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Sexual Relationship Types, Partner HIV Self-Testing, and Pre-Exposure Prophylaxis Among South African Adolescent Girls and Young Women: A Latent Class Analysis

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Abstract

Background.—Sexual relationships among adolescent girls and young women (AGYW) are influenced by social, economic, and gender dynamics. Understanding AGYW's different relationship types and their implications for HIV risk is important for development of tailored interventions. We sought to identify relationship typologies among AGYW and their impact on uptake of HIV prevention interventions.

Methods.—From May 2018-February 2019, 2200 HIV-negative AGYW (ages 16–24) in Johannesburg, South Africa participated in an HIV prevention intervention involving distribution of HIV self-test kits to their male partners. AGYW were also offered pre-exposure prophylaxis (PrEP). At baseline AGYW completed a questionnaire, and outcomes were assessed for 3 months. We used latent class analysis to identify relationship types and mixture modeling to estimate the impact of relationship type on engagement in prevention interventions.

Results.—We identified three relationship types: "stable, empowered relationships with older partners" (Class 1, n=973); "shorter, empowered relationships with peer partners" (Class 2, n=1067); and "shorter relationships with risky partners" (Class 3, n=160). Compared with AGYW in Class 1 relationships, AGYW in Class 2 and 3 relationships were less likely to complete partner testing alongside HIV results sharing (Class 2 aRR: 0.89, 95% CI: 0.85–0.95; Class 3 aRR: 0.84,

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95% CI: 0.73–0.94). PrEP uptake was highest in Class 3 (11.2%) compared with Class 2 (3.8%) and Class 1 (1.0%; p<0.001).

Conclusion.—Relationship type impacts uptake of HIV prevention interventions among South African youth. Intervention effectiveness could be optimized by using tailored approaches to HIV risk mitigation among AGYW.

Keywords

adolescent girls and young women; HIV prevention; HIV self-testing; pre-exposure prophylaxis; male partners; latent class analysis; South Africa

Introduction

Throughout sub-Saharan Africa, adolescent girls and young women (AGYW) are at increased risk for acquisition of HIV infection due to a combination of biological, behavioral, and structural factors.[1,2] It is therefore critical to engage AGYW in HIV prevention efforts, including testing, pre-exposure prophylaxis (PrEP), comprehensive sexual education, and condom provision.

In South Africa, engagement in HIV prevention remains low among many groups. Men are particularly disengaged from HIV testing, which elevates the risk of transmission of unknown HIV infection to their female partners.[3,4] Home-based HIV self-testing presents an opportunity to engage individuals that are difficult to reach by traditional, clinic-based testing services.[4–6] Secondary distribution of self-test kits by uninfected female sex workers and women receiving antenatal and postpartum care to their male partners has shown promise as a strategy to engage men in HIV testing in Kenya.[5] Empowering AGYW to distribute HIV self-test kits to their sexual partners can lead to detection of previously undetected infections in young men, resulting in AGYW learning their partners' status and gaining more accurate understandings of their own risk. AGYW can then determine whether and how to access prevention methods such as PrEP. While PrEP has great potential as an HIV prevention option for AGYW, adherence among AGYW in both research and implementation contexts has been challenging, reducing its impact.[7–9] Understanding AGYW's interest in and uptake of PrEP is a critical first step for targeting PrEP communications strategies to AGYW at greatest risk of HIV acquisition.

HIV prevention interventions for AGYW often approach them as independent individuals, ignoring the context of their relationships.[10–12] To gain insight into the factors that determine successful uptake of secondary distribution of self-testing kits to partners and AGYW's uptake of PrEP, it is important to understand the role played by both AGYW and male sexual partners in these processes. Relationships with male partners influence AGYW's risk of HIV both directly, through exposing them to HIV, and indirectly, through positioning them in wider sexual networks and fostering sexual risk behavior, and through influencing decisions made by AGYW.[11–13]

A recent qualitative study from South Africa showed that distinct types of sexual partnerships can differentially influence AGYW's decisions around engagement in the

HIV prevention cascade.[14] The study identified four primary relationship typologies with defined patterns of risk, which resulted in successful or unsuccessful engagement in the HIV prevention cascade. These included (1) relationship turnover and male partners with multiple partnerships; (2) intimate partner violence and male partner temperament; (3) AGYW with multiple partners; and (4) stable relationships with male partner openness.[14] Studies with AGYW and their male sexual partners in Uganda and Mozambique have further demonstrated that AGYW's relationships are diverse, driven by social and cultural norms, and often fluid (changing from casual to stable), influencing AGYW's perceptions of their risk.[15,16] These findings highlight the importance of understanding partner and relationship typologies to more effectively inform targeted HIV prevention interventions.

The objective of this study was to identify underlying constructs of AGYW's sexual relationship types and assess the association between relationship type and engagement in HIV prevention interventions. Specifically, we aimed to identify the main types of heterosexual relationships that exist among AGYW in South Africa and assess how relationship types influence successful partner testing (secondary distribution of HIV self-test kits to partners, partner uptake of HIV self-testing and disclosure of results), and AGYW PrEP uptake.

Methods

Study Setting and Sample

This study analyzed data from the Determined, Resilient, Empowered, AIDS-Free, Mentored, and Safe (DREAMS) Innovation Challenge project at Witkoppen Clinic in Johannesburg, South Africa. AGYW were recruited between May 2018 and February 2019 following AGYW HIV testing at a participating clinic, mobile site, or event in the community. Recruitment predominantly occurred alongside the DREAMS community testing team targeting AGYW but was coupled with recruitment among AGYW attending the local primary health centers for HIV testing, antenatal care, family planning or other services. AGYW were eligible for participation if they were aged 16–24 years, had tested HIV-negative, were in a heterosexual relationship for 3 or more months, were sexually active, had at least one partner of unknown HIV status, and did not report violence or fear of violence in their relationship. Each prospective participant received study information from a team member in her preferred language (English, Zulu or Sotho).

Ethics approval for the study was obtained from the Human Research Ethics Committee at the University of Witwatersrand in Johannesburg, South Africa. Oversight was seconded by the Johns Hopkins Bloomberg School of Public Health Institutional Review Board to the South African Committee. Written informed consent or assent (if <18 years) were obtained from each participant; for AGYW under age 18 years, parental consent was obtained.

Procedures

Participating AGYW (n=2,200) completed baseline questionnaires about their demographic and socioeconomic characteristics, perceived HIV risk, sexual behavior, and partnerships.

After completing the baseline questionnaire, AGYW watched a video explaining how to give an HIV self-test to their partners and received further counselling from study staff. Each AGYW received one self-test kit per sexual partner. The kit contained an oral HIV self-test (OraQuick), an instructional pamphlet with information about the self-testing process and post-test counseling, a USB flash drive with a video for male partners that included motivational messages for HIV testing and use of condoms and lubricants as well as instructions on how to perform the self-test. Additional kits were offered if AGYW had multiple partners and if they were interested in re-testing together with partners. PrEP was offered to all non-pregnant, non-lactating AGYW.

We followed up with AGYW via phone calls or face-to-face clinic meetings for those not reached by phone but attending the clinic at one- and two-weeks post-intervention, and then monthly for three months to determine the outcome of the self-test kit delivery. At each follow-up contact, we asked AGYW about their perceived HIV risk and their participation in the prevention cascade inquiring about their discussion of self-testing with their partner(s), distribution of self-test kits to their partner(s), actual self-testing of their male partner(s), disclosure of the test result by their male partner(s), their partners' linkage to care, AGYW PrEP uptake, and PrEP adherence.

Measures

Four sociodemographic variables were included in our models. Firstly, age was measured continuously. Secondly, educational level was measured categorically (no schooling or primary, secondary, or post-secondary schooling). Thirdly, self-reported alcohol use was measured categorically (never drink, drink with friends but never get drunk, sometimes get drunk, or drink a lot). Fourthly, access to income was measured categorically (no personal income, part-time job, or full-time job).

Latent classes were identified through the following variables: perceived HIV risk (highest tercile vs. lowest two terciles), multiple AGYW partnerships (two or more male sexual partners in the last six months), short-term partnerships (<3 months in duration), age-disparate partnerships (male partner ≥5 years older), cohabitation with partner, consistent condom use with partner in past 30 days, male partner suspected to have one or more other sex partners, low overall sexual relationship power (summary score at or below 25^{th} percentile on the Sexual Relationship Power Scale), awareness of male partner's HIV status, talking about HIV with partner, and receipt of financial support from partner. All characteristics were dichotomized as present/absent. Details on their measurement and coding are provided in Supplementary Table 1.

Three key outcome variables were used in our final models. Firstly, HIV self-test cascade completion was measured as follows: At follow-up, we asked AGYW the following: (1) "Did you give the HIV self-test to [partner]?" (2) "Did [partner] test?" and (3) "Did [partner] share his result?" If AGYW responded "yes" to all three questions, we assigned a variable indicating they had completed the cascade. If AGYW responded "no" to any of these three questions, they were classified as not having completed the cascade. Secondly, PrEP interest was measured among AGYW who were eligible for PrEP (i.e., not pregnant or breastfeeding) based on preliminary interest (yes/no) in receiving more information about

PrEP for a current or future PrEP referral; this was documented as part of intervention implementation. Thirdly, PrEP uptake was assessed among PrEP-eligible AGYW and was defined as receiving a prescription and a one-month supply of pills by the study nurse (other clinics or community services in the area did not provide PrEP) at baseline or within the 3-month follow-up period as part of implementation.

Statistical Analysis

We used descriptive statistics to summarize the demographic and relationship characteristics of AGYW and used latent class analysis (LCA) to determine and classify sexual relationships based on 11 characteristics reported by AGYW at baseline (see Supplementary Table 1). Selection of the 11 characteristics was informed by the literature on relational factors influencing AGYW's HIV risk and by qualitative findings from a subsample in our study.[14]

We considered models with 2–6 classes and compared the Akaike Information Criterion, Bayesian Information Criterion, Vuong-Lo-Mendell-Rubin, bootstrapped likelihood ratio test, and entropy to assess model fit and select the most parsimonious model. Model fit statistics are available in Supplementary Table 2. Along with fit statistics, we examined the probabilities of latent class membership and conditional probabilities to select the best fitting and most interpretable model.

After the final model was selected, we used the Bolck, Croon, and Hagenaars (BCH) three-step mixture modeling procedure[18] to estimate differences in engagement in HIV prevention interventions between classes without changing the class structure. Mixture modeling is a latent variable modeling approach which is suitable for analyses involving both latent (unobserved) and observed variables. In our mixture models, class membership was treated as latent while covariates and outcomes were observed. The BCH procedure outperforms other three-step approaches by avoiding shifts in latent classes and using weights to account for measurement error of latent classes.

We ran three BCH models to estimate the impact of class membership on each outcome separately. We used Wald tests to assess differences in the outcome by class and calculated risk ratios to summarize the relative magnitude of these differences. All models were adjusted for age and education. For the model assessing HIV self-test cascade completion, we generated stabilized inverse probability of observation weights to account for differential follow-up of outcome ascertainment.[19] Weights were conditional on age, education, country of origin, income, relationship status, cohabitation with a partner, condom use, presence of an older partner, and receiving financial support from a partner. Data on PrEP outcome were complete, so these analyses were unweighted.

Analyses were performed in Stata Version 15[20] and Mplus Version 8.[21]

Results

AGYW demographic and relationship characteristics

A total of 2,200 AGYW participated. The median age was 22 years (interquartile range [IQR] 20–23, Table 1), the majority (78%) had completed some or all of secondary school, just over a quarter (27%) reported some source of personal income, half (52%) reported living with their family, and 40% reported living with their partner or his family.

The majority of AGYW (75%) felt they had a low risk of acquiring HIV in the next six months. Most (89%) reported only one partner in the last six months, nearly all (98%) had been sexually active in the past 30 days, 20% reported consistent condom use with their partners in the last 30 days, and just over half (56%) reported having more say than their partners about condom use (Table 2). The median sexual relationship power score was 55 (IQR: 52–57), with possible scores ranging from 23–76.

Latent Class Analysis: Classes of Sexual Relationships

Latent class analysis identified three types of relationships. Class 1 consisted of stable, longer-duration relationships with older partners and low AGYW perception of risk. These relationships were characterized by stability, AGYW empowerment (higher AGYW relationship power score), higher probability of cohabitation, provision of financial support by the partner, and discussing HIV with the partner. Class 2 relationships were shorter relationships with peer partners, characterized by AGYW relationship empowerment, moderate discussion of HIV with partners, and the highest probability of consistent condom use across the three classes. Class 3 relationships were shorter in duration with risky partners, and were characterized by less consistent condom use, greater suspicion that the partner had other partners, higher perceived HIV risk, and lower sexual relationship power. For example, the conditional probability of having high perceived HIV risk was 34% in Class 3, compared with 4% in Class 2, and the probability of having high sexual relationship power was 34% in Class 3, compared with 85% in Class 2.

Based on posterior classification probabilities, the prevalence of the three relationship types were 47% for Class 1 (stable, empowered relationships with older less risky partners), 43% for Class 2 (shorter, empowered relationships with peer partners), and 10% for class 33 (shorter relationships with risky partners).

AGYW's demographic, family, and relationship characteristics varied by most likely relationship type (Table 4). The majority of AGYW most likely in Classes 2 or 3 were from South Africa (83% and 70%, respectively), whereas those in Class 1 were more diverse in their countries of origin ($p<0.01$). Around half (51.8%) of AGYW most likely in Class 1 had completed some secondary school or less, and only 8.9% had received tertiary education, whereas 27.7% and 18.1% of AGYW most likely in Classes 2 and 3, respectively, had received tertiary education ($p<0.01$). While reported history of transactional sex was low in the sample overall, 9.4% of AGYW most likely in Class 3 reported ever engaging in transactional sex, compared with 2.4% and 2.5% of AGYW most likely in Classes 1 and 2, respectively ($p<0.01$). There was also variation in living situation, reported relationship status, and history of pregnancy between classes ($p<0.01$).

Relationship Type and HIV Prevention Outcomes

Outcome data were available for 1,673 (76%) of the 2200 participating AGWY. Overall, most (79.6%) of these AGYW reported completing all steps of the partner HIV self-testing cascade. Relationship class membership was significantly associated with HIV self-test cascade completion (Table 5). The likelihood of HIV self-test cascade completion was lower in Class 2 and 3 relationships compared to Class 1 relationships. Compared to AGYW in Class 1 partnerships, AGYW in Class 2 partnerships were 10% less likely (aRR 0.90, 95% CI 0.85–0.95) and AGYW in Class 3 relationships were 16% less likely to have completed the partner testing cascade including seeing his test result in the weighted model. There was no difference in HIV self-test cascade completion between AGYW in Class 2 vs Class 3 relationships (results not shown).

Overall, 37.4% of eligible AGYW expressed interest in PrEP. Relationship class membership was significantly associated with PrEP interest and PrEP uptake. PrEP interest was highest among AGYW in Class 3 relationships (64.9%) (Table 5). Compared to AGYW in Class 1, AGYW in Class 2 were 26% more likely to express an interest in PrEP (aRR 1.26, 95% CI 1.13–1.39), and AGYW in Class 3 were more than twice as likely to likely to express an interest in PrEP in the BCH-weighted analysis. PrEP interest also significantly differed when comparing AGYW in Class 2 vs Class 3 partnerships (aRR 0.60; 95% CI 0.46–0.74). While PrEP uptake was low overall (3.1%), it was highest among AGYW most likely to be in Class 3 relationships (11.2%; $p<0.001$).

Discussion

In this study we identified three distinct relationship types characterized by relationship power and HIV risk. We observed significant associations between the type of relationships in AGYW in urban South Africa and outcomes of distribution of HIV self-tests to male partners and AGYW PrEP interest and uptake, two vital HIV prevention efforts. Our findings highlight the important role of sexual partnerships in HIV prevention for AGYW and supports the development of targeted communication strategies to optimize the effectiveness of HIV prevention in this critically vulnerable population.

AGYW in Class 1, the most frequent relationship type among these urban South African AGYW, were empowered, had had stronger partner communication and stable relationships with older (>5 years age difference) partners, and low suspicion of the male partner having other partners, but were less educated and reported relying on their partners financially. AGYW in Class 1 type relationships were the most likely AGYW to report completion of the partner HIV self-testing cascade. This is in contrast to previous research that found that older male partners may be less likely to discuss HIV with younger partners.[22,23] Our finding challenges notions that older male partners are inherently “risky” for AGYW and suggests that AGYW in relationships with older partners may not necessarily be disempowered, but may be more likely to discuss HIV and engage in HIV preventive behavior with these partners. Others have further explored the social and economic benefits associated with age-disparate relationships.[24–26] While such benefits were not directly explored in our study, it is likely that for many AGYW in this community who struggle to meet their needs, older partners may offer access to food, clothing, and shelter along

with other commodities that, while less economically valuable, increase AGYW's social standing. AGYW may also pursue these relationships with the goal of gaining financial independence and social mobility. However, because Class 1 relationships were also characterized by cohabitation and longer duration of the relationship, they may reflect that more committed, stable partnerships are protective for AGYW. At the same time, because AGYW's perceptions of their own risk may not always be accurate, it is important to consider whether AGYW in Class 1 partnerships may remain vulnerable to unknown risks. Despite the positive features we identified in these relationships, the risk of HIV acquisition for AGYW with older partners has been well-established in the literature.[27–29] For these AGYW, interventions may include financial empowerment, promotion of male engagement in HIV and sexual and reproductive health, and interventions which help AGYW accurately assess their own HIV risk.

Even though AGYW in shorter relationships with peer partners (Class 2) generally reported empowerment within their relationships, the frequency with which these AGYW reported discussing HIV with partners was low, and AGYW knowledge of their partner's HIV status was less than 50%. Interventions that encourage positive engagement with peer male partners at a younger age and early on within relationships may promote more sustained engagement in HIV preventive behavior and more effectively protect AGYW as they age.[30]

AGYW in shorter relationships with risky partners (Class 3) were most likely to view themselves at high risk of HIV acquisition, to have experienced some form of violence, and to have poor partner communication and low sexual relationship power. Despite perceiving themselves at high risk, they were least likely to report completion of the partner HIV self-testing cascade. One possible explanation for this is that these AGYW tend to engage in transactional relationships with older partners who may belong to higher-risk sexual networks, causing AGYW to perceive their own risk as higher yet remain disempowered to negotiate HIV testing, condom use, or other preventive behaviors.[31–33] For these AGYW, empowerment interventions as well as enhanced promotion of PrEP and other prevention services may be needed, but attention must also be paid to the potential for violence, multiple partnerships, nascent relationships, and economic vulnerabilities of these AGYW.

With regards to relationship types, our quantitative results were similar to the four relationship types identified in Holmes et al's qualitative study on a subsample of our study population.[14] The qualitative study identified a relationship type characterized by male partner openness and relationship stability; this aligns closely with our LCA-identified Class 1. The qualitative study found that AGYW in these relationships had committed relationships and were willing to engage in the HIV self-testing intervention and PrEP.[14] This aligns with our finding that AGYW in Class 1 relationships were most likely to complete the self-testing cascade. Holmes et al also identified a group of AGYW with multiple partners who successfully engaged in the HIV self-testing cascade, which aligns with our class of empowered AGYW in short-term peer partnerships (Class 2). This finding challenges notions of all AGYW as a disempowered, sexually vulnerable group and suggests that some AGYW who are not ready for a monogamous relationship may choose to pursue multiple shorter partnerships, yet remain aware of their HIV risk and are empowered to take preventive action.

In contrast to the findings of the qualitative study, we did not observe differences between AGYW who had multiple partners themselves and AGYW who suspected their partners to have multiple other partners. In our LCA, these characteristics were most probable in a single class (Class 3). Another important difference between our findings and those from the qualitative study was a fourth qualitatively-identified relationship type, characterized by fear of violence. This type was not identified by our LCA, potentially due to underreporting of violence in the quantitative survey. We, however, did observe differences across classes in experiences of violence, supporting the potential salience of violence, though we were not directly able to include it in our measurement model. The triangulation of our quantitative results with qualitative findings from a subsample of our study gives strong support for our conclusions.[14]

Others have also used LCA to identify types of relationships among AGYW. In rural South Africa, one study identified five types of relationships, including one with older partners and four with peer partners further differentiated by in- vs out-of-school, presence of monogamy, partner anonymity, and cohabitation.[13] Because LCA is a data-driven approach, these differences are not surprising and likely reflect differences in age and urban vs rural in study samples. We could not identify any other studies that investigated the association between AGYW relationship typologies and the outcome of engagement in HIV prevention interventions.

There are some limitations to this study. First, LCA relied on AGYW's self-reported partner characteristics and self-testing outcomes, so misclassification, recall, and social desirability bias may have been present. Second, because LCA is a data-driven approach, our findings are specific to AGYW in our sample and may not be generalizable to other populations. Furthermore, our sample was limited to AGYW reporting being in a non-violent relationship for at least 3 months, thus other relationship types may have been missed. We also did not assess emotional violence in relationships. Third, while we were successful in recruiting a small number of younger AGYW, the requirement for parental consent may have limited our ability to reach this group. Fourth, sparse data precluded use of the three-step procedure for PrEP uptake, so we were unable to present BCH-weighted aRRs for this outcome. Finally, while we were able to adjust for possible confounders of the association between relationship type and HIV cascade completion and applied inverse probability weighting to account for incomplete outcome ascertainment, there remains potential for unmeasured confounding and bias.

Our findings highlight several additional areas for research. First, greater understanding of the heterogeneity of risk across AGYW's older partners is warranted. Our findings suggest that, while some older partnerships may be risky for AGYW, others may be more stable and potentially protective in nature. Better understanding the HIV burden among AGYW's various older male partners is important for better estimating AGYW's risk and targeting interventions. It is also important to understand how relationship durations may drive HIV risk. We found, for example, that AGYW with longer-term relationships were most likely to complete the partner self-testing cascade which might reduce risk, although these relationships were also characterized by factors (i.e. older partners and financial support) that may subsequently increase risk. It is possible that relationship duration moderates the

impact of age-disparate or transactional sex partnerships and HIV risk. Third, additional research is needed on the specific role of empowerment in HIV risk. We found that AGYW with high risk perception and low sexual relationship power (Class 3) were least likely to complete the partner self-testing cascade, but most likely to express interest in PrEP and take it up. Better understanding the mechanisms through which sexual and other forms of empowerment influence HIV preventive behavior and subsequent risk is important to inform and appropriately target interventions. Finally, the association between relationship type and PrEP use should be examined with greater depth. We found that PrEP interest and uptake varied across relationship types in our sample, with AGYW at potentially greater risk being more likely to express interest in and take up PrEP. Additional, longitudinal research should examine how AGYW with various sexual relationship characteristics not only take PrEP but use it long term, including patterns of PrEP continuation and cycling on and off PrEP.

Conclusion

AGYW in South Africa remain a priority population for HIV intervention. Relationship power, communication, multiple partnerships, and relationship duration demonstrate complex dynamics impacting AGYW's sexual relationships. Together, these are associated with AGYW's condom use, engagement in transactional sex, and experiences of physical violence. Our findings reinforce evidence that heterogeneity of risk is more complex than age-disparateness, and that appropriately characterizing AGYW's sexual partnerships has important implications for targeting communication in order to improve the effectiveness of HIV prevention interventions. Communication strategies should consider moving beyond a focus on age-disparate or short-term relationships and take more nuanced approaches to addressing risk heterogeneity in reducing AGYW's sexual HIV risk.

Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

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Table 1.

Demographic characteristics of adolescent girls and young women engaged in the HIV prevention intervention in Johannesburg at baseline (n=2,200).

AGYW Demographic Characteristic	N (%) Median (IQR)
Age	22 (20–23)
Country of Origin	
South Africa	1475 (67.0%)
Zimbabwe	579 (26.3%)
Other	146 (6.6%)
Currently in School	
No	1661 (75.5%)
Yes	539 (24.5%)
Educational Level	
Primary school or less	67 (3.0%)
Some secondary school	846 (38.5%)
Completed secondary school	875 (39.8%)
Tertiary education	412 (18.7%)
Living Situation	
Living together with family	1145 (52.0%)
Living with partner or his family	889 (40.4%)
Living alone	137 (6.2%)
Living with friends	29 (1.3%)
Monthly Household Income (ZAR)	4000 (2500–6000)
Personal Steady Income	
None	1604 (72.9%)
Part-time job	220 (10.0%)
Full-time job	303 (13.8%)
Income not from a job	73 (3.3%)
Relationship Status	
Casual	348 (15.8%)
Steady, not living together	964 (43.8%)
Steady, living together	727 (33.0%)
Married	161 (7.3%)
History of pregnancy	
No	718 (32.6%)
Yes	1482 (67.4%)
History of previous HIV testing	
No	97 (4.4%)
Yes	2103 (95.6%)
Ever experienced physical violence	
No	2109 (95.9%)
Yes	91 (4.1%)

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AGYW Demographic Characteristic	N (%) Median (IQR)
Ever experienced sexual violence	
No	2162 (98.3%)
Yes	38 (1.7%)

Table 2.

Baseline relationship characteristics of 2,200 adolescent girls and young women engaged in the HIV prevention intervention in Johannesburg.

AGYW-reported partner characteristics	N (%) Median (IQR)
Perceived HIV risk	
Low (0–33)	1641 (74.6%)
Medium (34–66)	409 (18.6%)
High (67–100)	150 (6.8%)
Number of sexual partners in past 6 months	
0	10 (0.5%)
1	1958 (89.0%)
2	155 (7.0%)
3 or more	77 (3.5%)
Partner's suspected number of other female sexual partners	
0	1799 (81.8%)
1 or more	401 (18.2%)
Who has more say about condom use?	
AGYW	1226 (55.7%)
Male partner	974 (44.3%)
Sexual Relationship Power Score †	55 (52–57)
Sex in the past 30 days	
No	49 (2.2%)
Yes	2151 (97.8%)
Condom use in the past 30 days	
Always	425 (19.8%)
Often	280 (13.0%)
Rarely	586 (27.2%)
Never	860 (40.0%)
Primary partner HIV status ‡	
HIV positive	1 (0%)
HIV negative	1008 (45.8%)
Unknown	1191 (54.2%)

† Score generated from 23-item Sexual Relationship Power Scale, with total possible score ranging from 23 (low power) to 76 (high power), and sample range of 36–75.

‡ Some AGYW had multiple partners, at least one of which was of unknown HIV status to meet eligibility criteria

Table 3.

Classes of relationship type, prevalence of class membership, and conditional probabilities of class indicators identified through latent class analysis among 2200 adolescent girls and young women in Johannesburg, South Africa. †

	Class 1: Stable, empowered relationship with older partners	Class 2: Shorter, empowered relationship with peer partners	Class 3: Shorter, less empowered relationship with risky partners
Prevalence of Class Membership	47%	43%	10%
High perceived HIV risk	0.04	0.04	**0.34**
≥2 sexual partners in last six months	0.05	0.13	**0.31**
Relationship duration < 3 months	0.22	0.39	**0.44**
Cohabit with partner	**0.80**	0.01	0.25
Always used condom with partner in past 30 days	0.08	**0.35**	0.07
Partner suspected to have one or more other partners	0.09	0.17	**0.66**
Previously discussed partner HIV status	**0.50**	0.46	0.26
Receive financial support from partner	**0.97**	0.73	0.71
Partner ≥ 5 years older	**0.61**	0.34	**0.49**
High sexual relationship power	0.71	**0.85**	**0.34**
Talk about HIV with partner	**0.63**	0.34	0.36

† Bold values indicate key characteristics used to define relationship types, based on having a low or high conditional probability of the characteristic compared to other classes.

Table 4.

Characteristics of AGYW (N=2200), by most likely relationship type as determined through LCA. †

	Class 1: Stable empowered relationship with older less risky partners (N=973)	Class 2: Shorter empowered relationship with peer partners (N=1067)	Class 3: Shorter, less empowered relationship with risky partners (N=160)	p value‡
Age	22 (21–24)	21 (19–23)	22 (19.5–24)	<0.01
Country of Origin				
South Africa	478 (49.1%)	892 (83.0%)	112 (70.0%)	
Zimbabwe	377 (38.8%)	161 (15.0%)	42 (26.3%)	<0.01
Other	118 (12.1%)	22 (2.0%)	6 (3.7%)	
Educational Level				
Primary school or less	46 (4.7%)	15 (1.4%)	6 (3.8%)	
Some secondary school	458 (47.1%)	329 (30.1%)	59 (36.9%)	<0.01
Completed secondary school	382 (39.3%	427 (40.0%)	66 (41.3%)	
Tertiary education	87 (8.9%)	296 (27.7%)	29 (18.1%)	
Living Situation				
Living together with family	103 (10.6%)	938 (87.9%)	104 (65.0%)	
Living with partner or his family	854 (87.8%)	0 (0.0%)	33 (21.9%)	
				<0.01
Living alone	12 (1.2%)	107 (10.0%)	18 (11.3%)	
Living with friends	4 (0.4%)	22 (2.1%)	3 (1.9%)	
Monthly Household Income (ZAR)	4000 (2800–6000)	4000 (2500–6000)	3600 (2000–5100)	0.34
Personal Steady Income				
No	725 (74.5%)	772 (72.4%)	107 (66.9%)	
Yes, from part-time job	92 (9.5%)	113 (10.6%)	15 (9.4%)	0.14
Yes, from full-time job	131 (13.5%)	144 (13.5%)	28 (17.5%)	
Other income not from a job	25 (2.6%)	38 (3.6%)	10 (6.3%)	
Relationship Status				
Casual	28 (2.9%)	270 (25.3%)	50 (31.3%)	
Steady, not living together	144 (14.8%)	742 (69.5%)	78 (48.8%)	<0.01
Steady, living together	645 (66.3%)	53 (4.9%)	29 (18.1%)	
Married	156 (16.0%)	2 (0.2%)	3 (1.9%)	
History of pregnancy				
No	158 (16.2%)	507 (47.5%)	53 (33.1%)	<0.01
Yes	815 (83.8%)	560 (52.5%)	107 (66.9%)	
History of previous HIV testing				
No	35 (3.6%)	55 (5.2%)	7 (4.4%)	0.23
Yes	938 (96.4%)	1,012 (94.9%)	153 (95.6%)	
History of transactional sex				
No	950 (97.6%)	1040 (97.5%)	145 (90.6%)	<0.01
Yes	23 (2.4%)	27 (2.5%)	15 (9.4%)	

		Class 1: Stable empowered relationship with older less risky partners (N=973)	Class 2: Shorter empowered relationship with peer partners (N=1067)	Class 3: Shorter, less empowered relationship with risky partners (N=160)	p value‡
Ever experienced physical violence					
	No	939 (96.5%)	1023 (95.9%)	147 (91.9%)	0.02
	Yes	34 (3.5%)	44 (4.1%)	13 (8.1%)	
Ever experienced sexual violence					
	No	958 (98.5%)	1048 (98.2%)	156 (97.5%)	0.68
	Yes	15 (1.5%)	19 (1.8%)	4 (2.5%)	

†A most likely relationship type was assigned to AGYW based on their posterior probabilities of class membership.

‡p values are based on Chi-square test for categorical variables and analysis of variance for continuous variables.

Table 5.

Adjusted risk ratios and 95% confidence intervals for the association between relationship type and HIV prevention outcomes (completion of HIV prevention cascade; PrEP interest; PrEP uptake) among AGYW.[†]

Outcome: Partner Self-Testing Cascade Completion[‡]		
Relationship Type	**Completed Cascade Crude N (%)** [§]	**aRR (95% CI)**[‡¶]
Class 1: Stable empowered relationship with older less risky partners	613 (63.0%)	REF
Class 2: Shorter empowered relationship with peer partners	632 (59.2%)	0.89 (0.85–0.95)
Class 3: Shorter, less empowered relationship with risky partners	87 (54.4%)	0.84 (0.73–0.94)
Outcome: PrEP Interest[#]		
Relationship Type	**PrEP Interest Crude N (%)**	**aRR (95% CI)**
Class 1: Stable empowered relationship with older less risky partners	248 (31.1%)	REF
Class 2: Shorter empowered relationship with peer partners	368 (38.7%)	1.26 (1.13–1.39)
Class 3: Shorter, less empowered relationship with risky partners	87 (64.9%)	2.10 (1.95–2.24)
Outcome: PrEP Uptake[#]		
Relationship Type	**PrEP Uptake Crude N (%)**	**p value** [††]
Class 1: Stable empowered relationship with older less risky partners	8 (1.0%)	
Class 2: Shorter empowered relationship with peer partners	36 (3.8%)	<0.001
Class 3: Shorter, less empowered relationship with risky partners	15 (11.2%)	

[†]Models were adjusted for the following to estimate aRR: age, educational level.

[‡]Estimates for the outcome of partner self-testing cascade completion were weighted using stabilized inverse probability of observation weights as outcome ascertainment was not available for all AGYW.

[§]To calculate Ns and percentages, a most likely relationship type was assigned to AGYW are based on posterior probabilities of class membership. However, these class assignments were not fixed, and aRRs calculated via mixture modeling treated class membership as a latent variable.

[¶]Among AGWY for whom outcome data were available (N=1,673). Complete data were available for 716 AGYW most likely in Class 1, 840 most likely in Class 2, and 117 most likely in Class 3.

[#]Among AGYW who were eligible for PrEP (N=1,882). Of the AGYW eligible for PrEP, 793 were most likely in Class 1, 964 were most likely in Class 2, and 125 were most likely in Class 3.

[††]PrEP uptake models did not converge; aRRs are not presented, but rather a p value from a Chi-square test of the crude association between most likely relationship type and PrEP uptake.