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Sexual partnership patterns among South African adolescent girls enrolled in STI preventions trial network 068: Measurement challenges and implications for HIV/STI transmission

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Abstract

Background: Estimates of sexual partnership durations, gaps between partnerships, and overlaps across partnerships are important for understanding sexual partnership patterns and developing interventions to prevent transmission of HIV/sexually transmitted infections (STIs). However, a validated, optimal approach for estimating these parameters, particularly when partnerships are ongoing, has not been established. **Methods:** We assessed 4 approaches for estimating partnership parameters using cross-sectional reports on dates of first and most recent sex and partnership status (ongoing or not) from 654 adolescent girls in rural South Africa. The first, commonly used, approach assumes all partnerships have ended, resulting in underestimated durations for ongoing partnerships. The second approach treats reportedly ongoing partnerships as right-censored, resulting in bias if partnership status is reported with error. We propose 2 "hybrid" approaches, which assign partnership status to reportedly ongoing partnerships based on how recently girls last had sex with their partner. We estimate partnership duration, gap length, and overlap length under each approach using Kaplan-Meier methods with a robust variance estimator. **Results:** Median partnership duration and overlap length varied considerably across approaches (from 368 to 1024 days and 168 to 409 days, respectively), but gap length was stable. Lifetime prevalence of concurrency ranged from 28% to 33%, and at least half of gap lengths were shorter than 6 months, suggesting considerable potential for HIV/STI transmission. **Conclusions:** Estimates of partnership duration and overlap lengths are highly dependent on measurement approach. Understanding the effect of different approaches on estimates is critical for interpreting partnership data and using estimates to predict HIV/STI transmission rates.

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Sexual partnership patterns among South African adolescent girls enrolled in HPTN 068: measurement challenges and implications for HIV/STI transmission

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Abstract

Background—Estimates of sexual partnership durations, gaps between partnerships, and overlaps across partnerships are important for understanding sexual partnership patterns and developing interventions to prevent transmission of HIV/STIs. However, a validated, optimal approach for estimating these parameters, particularly when partnerships are ongoing, has not been established.

Methods—We assessed four approaches for estimating partnership parameters using cross-sectional reports on dates of first and most recent sex and partnership status (ongoing or not) from 654 adolescent girls in rural South Africa. The first, commonly used, approach assumes all partnerships have ended, resulting in underestimated durations for ongoing partnerships. The

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second approach treats reportedly ongoing partnerships as right-censored, resulting in bias if partnership status is reported with error. We propose two “hybrid” approaches, which assign partnership status to reportedly ongoing partnerships based on how recently girls last had sex with their partner. We estimate partnership duration, gap length, and overlap length under each approach using Kaplan-Meier methods with a robust variance estimator.

Results—Median partnership duration and overlap length varied considerably across approaches (from 368 to 1,024 days and 168 to 409 days, respectively), but gap length was stable. Lifetime prevalence of concurrency ranged from 28% to 33%, and at least half of gap lengths were shorter than 6 months, suggesting considerable potential for HIV/STI transmission.

Conclusion—Estimates of partnership duration and overlap lengths are highly dependent on measurement approach. Understanding the effect of different approaches on estimates is critical for interpreting partnership data and utilizing estimates to predict HIV/STI transmission rates.

Temporal patterns in sexual partnerships play an important role in HIV and sexually transmitted infection (STI) transmission dynamics. Concurrency in particular has received considerable attention (1–6) because it is hypothesized to contribute to rapid, extensive spread of HIV and other STIs (7–10). However, not all patterns of concurrency confer the same level of transmission risk (11–14), and other partnership patterns beyond concurrency can influence transmission. Sexual partnership duration (15–17), gap length between partnerships (15, 16, 18–22), and overlap length across concurrent partnerships (15, 16, 23) are important determinants of the rate and reach of HIV/STI transmission, and capture temporal patterns in partnerships that are missed by standard measures of concurrency (11). Measuring these patterns and understanding how they impact HIV/STI transmission are critical for developing targeted interventions to prevent transmission.

Estimating temporal patterns requires a clear definition of sexual partnerships and rules for its operationalization. Sexual partnerships are commonly defined as the time between date of first sex (partnership start) and date of last sex (partnership end) (15–20, 22). The date of partnership end can be difficult to establish if a partnership is ongoing at the time of data collection because the respondent can only provide the date of most recent sex (i.e., the date she/he last had sex with the partner before the interview), not the date of true last sex. To address this issue, some studies assess whether participants believe that their partnerships are ongoing and incorporate this information into analyses.

To date, there have been two main approaches for measuring partnership duration. One approach, which we call the “first-generation” approach, typically does not gather information about partnership ongoing status and thus assumes all partnerships have ended at the time of data collection (i.e. assumes that most recent sex is truly last sex). Under this approach, partnership duration is estimated by taking the difference between the dates of first and most recent sex (15, 16, 24). When partnerships have truly ended, this approach estimates partnership duration (Figured 1A, 1C). When partnerships are ongoing, this approach underestimates partnership duration (Figures 1B, 1D) (17) and concurrency (Figures 1F, 1H) because it misclassifies ongoing partnerships as ended rather than right-censoring them. Nevertheless, this approach does evaluate partnerships as they are at the time of the interview without introducing error/uncertainty due to respondents predicting future sex.

Another approach, which we call the “second-generation” approach, assesses partnership ongoing status and incorporates this information by taking the difference between dates of first and most recent sex if the partnership has reportedly ended, and first sex and interview if the partnership is reportedly ongoing. Partnership durations are then estimated using Kaplan-Meier methods, and reportedly ongoing partnerships are right-censored (Figures 1C, 1D) (17). However, if respondents incorrectly determine whether partnerships are ongoing, this approach biases partnership duration and concurrency (Figures 1B, 1C, 1F, 1G) (11, 25, 26).

Given these concerns, we explore an alternative “hybrid” approach where respondents still classify partnerships as ongoing/ended, but only those reportedly ongoing partnerships in which sex occurred recently are right-censored (where “recently” is defined as the past 3 or 6 months).

We examine how estimates of partnership duration, gap length, and overlap length vary under the first-generation, second-generation, and hybrid approaches in a cohort of sexually active adolescent girls living in rural South Africa. In addition, we estimate the lifetime prevalence of concurrency and assess the potential for rapid HIV/STI transmission in relation to estimated gap lengths.

METHODS

Study design, setting, and population

This secondary analysis uses baseline data from the HIV Preventions Trial Network (HPTN) 068 study, a randomized controlled trial of cash transfers for HIV prevention among 2,533 unmarried school girls, ages 13–20. Baseline data were collected between March 2011 and December 2012 from young women living in rural Mpumalanga Province, South Africa in households situated in the Agincourt Health and Sociodemographic Surveillance System (AHDSS) (27). This study focuses on a sub-cohort of 654 adolescent girls who reported ever having sex at baseline and provided information on the date of first sex, date of most recent sex, and partnership status (ongoing or not) for at least one sexual partnership.

Ethics approval for the study was obtained from the University of North Carolina Institutional Review Board, the University of the Witwatersrand Human Subjects Ethics Committee, and the Mpumalanga Departments of Health and Education. Assent and informed consent were obtained from the girls and their parent/legal guardian, respectively, at study enrollment.

Data collection

Adolescent girls were interviewed using audio computer assisted self-interview (ACASI) at study enrollment about the exact date of first sex (What was the month, day, year that you first had sex with [partner]?), date of most recent sex (What was the month, day, and year that you last had sex with [partner]?), and partnership status (Is this partnership ongoing or ended?) at the time of interview for their three most recent sexual partners. In situations where one partnership ended on the same day that another partnership started, we assumed that the partnerships were separated by a gap of 0,5 days. Partnerships with implausible start or end dates (e.g., date of first sex was after the date of most recent sex, date of most recent sex was before the date of first sex) or missing start or end dates were excluded from the analysis (with the exception of reportedly ongoing partnerships with missing end dates under the second generation approach, where we assumed the date of the interview was equal to the date of most recent sex). We did not limit the time period during which girls could report on their sexual partnerships, avoiding the length time bias that can be introduced when sampling windows (such as allowing participants to only report on partners in the past year) are used (17).

Data analysis

We used information on date of first sex, date of most recent sex, and partnership status (ongoing or ended) to estimate median partnership duration, gap length between partnerships, and overlap length across concurrent partnerships. We used four measurement approaches that implemented different rules in determining when partnerships had ended (Table 1). We first calculated crude partnership durations, gap lengths, and overlap lengths under each approach before estimating the distributions of these measures using Kaplan-Meier with a robust variance estimator to account for correlation due to girls reporting multiple partnerships (28). Across all approaches, crude values that equaled zero were re-assigned a value of 0.5 days to enable their inclusion in the Kaplan-Meier distribution. All analyses were performed using SAS v.9.3 (SAS Institute, Cary, NC).

Defining and estimating partnership parameters: first-generation approach— Under the first-generation approach, we assumed that all partnerships ended at the time of most recent sex regardless of reported ongoing status. We calculated crude partnership duration by taking the difference between the date of first sex and most recent sex (Figure 1A–1D). Among sets of non-concurrent partnerships, we calculated crude gap length by taking the difference between the date of most recent sex for the earlier partner (MR_1) and the date of first sex for the newer partner (F_2) (where "earlier" vs. "newer" is determined by the date of first sex) (Figure 1E–1H). Among concurrent partnerships, we calculated crude overlap length following methods outlined in Powers et al. (15) and Mercer et al. (20). If the partnerships were partially contained (i.e. one partnership partially overlapped another), we calculated overlap length by taking the difference between the date of first sex for the newer partner (F_2) and the date of most recent sex for the earlier partner (MR_1). If one partnership was completely contained in the other, we calculated overlap length by taking the difference between the dates of first (F_2) and most recent sex (MR_2) for the fully contained partnership. We then estimated the distribution of these crude measures – partnership duration, gap length, and overlap length – using a Kaplan-Meier approach assuming no censoring.

Defining and estimating partnership parameters: second-generation approach —Under the second-generation approach, we assumed that if partnerships were reportedly ongoing, sex would continue up to and past the date of the interview. Therefore, we reassigned the date of most recent sex to the date of the interview in these partnerships.

Importantly, this reassignment changed concurrent partnerships that were completely contained under the first-generation approach to partially contained under the second-generation approach, if the newer partnership was reportedly ongoing. It also changed concurrent partnerships that were partially contained under the first-generation approach to completely contained under the second-generation approach, if the earlier partnership was reportedly ongoing but the newer partnership reportedly ended. Finally, partnerships that were separated by a gap under the first-generation approach became concurrent under the second-generation approach, if the earlier partnership was reportedly ongoing.

Under this approach, both partnership duration and overlap length could be ongoing. Overlaps were considered ongoing if both concurrent partnerships were reportedly ongoing. We treated ongoing partnerships and overlaps as right-censored when estimating their distribution using a Kaplan-Meier estimator. For partnerships or overlaps that reportedly ended, and for all gaps, we calculated crude estimates according to the first-generation approach and treated these measures as not censored.

Defining and estimating partnership parameters: hybrid-6 month approach— We followed the second-generation approach for estimating partnership durations, gap lengths, and overlap lengths, but instead of basing censoring determination solely on self-reported partnership status, we considered partnerships to be right-censored (i.e. ongoing) only if the girl reported: 1) that the partnership was ongoing, and 2) that she had sex with her partner within the last 6 months (i.e. time from most recent sex to interview was ≤180 days). If a partnership was reportedly ongoing but there was no sexual activity in the last 6 months, we administratively ended the partnership at the time of most recent sex and treated it as not censored in the analysis.

Defining and estimating partnership parameters: hybrid-3 month approach— We took the same approach described under the hybrid-6 month approach, except we used a cut-off of 3 months to administratively end partnerships.

Assessing implications for HIV and STI transmission: concurrency and short gap lengths that can facilitate transmission—Lifetime concurrency status was determined using self-reported dates of first and most recent sex for the 3 most recent sexual partnerships and was defined as having any partnership set where the date of first sex for the newer partner occurred before the date of most recent sex for the earlier partner.

Serially monogamous partnerships can facilitate HIV/STI transmission if the gap length between partnerships is shorter than the remaining, highly infectious early HIV infection period or shorter than the remaining infectious period for an STI (18, 20). We explored the potential for transmission by short gap lengths between serially monogamous partnerships by estimating the percentage of partnership gaps that were shorter than 3, 6, 9, 12, and 24 months, choosing these cut points to approximate infectious periods of common STIs and the early HIV infection period. We also generated Kaplan-Meier survival curves of the distribution of gap lengths across the four approaches to examine their relationships to the infectious periods of selected STIs and early HIV infection.

RESULTS

Of the 2,533 adolescent girls eligible for the parent study, we excluded 1,840 girls who reported no history of sex, 32 sexually experienced girls with missing dates of first/most recent sex for their only reported sexual partnership, and 7 sexually experienced girls who reported a future date of first sex for their only reported sexual partnership. The remaining 654 girls were eligible for analysis and contributed a total of 1,066 sexual partnerships.

Mean age was 17 years, mean age at first sex was 14.6, and 85% of girls reported ≤3 lifetime sexual partners (Table 2). Sixty-five percent of girls reported that their most recent partner was >2 years older and 41% reported not using a condom at last sex. Six percent of girls were HIV-positive (N=40) and 13% had HSV-2 (N=84).

Partnership duration, gap length between partnerships, overlap length across partnerships

Median partnership duration ranged from 368 days (95% CI: 338, 424) to 1,024 days (95% CI: 810, 1,531) under the first- and second-generation approaches (Table 3), respectively. Both hybrid approaches produced intermediate estimates (387 and 595 days), with the shorter estimate under the hybrid-3 month approach. Under the hybrid-6 month and hybrid 3-month approaches, we administratively ended 12% (n=125) and 19% (n=200) of all reportedly ongoing partnerships, respectively.

Estimated gap lengths were relatively stable across approaches, with median values ranging from 143 days (95% CI: 96, 194) under the first-generation approach to 185 days (95% CI: 137, 262) under the second-generation approach (Table 3). Both hybrid approaches were within this narrow range.

Median overlap length across concurrent partnerships ranged from 168 days (95% CI: 101, 237) under the first-generation approach to 409 days (95% CI: 274, 919) under the second-generation approach (Table 3). Estimates from both hybrid approaches were intermediate, with a shorter overlap estimate from the three-month approach (185 days) than the six-month approach (240 days).

Implications for HIV/STI transmission

The lifetime prevalence of concurrency was stable across the four approaches, ranging from 28% to 33% (Table 4). The proportion of gaps shorter than 3, 6, 9, 12, and 24 months was also consistent across approaches, ranging from 32% to 39%, 50% to 55%, 61% to 67%, 69% to 73%, and 88% to 90%, respectively (Table 5). The distribution of estimated gap lengths suggests considerable potential for short gap lengths between serially monogamous partnerships (Figure 2) to facilitate transmission of HIV and several common STIs.

DISCUSSION

We estimated sexual partnership durations, gap lengths between partnerships, and overlap lengths across concurrent partnerships among sexually experienced adolescent girls living in rural South Africa. Adolescent girls in this context are at extremely high risk for HIV acquisition (29) and their partnership patterns may have important implications for disease transmission. These girls reported long sexual partnerships, which can reduce the risk of HIV/STI acquisition when partnerships are monogamous and both partners are uninfected. However, the girls also reported high levels of concurrency and short gaps between partnerships, which can facilitate transmission (18, 20). Gap length may be especially important for STIs with short infectious periods like gonorrhea, which can be sustained in a population when only a small group of individuals exhibit short gaps and medium partnership lengths (18).

We relied on cross-sectional data which poses challenges for estimating ongoing partnership parameters, including partnership duration and the prevalence and length of concurrency. Specifically, such data forces us to rely on girls' ability to predict their future sexual behavior rather than directly measuring this behavior longitudinally. Studies that longitudinally collect partnership data do not require participants to predict future behavior, but they do not fully eliminate the problem of censoring due to ongoing partnerships at the end of a cohort study. An optimal approach for addressing ongoing partnerships is still needed for both cross-sectional and longitudinal data.

Estimates of these parameters are important for HIV/STI transmission modeling and for understanding the potential impact of prevention programs. However, there are considerable challenges in how these parameters are estimated, and a validated, optimal approach has not been established. Kaplan-Meier approaches that rely on self-reported partnership ongoing status (i.e., the "second-generation" approach) have been recommended for partnership duration estimation (15, 17, 18), but neither the reliability of such self-reports nor the effects of different assumptions about their reliability have been assessed. We addressed the latter issue and found that estimates of partnership duration and overlap length varied considerably across approaches (e.g., the hybrid-3 month approach employed a more "stringent" definition of ongoing partnership than the hybrid-6 month or second-generation approaches, resulting in shorter durations).

Notably, we observed many cases where girls reported that partnerships were ongoing even when more than six months had passed since most recent sex. This finding may suggest that adolescents have difficulty determining when a partnership is "ongoing" and that analysis approaches reliant on self-report for determining censoring may be unreliable. Alternatively, if these girls are in fact accurately forecasting future sexual contact with their partners, these findings could suggest that long breaks in sexual activity are common in this population. Indeed, long partnerships may be interspersed with breaks due to a migrant partner (30) or because partners break up and get back together again (24). On-again/off-again partnerships may be particularly common among adolescents who are experimenting sexually with different partners.

Thus, our results not only highlight how sensitive estimates are to how censored status is determined, they also raise fundamental questions about how partnerships are defined for studying HIV/STI transmission. One under-appreciated feature of the second-generation approach is that it administratively adds time (equal to the time between most recent sex and interview) to reportedly ongoing partnerships when we explicitly know that sex did not occur during this period. Because many applications of these types of partnership duration estimates assume that within-partnership behaviors are constant across the entire estimated duration, any resulting transmission rate predictions may be exaggerated. In sum, the standard definition of sexual partnerships (time from first sex to last sex), the corresponding “second-generation” estimation approach (Kaplan-Meier with censoring based on self-reported ongoing status), and common applications of these estimates (e.g., in transmission models) may all be too simplistic to capture important features of sexual partnership patterns in many circumstances.

Based on these observations, we suggest several avenues for future research. First, we advocate that future studies evaluate the extent to which individuals are able to predict their future sexual behavior, and the reliability of alternate approaches (e.g., administrative ending as performed in the “hybrid approach”) to determine partnership end. Additionally, we encourage the development of more complex concepts of a “partnership” beyond a single duration with assumed uniformity of behaviors within it. More nuanced approaches could account for temporal changes in coital frequency, partner migration, and on-again/off-again partnerships. Such concepts can be iteratively developed alongside studies that measure more complex partnership patterns and behaviors over time to better understand dynamic partnerships patterns and their implications for transmission. We acknowledge that such studies will be challenging to implement but our findings suggest that further thought and research into these issues is important.

We note that the hybrid approach used in these illustrative analyses only highlights potential biases of the second-generation approach arising from respondents predicting that partnerships will continue when they in reality will not. We did not consider measurement bias due to girls misreporting ongoing partnerships as ended (Figure 1B, 1F), though some bias in this direction may also be likely and could be a valuable topic for future work. In addition, we focused specifically on comparing analytical approaches that differed in their determination of partnership end, though other estimation approaches exist and warrant further investigation. One approach that was not compared, but has been used in at least one modeling study(31), uses the mean age only of reportedly ongoing partnerships to estimate partnership duration. This approach makes a number of assumptions, including 1) that the mean age of ongoing relationships at a randomly selected point in time is equal to the expectation for the mean duration of relationships after completion over a long period of time, and 2) that the distribution of partnership durations is geometric, resulting in left and the right censoring cancelling each other out. Future studies should examine this approach, the plausibility of its assumptions, and its potential benefits and tradeoffs.

In sumary, measures of partnership patterns that take into account temporal aspects of partnerships, including partnership duration, gap length, and overlap length, are critical for understanding transmission dynamics and designing effective prevention programs. Standardized measures of concurrency (11) can provide some insight into HIV and STI transmission, but they fail to fully capture the rich diversity and multi-faceted nature of partnership patterns. More detailed characterizations of partnership patterns and how they influence transmission can help researchers design more effective, targeted interventions. Measuring partnership patterns is challenging, and we demonstrated that estimates are sensitive to methods for assessing and accounting for ongoing partnerships. Additional studies that track partnerships longitudinally and with frequent follow-up intervals, along with additional analytical methods and conceptual frameworks for describing partnership dynamics, are needed to better characterize partnership patterns in the context of infectious disease transmission.

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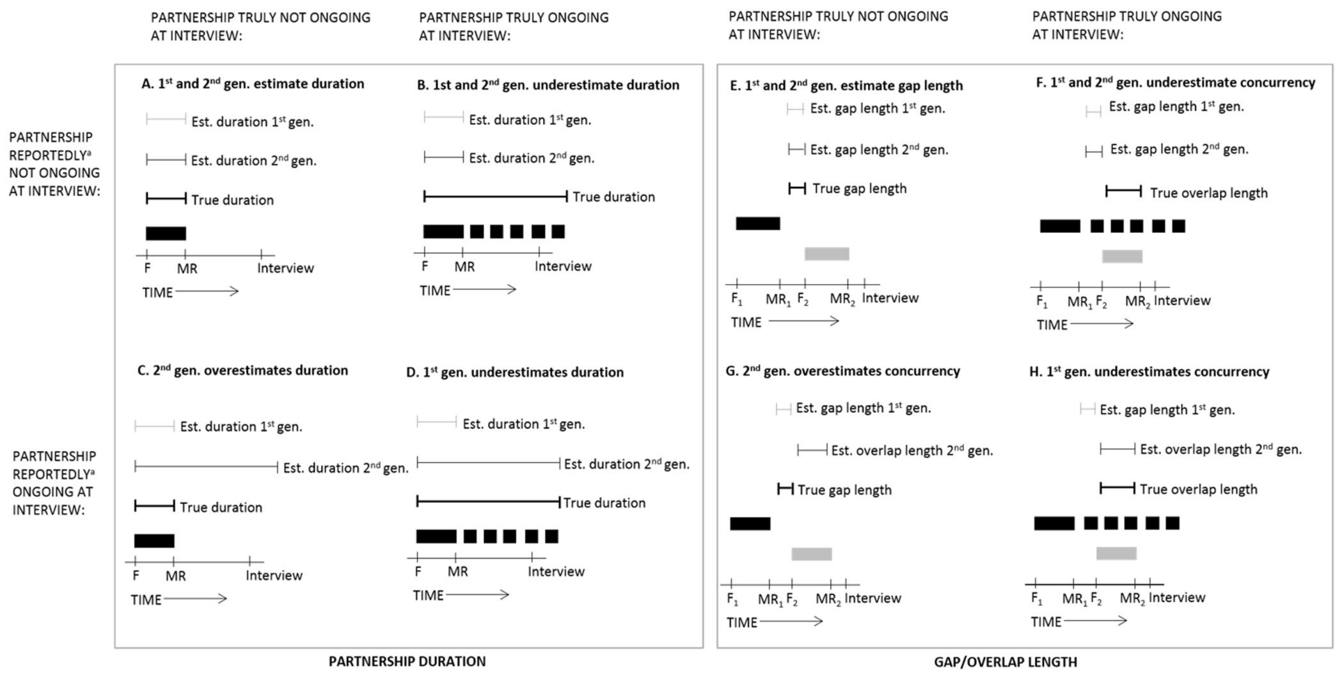

Figure 1.

Partnership Duration, Gap, and Overlap Lengths as Estimated by First- and Second-Generation Approaches According to True Partnership Status (Ongoing or Not) and Reported Partnership Status at Interview. Abbreviations: Est., estimated; gen, generation; F, date of first sex; Interview, date of interview; MR, date of most recent sex. Black and gray bars represent sexual partnerships. Panels A–D represent partnership durations for a single partnership, with the true partnership duration given by the bolded black line, and the 1st and 2nd generation estimated lengths given by the thin gray and black lines, respectively. Panels E-H represent gap and overlap lengths for two partnerships, with the true overlap/gap length again represented by the bolded black line, and the 1st and 2nd generation estimates by the thin gray and black lines, respectively. a In the case of studies using the first-generation approach, respondents are not asked if partnerships are reportedly ongoing; it is assumed that all partnerships have ended.

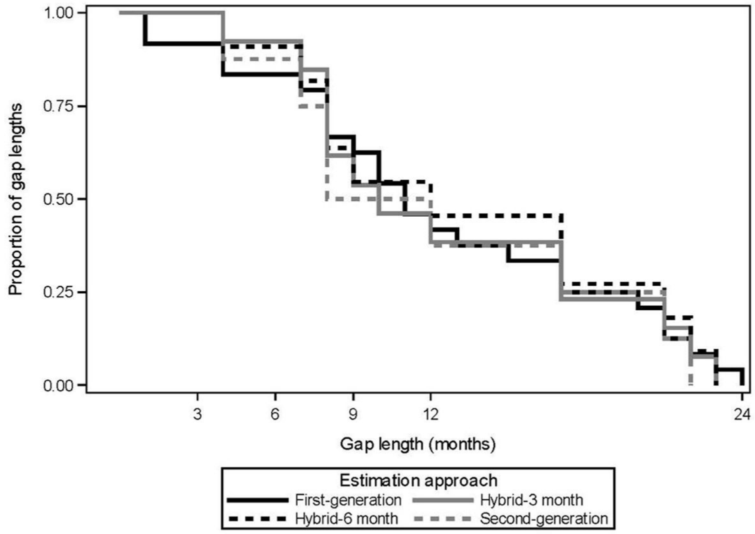

Figure 2.

Kaplan-Meier Survival Curve of Partnership Gap Lengths Among Sexually Active Adolescent Girls, Ages 13–20, South Africa, 2011–2012. Gap lengths shorter than the period for early HIV infection or shorter than the infectious period for STIs can facilitate transmission through biological concurrency.

Mean infectious period commonly used in modeling studies	
Early HIV infection	3–6 months
Gonorrhea (symptomatic)	3–45 days
Gonorrhea (asymptomatic)	3–12 months
Syphilis	6 months
Chlamydia	40 days-2 years

Table 1

Summary of Measurement Approaches

Approach	Self- reported partnership status	Time from most recent sex to interview	Censorship status used in model	Crude partnership duration
First- generation	Ended	n/a	Ended	Most recent sex – First sex
	Ongoing	n/a	Ended	Most recent sex – First sex
Hybrid-3 month	Ended	n/a	Ended	Most recent sex – First sex
	Ongoing	> 90 days	Ended	Most recent sex – First sex
		≤ 90 days	Ongoing	Interview – First sex
Hybrid-6 month	Ended	n/a	Ended	Most recent sex – First sex
	Ongoing	> 180 days	Ended	Most recent sex – First sex
		≤ 180 days	Ongoing	Interview – First sex
Second- generation	Ended	n/a	Ended	Most recent sex – First sex
	Ongoing	n/a	Ongoing	Interview – First sex

Table 2

Descriptive Statistics of Sexually Active Adolescent Girls, Ages 13–20, South Africa, 2011–2012 (N=654)[a]

		N	%
Demographics factors			
Age[b]	13	11	1.68
	14	34	5.20
	15	91	13.91
	16	156	23.85
	17	172	26.3
	18	106	16.21
	19	60	9.17
	20	24	3.67
	Yes	38	5.90
Orphan[c]			
	No	606	94.10
Socioeconomic status[d]	First quartile	165	25.23
	Second quartile	174	26.61
	Third quartile	167	25.54
	Fourth quartile	148	22.63
Sexual risk			
	1	329	51.09
Number of lifetime sexual partners	2	157	24.38
	3	61	9.47
	>3	97	15.06
Currently has a boyfriend or partner	Yes	513	78.44
	No	141	21.56
Age difference for most recent sexual partner	Partner > 2 years younger	40	6.12
	0 ≤ Partner ≤ 2 years	189	28.90
	Partner > 2 years older	425	64.98
Living with most recent sexual partner	Yes	59	9.04
	No	594	90.96
Condom use at last sex for most recent sexual partner	Yes	384	58.81
	No	269	41.19
HIV positive[e]	Yes	40	6.16
	No	609	93.84
HSV-2 positive[f]	Yes	84	12.90
	No	567	87.10
Age at first sex	Mean (SD)	14.60	3.61
Number of sexual partners in last 12 months	Mean (SD)	1.31	1.09

[a]All data were derived from the baseline survey for HPTN 068. The study population included sexually active girls who reported valid dates of first and most recent sex for at least one sexual partner.

[b]One girl was 20 years old when she was screened for study participation but turned 21 at study enrollment.

[c]Orphans were defined as girls who reported that both their mother and father had died.

[d]Socioeconomic status was based on per capita household spending data collected from girl's parent/legal guardian at baseline. Quartiles were derived from the full sample of enrolled girls.

[e]Five samples were excluded from the analysis due to incomplete or inconclusive HIV test results.

[f]Three samples were excluded from the analysis due to incomplete or inconclusive HSV-2 test results.

Table 3

Median Partnership Duration, Gap Length, and Overlap Length Among Sexually Active Adolescent Girls, Ages 13–20, South Africa, 2011–2012[a]

	Partnerships (N)[b]	Median	95% CI
Partnership duration			
1st generation	1,066	368	338, 424
Hybrid-3 month	1,066	387	362, 453
Hybrid-6 month	1,066	595	428, 730
2nd generation	1,066	1024	810, 1,531
Gap length			
1st generation	182	143	96, 194
Hybrid-3 month	171	169	126, 219
Hybrid-6 month	162	182	143, 253
2nd generation	132	185	137, 262
Overlap length			
1st generation	230	168	101, 237
Hybrid-3 month	241	185	130, 306
Hybrid-6 month	250	240	165, 371
2nd generation	280	409	274, 919

[a] All data were derived from the baseline survey for HPTN 068. The study population included sexually active girls who reported valid dates of first and most recent sex for at least one sexual partner.

[b] Variation in sample sizes across approaches is due overlaps being measured as gaps under certain circumstances (see Figure 1H for illustration of underestimated concurrency). Gap lengths were estimated only among pairs of non-concurrent (serially monogamous) partnerships, while overlap lengths were estimated only among pairs of concurrent partnerships.

Table 4

Lifetime Prevalence of Concurrency Among Sexually Active Adolescent Girls, Ages 13–20, South Africa, by Measurement Approach (N=654)[a]

	Lifetime prevalence of concurrency[b]
1st generation	28.44
Hybrid-3 month	29.66
Hybrid-6 month	30.58
2nd generation	33.33

[a] All data were derived from the baseline survey for HPTN 068. The study population included sexually active girls who reported valid dates of first and most recent sex for at least one sexual partner.

[b] Concurrency was determined using self-reported date of first and most recent sex for the 3 most recent sexual partnerships. Girls were defined as concurrent if they had any partnership set where the date of first sex for the newer partner occurred before the date of most recent sex for the earlier partner.

Table 5

Proportion of Gap Lengths Shorter than Common STI Infectious Periods and Early HIV Period Among Sexually Active Adolescent Girls, Ages 13–20, South Africa, 2011–2012, by Measurement Approach[a]

	Proportion of gap lengths				
	≤3 months	≤6 months	≤9 months	≤12 months	≤24 months
1st generation	38.85	55.28	67.33	72.83	90.38
Hybrid-3 month	33.18	51.85	64.66	70.50	89.76
Hybrid-6 month	31.34	49.18	62.09	68.87	88.58
2nd generation	31.65	49.76	61.07	69.38	88.26

[a] All data were derived from the baseline survey for HPTN 068. The study population included sexually active girls who reported valid dates of first and most recent sex for at least one sexual partner.