with multiple concurrencies (18). Lifetime number of sex partners did not differ significantly among the other groups.

Within each of the concurrency types, females reported fewer lifetime sex partners than did males (Table 5). Women reported higher coital frequency than men across transitional (5.4 versus 3.7) and single-day (7.3 versus 5.0) concurrent partnerships and fewer days of overlap in contained concurrency (34.2 versus 67.5).

There were no significant associations between demographic characteristics other than gender and coital frequency or condom use. Duration of overlap was positively associated with age and negatively associated with Hispanic race/ethnicity. Lifetime number of sex partners was also positively associated with age and negatively associated with years of education and Black race/ethnicity.

## DISCUSSION

In this study, we use longitudinal, partnership-specific data to describe types of concurrency observed among an ethnically-diverse sample of young adults at increased risk of HIV/STI over twelve months and assess characteristics of concurrent partnerships that are directly related to STI risk. Consistent with our recruitment of heterosexuals with elevated HIV risk, the proportions of participants reporting concurrency were higher in our study than in national surveys. About a third of women in our study reported concurrency in the previous 4 months as compared with 23% of women aged 18-24 years in the National Survey of Family Growth (NSFG) who reported concurrency within the last five years.[13] Almost half of male participants reported at least one concurrent partnership in the previous 4 months as compared with NSFG data in which 12% of sexually-experienced men reported concurrency in the previous year.[10] However, our estimates were similar to those reported in a random-digit dialing survey of young adults in Seattle in which 27% of men and 18% of women reported concurrency during their most recent relationship.[5]

Comparisons of concurrency types across studies are complicated by differing definitions of concurrency types. We categorized *transitional* and *contained* concurrency following Doherty and colleagues [8] in their analysis of NSFG data. However, partnership dates in the NSFG are limited to month and year, so *contained* was defined as lasting at least one month, whereas *contained* in our study was defined as lasting more than one day. Likewise, *experimental* was defined in the NSFG analysis as overlapping for one month. Because our data included day, month, and year, we created the concurrency type, *single-day*, to capture “one-night stands”, which we expected to be closely related to *experimental* concurrency in

regard to condom use, but also a distinct type whose STI risk characteristics would be valuable to explore.

Single-day concurrency was less common among both young men and women than was contained concurrency, which was somewhat surprising given that previous work suggested experimental concurrency is common among young adults.[6] It may be that our contained concurrency category included some partnerships that would have been categorized as experimental in other studies; however, the estimated mean duration of overlap for contained concurrency was over 49 days. The STI risk associated with contained concurrency is likely higher, given the overlap, than that for experimental concurrency.

Multiple concurrencies were the most common concurrency type we observed. A multiple concurrencies type has not been reported in previous studies, with the exception of NSFG analyses. Among men in the national sample reporting concurrency in the previous 12 months, over 70% reported one pair of concurrent partnerships, 15% reported two pairs, and 14% had three pairs. Similar to overall concurrency prevalence, reporting of multiple concurrencies is significantly higher in our study. The relatively high prevalence of multiple concurrencies is an important finding because multiple concurrencies within a sexual network have an exponentially greater potential to spread STIs as compared with 2-partner concurrency. Further, young men reported multiple concurrencies in higher proportions than did women – 64% of men ever reported concurrency as compared with 38% of women. In this heterosexual sample, higher multiple concurrencies among young men represent a significant risk to female partners. Future research should examine the phenomenon of multiple concurrencies in greater depth.

Overall, the variations in the characteristics of concurrency do not point to one type of concurrency as being clearly riskier than the others. However, different types appear to carry risk for different reasons. In our sample, condom use ranged from 51% - 63%, with those in the multiple concurrencies category reporting the highest use and those in contained concurrency the lowest. As our condom use estimates include all partners in an interval, we cannot make comparisons with other studies examining condom use with 2 partners or categorized by main and casual partners. It is notable that transitional concurrency does not have the lowest condom use, as would have been expected from the qualitative descriptions of concurrency types and condom use.[6] However, the duration of partnership overlap in the transitional category was quite long, suggesting prolonged exposure and higher STI risk. Persons involved in multiple concurrencies, not surprisingly, had the highest lifetime number of sexual partners.

Notable strengths of this work lie in the longitudinal design and the relevance of the study population to HIV/STI control – ethnically diverse, young adults at elevated STI risk but recruited from the community. Because we did not use probability sampling and recruited from the greater Los Angeles area, our results are not generalizable to any specific population. However, the characteristics of our participants are similar to those in other high-risk samples. Although study attrition reached 38% by Time 4, supplemental analyses indicated that attrition was not related to concurrency. Classification of concurrency itself was limited by self-reported, retrospective recall of partnership dates, which may be

inaccurate due to memory failure or recall bias. However, the relatively short recall period of 4 months was intended to reduce the extent of these problems, as did the extensive data cleaning of partnership dates.

All types of concurrency appear to carry risk of STI transmission and acquisition. Given the high prevalence of concurrency observed, more intensive preventive interventions for young adults that operate at multiple levels may be needed. It is critical that health care providers discuss the risks of concurrency with their young adult patients. Broader media campaigns also could be employed to raise awareness of the potential consequences of involvement in extended sexual networks and the part concurrency plays in persistent epidemics of STIs in the U.S.

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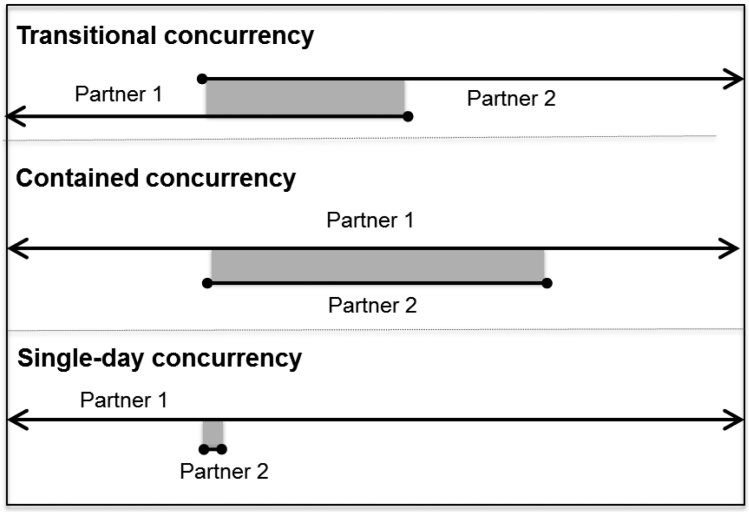
## Summary

In this study of young heterosexual adults at increased risk for HIV, multiple concurrencies were the most common type among men and women. Types of concurrency varied by condom use, coital frequency, total duration of overlap, and lifetime number of sex partners.




Note: Concurrency measured within 4-month intervals. An interval in which a participant's overlapping partnerships involved three or more partners (not necessarily simultaneously) was classified as *multiple concurrencies*.

**Figure 1.**
Concurrency Types with Two Partners

## Table 1

Characteristics of the sample at baseline, by gender

| | Men (N=261) | Women (N=275) | Total (N=536) |
|---|---|---|---|
| **Age, mean years (SD)** | **23.0 (3.8)** | **23.2 (3.7)** | **23.1 (3.8)** |
| Race/ethnicity | | | |
| White | 77 (30%) | 82 (30%) | 159 (30%) |
| African-American | 73 (28%) | 78 (28%) | 152 (28%) |
| Hispanic | 68 (26%) | 81 (29%) | 149 (28%) |
| Other | 43 (16%) | 34 (12%) | 77 (14%) |
| Education, mean years (SD) | 13.9 (2.1) | 14.4 (2.7) | 14.2 (2.4)* |
| Student | 126 (48%) | 154 (56%) | 280 (52%) |
| Employed | 194 (74%) | 204 (74%) | 398 (74%) |
| Has children | 52 (20%) | 46 (17%) | 98 (18%) |
| Age of first sex, mean (SD) | 15.8 (2.5) | 16.6 (2.6) | 16.2 (2.6)*** |
| Lifetime sex partners, mean (SD) | 19.0 (21.8) | 11.7 (14.8) | 15.3 (18.9)*** |
| Previous STI diagnosis | 44 (17%) | 90 (33%) | 135 (25%)*** |
| Concurrency in past 4 months | 122 (47%) | 87(32%) | 209 (39%)*** |

**<.01

*Note*: Percentages may not equal 100 due to rounding.

* <.05

*** <.001

**Table 2**

Type of Concurrency at Baseline, by Gender

| Concurrency Type | Men (N=122) | Women (N=87) | Total (N=209) |
|---|---|---|---|
| Transitional | 12 (10%) | 16 (18%) | 28 (13%) |
| Contained | 28 (23%) | 27 (31%) | 55 (26%) |
| Single-day | 14 (11%) | 16 (18%) | 30 (14%) |
| Multiple | 68 (56%) | 28 (32%) | 96 (46%) |

*Note:* Percentages may not equal 100 due to rounding.

## Table 3

Concurrency Type Status Summary among Male Participants (*n*=156) and Female Participants (*n*=118)

| Concurrency Type | OVERALL | | BETWEEN | | WITHIN | |
|---|---|---|---|---|---|---|
| | Male | Female | Male | Female | Male | Female |
| | ***n* (%)** | ***n* (%)** | ***n* (%)** | ***n* (%)** | **%** | **%** |
| Transitional | 74 (8.0) | 72 (14.3) | 30 (19.2) | 30 (25.4) | 46.3 | 68.4 |
| Contained | 142 (15.4) | 122 (24.3) | 56 (35.9) | 50 (42.4) | 61.0 | 73.1 |
| Single-day | 84 (9.1) | 70 (13.9) | 41 (26.3) | 33 (28.0) | 65.8 | 70.9 |
| Multiple | 622 (67.5) | 239 (47.5) | 99 (63.5) | 45 (38.1) | 81.8 | 83.6 |
| Total | 922 (100) | 503 (100) | 226(144.9) | 158 (133.9) | 69.03 | 74.7 |

Note: The *overall* category refers to the total number of partnership intervals and ignores clustering within participants; *between* refers to the number of participants who were *ever* in a particular type of concurrency; and *within* is conditional on a participant ever having been in a particular type of concurrency, the proportion of intervals that are also that type of concurrency.

## Table 4

Characteristics of Concurrent Partnerships by Concurrency Type

| Characteristic (Estimated Means) | Concurrency Type | | | |
|---|---|---|---|---|
| | Transitional Concurrency | Contained Concurrency | Single-day Concurrency | Multiple Concurrency |
| Coital Frequency | 4.4 [a] | 5.4 [b] | 5.7 [b] | 3.6 [c] |
| Condom Use | 0.6 [a] | 0.5 [b] | 0.6 [a,b] | 0.6 [a] |
| Overlap (in days) | 130.5 [a] | 51.8 [b] | 0.00 [c] | 26.4 [d] |
| Number of lifetime sex partners | 15.0 [a] | 14.7 [a] | 14.1 [a] | 18.3 [b] |

*Note:* In each row, estimates with different superscripts differ significantly ($p<0.05$) from one another. Coital frequency is the estimated number of episodes of vaginal or anal intercourse. Models adjusted for age, race/ethnicity, student status, and years of education.

## Table 5

Characteristics of Concurrent Partnerships by Gender, within Concurrency Type

| Characteristic (Estimated Means) | Concurrency Type | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | Transitional Concurrency | | Contained Concurrency | | Single-day Concurrency | | Multiple Concurrency | |
| | Male | Female | Male | Female | Male | Female | Male | Female |
| Coital Frequency | 3.7 [a] | 5.4 [b] | 5.7 | 5.2 | 5.0[a] | 7.2[b] | 3.5 | 3.5 [a] |
| Condom Use (%) | 61 | 52 | 52 | 54 | 61 | 51 | 63 | 58 |
| Overlap (in days) | 168.8 | 92.3 | 68.0 [a] | 34.2 [b] | 0.0 | 0.0 | 28.1 | 18.9 |
| Number of lifetime sex partners | 18.6 [a] | 11.2 [b] | 17.3 [a] | 11.7 [b] | 15.5 [a] | 12.1 [b] | 21.8[a] | 13.2[b] |

*Note:* Estimates that differ significantly ($p<0.05$) between men and women, within each concurrency type, have different subscripts. Models adjusted for age, race/ethnicity, student status, and years of education.