**Supplemental Materials**

The following table describes how the 10 partner characteristicsincluded in the latent class model were assessed in the study survey and then transformed for inclusion in the latent class model.

Table 1. Measurement and coding of partner characteristics

| **Partner characteristic** | **Survey question and response options** | **Coding in latent class model** |
| --- | --- | --- |
| Age | How old is [initials]?  [ ] years | ≥5 older than index  <5 years older than index |
| School enrollment | Is [initials] currently enrolled in school?  Yes  No | Yes  No |
| Children with index | Do you have children with [initials]?  Yes  No | Yes  No |
| Children with other women | Does [initials] have any children by other women?  Yes  No  I don’t know | Yes  No  Don’t know |
| Cohabit with index | Do you currently live with [initials]?  Yes  No | Yes  No |
| Sex with index only one time | On average, since the beginning of your relationship, how often have you had sex with [initials]?  Once a day or more  3 to 6 times a week  Once or twice a week  2 or 3 times a month  Once a month or less  One time | Yes  No |
| Condom use with index | On average, how often would you say you have used condoms when you have sex with [initials]?  Never, none of the time  Rarely, once in a while  Sometimes, about half of the time  Frequently, but not all the time  Always, every time | Always  Less than always |
| HIV-positive | Does [initials] have HIV?  Yes  No  I don’t know | Yes  No  Don’t know |
| Concurrent sexual partners | As far as you know, during the time that you and [initials] have had a sexual relationship, has [initials] had any other sexual partners, such as girlfriends, wives or sex workers?  Yes  No  I don’t know | Yes  No  Don’t know |
| Trasactional sex with index | Has [initials] ever given you money?  Did you feel like you had to have sex with [initials] because they gave you money?  Has [initials] ever given you things, like groceries, clothes or airtime, that help you get by?  Did you feel like you had to have sex with [initials] because they gave you things?  Yes  No | Yes (defined as being given money or things and then feeling like you had to have sex with partner)  No |

**Supplemental explanation of latent class analysis methods and results**

Selecting number of latent classes: To ensure that we captured a large number of classes (if apparent in the data), we considered LCA models with two through eight classes, starting with a 2-class model and increasing the number of classes until the AIC, BIC, and G2 stopped decreasing (see Supplemental Table 2). To assess model identification, we ran the latent class model 100 times with randomly generated seeds. We present the proportion of solutions that generated the best model fit – giving us confidence that the presented model represents the true maximum likelihood solution – in Supplemental Table 2.

Next, we examined the conditional probabilities (the probability of a specific response to an item conditional on class membership) and latent class prevalences (prevalence of each class in the study population) to select the best fitting and most interpretable model with classes large enough to support further analyses (Supplemental Table 3).

Finally, to ensure class assignments were done with an adequate measure of certainty, we only considered models where the mean and median posterior probabilities (the probability of a partner belonging to a specific partner class conditional on the pattern of responses to all considered items) were greater than 0.70 (Supplemental Table 4).

Assigning and naming sexual partner types: After determining the optimal number of latent classes, we assigned sexual partners to the latent class/sexual partner type for which they had the highest posterior probability of membership. We then calculated the relative frequency of each of the 10 partner characteristics by LCA-identified sexual partner type, and used these frequencies along with the conditional probabilities generated by the latent class model to interpret and name the sexual partner types (Table 2 in text).

Association between sexual partner type and incident HIV-infection:

To understand the association between sexual partner type and incident HIV-infection, we created an AGYW-level data set where each row of data was a year of AGYW follow-up. We then created a visit-specific partner-exposure variable for each sexual partner type by looking across all sexual partners reported by AGYW at each study visit. An AGYW was coded as exposed to a specific partner type if any of her reported partners at that study visit included the partner type. For the pre-specified partner label analysis, an AGYW was coded as unexposed if she reported only having main partner(s)/boyfriend(s) (referent level). For the LCA-identified partner type analysis, an AGYW was coded as unexposed if she reported only having monogamous HIV-negative peer partner(s) (referent level).

We used generalized estimating equations (GEE) with an exchangeable correlation matrix, binomial distribution, and log link to estimate risks, risk ratios (RR), and 95% confidence intervals (CI) for the association between sexual partner type and incident HIV infection (Table 4 in text). To account for potential correlation due to AGYW reporting multiple sexual partners over time, we used a robust variance estimator.

Sensitivity analysis for association between sexual partner type and incident HIV-infection:

A potential limitation of this analysis is that if an AGYW reported more than one sexual partner at a follow up visit and became HIV-infected, we are unable to identify which sexual partner infected her. To assess the potential impact of this limitation, we conducted a sensitivity analysis where we limited the dataset to AGYW who reported one sexual partner at a specific follow up visit. Thus, if an AGYW became HIV infected, we could be more certain about the partner who infected her.

The results from the LCA-identified partner type analysis were consistent, though attenuated, when we limited the analysis to AGYW who reported only one sexual partner. As with the main analysis, AGYW with out-of-school older partners had the highest risk of incident HIV-infection while AGYW with cohabiting with children in-school peer partners had the lowest risk compared to AGYW with only monogamous HIV-negative peer-partner(s). The results from the pre-specified partner label analysis varied slightly when we limited the analysis to AGYW who reported only one sexual partner (Supplemental Table 6). In this subset of AGYW, having a regular casual sex partner was associated with a slight but non-significant decrease in risk of HIV infection compared to AGYW with a main partner/boyfriend(s) (aRR: 0.67, 95% CI: 0.26, 1.74).

Supplemental Table 2. Fit statistics comparing 2-8 class latent class models of sexual partner type among sexually active adolescent girls and young women (AGYW) ages 13-23 in rural South Africa March 2011 to March 2015 (N=2968 partners-reports)a,b

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Classes | DF | G2 | AIC | BIC | Percentage of seeds associated with best fitting model |
| 1 |  |  |  |  |  |
| 2 | 3428 | 3026.61 | 3080.61 | 3242.50 | 25% |
| 3 | 3414 | 2348.84 | 2430.84 | 2676.67 | 100% |
| 4 | 3400 | 2156.75 | 2266.75 | 2596.51 | 88% |
| 5 | 3386 | 2026.25 | 2164.25 | 2577.94 | 100% |
| 6 | 3372 | 1938.02 | 2104.02 | 2601.66 | 48% |
| 7 | 3358 | 1870.50 | 2064.50 | 2646.08 | 49% |
| 8 | 3344 | 1812.38 | 2034.38 | 2699.89 | 64% |

a AGYW could report up to 3 sexual partners at each study visit and may have multiple observations due to repeated study visits.

b The Baysian Information Criteria (BIC) and Akaike Information Criteria (AIC) measure relative model fit, while G2 measures absolute model fit. For all three fit indices, lower values indicate better model fit. The G2 and AIC did not stop decreasing even after 8 classes; however, the BIC stopped decreasing after 5 classes. In addition, 100% of 100 random seeds in the 5-class model were associated with the best fitting model.

Supplemental Table 3. Latent class prevaleneces and conditional probabilities for a 6-class latent class model of sexual partner type among sexually active adolescent girls and young women (AGYW) ages 13-23 in rural South Africa, from March 2011 to March 2015 (N=2968 partner-reports)a

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  | **Sexual Partner Type Identified by LCA** | | | | |
|  | Monogamous HIV-Negative Peer Partner | One-Time Protected Peer Partner | Anonymous Out-of-School Peer Partner | Out-of-School Older  Partner | Cohabiting with Children In-School Peer Partner |
|  | **Latent Class Prevalences** | | | | |
|  | 0.48 | 0.21 | 0.13 | 0.13 | 0.05 |
|  | **Conditional Probabilitiesb** | | | | |
| **Sexual Partner Characteristics** |  |  |  |  |  |
| Partner ≥5 years older | 0.12 | 0.04 | 0.21 | **0.67** | 0.24 |
| Partner not enrolled in school | 0.52 | 0.28 | 0.67 | **0.94** | 0.26 |
| Children with index AGYW | 0.29 | 0.02 | 0.08 | 0.32 | **0.77** |
| Children with other women: yes | 0.08 | 0.03 | 0.07 | 0.33 | **0.56** |
| Children with other women: don’t know | 0.03 | 0.07 | **0.65** | 0.06 | 0.02 |
| Cohabit with index AGYW | 0.09 | 0.01 | 0.09 | 0.14 | **0.82** |
| Sex with index AGYW only once | 0.08 | **0.50** | 0.19 | 0.13 | 0.02 |
| Always uses a condom with index AGYW | 0.10 | **0.59** | 0.17 | 0.16 | 0 |
| Partner HIV-positive: yes | 0.04 | 0.06 | 0.05 | 0.13 | **0.17** |
| Partner HIV-positive: don’t know | 0.08 | 0.16 | **0.71** | 0.19 | 0.02 |
| Partner has other concurrent sexual partners: yes | 0.23 | 0.17 | 0.13 | 0.30 | **0.32** |
| Partner has other concurrent sexual partners: don’t know | 0.12 | 0.28 | **0.83** | 0.23 | 0.02 |
| Transactional sex with index AGYWc | 0.28 | 0.09 | 0.19 | 0.35 | **0.82** |

a AGYW could report up to 3 sexual partners at each study visit and may have multiple observations due to repeated study visits. Sexual partner prevalences include all sexual partners across all follow-up visits.

bBold values indicate the highest conditional probability for a particular partner characteristic across LCA-identified sexual partner types.

Supplemental Table 4. Posterior probabilities comparing 2-8 class latent class models of sexual partner type among sexually active adolescent girls and young women (AGYW) ages 13-23 in rural South Africa March 2011 to March 2015 (N=2968 partners-reports)a,b

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
|  | **Posterior Probabilities** | | | | | |
| Classes | Mean | Median | 25% | 75% | Minimum | Maximum |
| 1 |  |  |  |  |  |  |
| 2 | 0.92 | 0.98 | 0.91 | 0.99 | 0.50 | 1.00 |
| 3 | 0.81 | 0.88 | 0.69 | 0.96 | 0.36 | 1.00 |
| 4 | 0.82 | 0.87 | 0.68 | 0.96 | 0.35 | 1.00 |
| 5 | 0.77 | 0.79 | 0.63 | 0.90 | 0.34 | 1.00 |
| 6 | 0.72 | 0.71 | 0.56 | 0.86 | 0.32 | 1.00 |
| 7 | 0.68 | 0.68 | 0.52 | 0.83 | 0.30 | 1.00 |
| 8 | 0.67 | 0.68 | 0.54 | 0.78 | 0.27 | 0.99 |

a AGYW could report up to 3 sexual partners at each study visit and may have multiple observations due to repeated study visits.

b We compared latent class models ranging from 2 classes up to 8 classes using the BIC, AIC and G2 fit indices, conditional probabilities, and posterior probabilities. Models with 6 classes or fewer have mean and median posterior probabilities greater than 0.70.

Supplemental Table 5. Comparison of sexual partner types identified by latent class analysis (LCA) versus pre-specified partner labels among sexually active adolescent girls and young women (AGYW) ages 13-23 in rural South Africa, from March 2011 to March 2015 (N=2968 partner-reports)a,b

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | **Sexual Partner Type Identified by LCA** | | | | | | | | | |
|  | Monogamous HIV-Negative Peer Partner | | One-Time Protected  In-School  Peer Partner | | Anonymous  Out-of-School Peer Partner | | Out-of-School Older Partner | | Cohabiting with Children  In-School  Peer Partner | |
|  | N | % | N | % | N | % | N | % | N | % |
| **Pre-Specified Partner Label** | | | | | | | | | | |
| Main Partner/Boyfriend | 1146 | 73.18 | 450 | 76.53 | 261 | 69.05 | 223 | 71.94 | 85 | 71.43 |
| Regular Casual Sex Partner | 279 | 17.82 | 74 | 12.59 | 72 | 19.05 | 63 | 20.32 | 18 | 15.13 |
| Non-Regular Casual Sex Partner | 96 | 6.13 | 41 | 6.97 | 3 | 8.20 | 12 | 3.87 | 9 | 7.56 |
| Sex Work Client | 9 | 0.57 | 2 | 0.34 | 2 | 0.53 | 3 | 0.97 | 2 | 1.68 |
| Otherc | 36 | 2.30 | 21 | 3.57 | 12 | 3.17 | 9 | 2.90 | 5 | 4.20 |

a AGYW could report up to 3 sexual partners at each study visit and may have multiple observations due to repeated visits. Sexual partner frequencies include all sexual partners across all follow-up visits. The same partner could be reported at multiple study visits; thus frequencies represent partner-reports, not distinct sexual partners. Percentages are column percents by sexual partner type.

b Pre-specified partner label missing for 7 partners.

c Other pre-specified partner label includes lover, child’s father, friend, and cases of rape/incest.

Supplemental Table 6. Unadjusted and adjusted risk ratios (RR) and 95% confidence intervals (CI) for the association between sexual partner type and incident HIV infection among sexually active adolescent girls and young women (AGYW) with only 1 reported sexual partner, ages 13-23 in rural South Africa, from March 2011 to March 2015 (N=2140 AGYW-visits)a,b

|  | HIV infections | AGYW-visitsc | Risk (95% CI) | RR (95% CI)c | aRR (95% CI)d |
| --- | --- | --- | --- | --- | --- |
| **Pre-Specified Partner Label** |  |  |  |  |  |
| Regular Casual Sex Partner | 5 | 254 | 0.020 (0.0082, 0.049) | 0.76 (0.29, 2.00) | 0.67 (0.26, 1.74) |
| Non-Regular Casual Sex Partner | 3 | 107 | 0.029 (0.0091, 0.092) | 1.10 (0.32, 3.70) | 0.95 (0.35, 2.58) |
| Main Partner/Boyfriend | 28 | 1093 | 0.026 (0.018, 0.038) | 1. | 1. |
|  |  |  |  |  |  |
| **LCA-Identified Sexual Partner Type** | | | | | |
| Out-of-School Older Partner | 5 | 140 | 0.037 (0.015, 0.090) | 1.63 (0.60, 4.43) | 1.61 (0.56, 4.63) |
| Anonymous Out-of-School Peer Partner | 4 | 129 | 0.032 (0.012, 0.086) | 1.40 (0.47, 4.17) | 1.38 (0.43, 4.40) |
| One-Time Protected In-School Peer Partner | 7 | 341 | 0.021 (0.0099, 0.045) | 0.92 (0.38, 2.22) | 1.24 (0.51, 3.02) |
| Cohabiting with Children In-School Peer Partner | 1 | 47 | 0.022 (0.0030 0.16) | 0.95 (0.12, 7.38) | 0.51 (0.06, 4.35) |
| Monogamous HIV-Negative Peer Partner | 19 | 853 | 0.023 (0.015, 0.036) | 1. | 1. |

a Sexual partner type was measured using two approaches. Pre-specified partner type labels: Adolesecnt girls and young wome (AGYW) were asked to categorize each of their sexual partners using the following labels: main partner/boyfriend, regular casual sex partner, non-regular casual sex partner, sex work partner (data not shown), and other partner (data not shown). LCA-identified sexual partner type: We used latent class analysis (LCA) to identify five sexual partner types: out-of-school older partners, one-time protected in-school peer partners, anonymous out-of-school peer partners, monogamous HIV-negative peer partners, and cohabiting with children in-school peer partners. In all cases, sexual partners were identified based on partner characteristics self-reported by the AGYW.

b Missing: Pre-specified partner label 4; LCA-identified sexual partner type 0.

c Risk ratios (RR) and 95% confidence intervals for the association between AGYW having a specific sexual partner type and incident HIV infection were estimated using generalized estimating equations (GEE) with an exchangable correlation matrix, binomial distribution, log link, and

robust variance estimator.

d Models were adjusted for the following confounders to estimate adjusted risk ratios (aRR): intervention arm, age, school enrollment, food insecurity, depression, low relationship power, intimate partner violence, alcohol consumption, drug use, early sexual debut, number of sexual partners in the past 12 months, and days since last follow-up visit.