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Friendships among young South African women, sexual behaviours and connections to sexual partners (HPTN 068)

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The authors declare that they have no conflicts of interest.

Compliance with Ethical Standards

All procedures performed in studies involving human participants were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki declaration and its later amendments or comparable ethical standards. Informed consent was obtained from all individual participants included in this study. Under 18's gave assent, and their parent/guardian gave informed consent.

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Abstract

Friends could be influential on young women's sexual health via influences on sexual behaviours and as connections to sexual partners, but are understudied in sub-Saharan Africa. We cross-sectionally surveyed 2326 13–20 year-old young women eligible for grades 8–11 in rural South Africa about their sexual behaviour and up to three sexual partners. Participants each described five specific but unidentified friends and the relationships between them in an 'egocentric' network analysis design. We used logistic regression to investigate associations between friendship characteristics and participants' reports of ever having had sex (n=2326) and recent condom use (n=457). We used linear regression with random effects by participant to investigate friendship characteristics and age differences with sexual partners (n=633 participants, 1051 partners). We found that it was common for friends to introduce young women to those who later became sexual partners, and having older friends was associated with having older sexual partners, (increase of 0.37 years per friend at least one year older, 95% CI 0.21–0.52, adjusted). Young women were more likely to report ever having had sex when more friends were perceived to be sexually active (adjusted OR 1.85, 95% CI 1.72–2.01 per friend) and when they discussed sex, condoms and HIV with friends. Perception of friends' condom use was not associated with participants' reported condom use. While this study is preliminary and unique in this population and further research should be conducted, social connections between friends and sexual partners and perceptions of friend sexual behaviours could be considered in the design of sexual health interventions for young women in South Africa.

Keywords

Peer influence; Sexual Behaviour; Sexual Partners; Adolescents; South Africa

Peer relationships among young people, including friendships, have been found to be influential on a range of health-related behaviours such as smoking and alcohol use, substance use, physical activity, diet and sexual behaviour(1–6). For young people in southern Africa, the ages at which they begin to develop romantic and sexual lives, progress through and leave education are also characterised by high incidence of HIV, especially for young women(7). Friendships could play a role in influencing young women's sexual behaviours and the characteristics of their sexual partners, in turn affecting their risk of HIV exposure and acquisition. However, with some recent exceptions(8–11), there have been few high quality quantitative studies specifically to understand the role that young people's friends play in their sexual health in Sub-Saharan Africa(12) and few studies have examined individual peer relationships and their characteristics – a social network approach – rather than describing peer relationships in general terms.

There are a range of mechanisms by which a young woman's friends might be influential on her risk of HIV. In reviewing existing evidence for peer influence on young people's sexual behaviour in sub-Saharan Africa, we previously suggested a framework for characterising different mechanisms by which young people might be influenced by their friends in their

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sexual behaviour(13). Friends could act as social connections to others, introducing young women to those boys or men who then become their romantic and sexual partners, whose characteristics, including age, affect their risk of acquiring HIV(14, 15). Because people tend to know others similar to themselves, a concept known as 'homophily'(16), a friend's *sociodemographic attributes* could influence the attributes of those to whom they provide connections. Via *perceived behaviour*s (17), also known as descriptive norms, friends could serve as models of behaviour, such that a young woman who perceived most of her friends to be sexually active might be more likely to become sexually active herself(18, 19). The extent to which norms among friends are influential could also vary by the strength of the friend relationship(20).

Communication between friends allows the spread of information. Talking about HIV/AIDS with social contacts has been found to increase perceptions of personal risk for HIV in Malawian and Kenyan adults(21, 22). Research on adolescent peer educator interventions in South Africa has posited that collective communication, shared critical engagement and reflection within peer groups could help young people to forge protective identities and behaviours(23, 24), and could therefore help them to avoid HIV infection by renegotiating potentially harmful norms around gender and sexuality(25–27).

Dense networks of interconnected friends could provide young women with a strong social identity and mutual support(17), potentially making them less vulnerable to circumstances, sexual behaviours and partners putting them at risk of HIV(28). However, dense friendship networks might also serve to reinforce dominant group norms, whatever character these norms take.

We have previously found that HIV status and herpes simplex virus type-2 (HSV-2) status among young women aged 13–20 years were associated with friendship characteristics, including age of friends and perceptions of whether friends are sexually active(29). Here, we have employed an egocentric network design to investigate these findings further by exploring the relationship between friendships, sexual partners, and sexual behaviours. Unlike many previous analyses investigating peer influences on sexual behaviours in the region, we have defined friends as our peer relationship of interest, collected data about specific friends, and used this information to investigate a range of different mechanisms by which friends could be influential on young women's sexual partnerships and sexual behaviours. We identified friend sociodemographic attributes, perceived friend behaviour, communication amongst friends and density of ties amongst friends as friendship network exposures. We investigated associations between these characteristics and participants reporting ever having had sex, any instance of condom use in the past three months and ages of sexual partners. Our hypotheses were that 1) young women with older friends, friends out of school and male friends were more likely to have older sexual partners and to have had sex; 2) that perceiving friends to be sexually active and using condoms would be associated with concordant participant behaviours, but that the effects would vary by density of the friendship network; 3) that young women who discussed sex with friends would be less likely to have had sex but more likely to use condoms; and 4) that higher frequency of contact and longer friendship duration would strengthen associations between perceived friend behaviours and participant behaviours.

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Methods

Our study was cross-sectional using baseline data from the HPTN 068 Conditional Cash Transfer (CCT) Trial, which recruited 2533 young women between March 2011 and December 2012 who were aged 13–20 years, eligible for grades 8–11, and not pregnant or married at the time of recruitment (30).

Study Setting

The study was set in the Agincourt Health and Socio-Demographic Surveillance System (HDSS) in rural Mpumalanga, northeast South Africa. The site, a former Apartheid 'homeland', is densely populated but rural, and has high levels of poverty and unemployment (31). HIV prevalence is 19.4% among those over 15(32).

Recruitment and Data Collection

Participants in this study were those young women enrolled in the CCT Trial at baseline. Agincourt HDSS households were identified as having potentially eligible participants from the annual census round. Fieldworkers visited to confirm eligibility, explain the study and obtain informed consent (assent for under 18's). Young women attended a community venue to complete study procedures and a survey in either English or Shangaan. We used Audio Computer Assisted Self Interview (ACASI), except for the friendship and other non-sensitive sections, for which we used an interviewer because their structure was relatively complex and participants were not reporting their own potentially sensitive behaviours.

Measures of Participant Characteristics and Outcomes

The questionnaire included demographics, household characteristics, education, and sexual partners and behaviours. Questionnaires were translated from English to Shangaan and back-translated again, with further testing during fieldworker training prior to the survey. If young women reported having had sex, they described up to three most recent sexual partners, including their ages. To obtain the age difference with sexual partners, we subtracted the young woman's age from that of each reported sexual partner, such that a positive value indicated an age difference with an older partner and a negative value an age difference with a younger partner. Participants reported whether they had ever had vaginal and/or anal sex. Sexually active young women reported frequency of sex and frequency of condom use in the previous three months. We created a binary variable indicating whether the young woman reported any instance of condomless sex in the previous three months. We used a household asset index to create a measure of relative socioeconomic position (SEP) and split this into quintiles.

Friendship Measures

All participants described each of their five closest friends in turn and then the relationships between them: 'egocentric networks' in social network terminology. These egocentric networks are referred to here as young women's 'friendship networks'. We collected information about each friend's sociodemographic attributes, their school status, participants' perceptions of each friend's sexual behaviours and condom use, whether they discussed sex, condom use and HIV with them, the frequency with which they saw them and

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duration of their friendship. The latter two characteristics were used as measures of friendship tie strength.

To capture the friendship environment, we took a ‘personal network exposure’ approach (33), creating summary proportional measures of the friendship network for each participant. Because all participants described five friends, these proportions could be easily converted to ‘number of friends’ measures so that friendship exposures took values between 0 and 5. If friends were missing a response for a given variable (up to two), the proportion was calculated with the number of reporting friends as the denominator and then converted to a number of friends as if all five had responses. For rarer friendship characteristics, we converted friendship exposures to binary variables (‘has at least one friend’).

We measured friendship density, which is defined as the number of reported friend-to-friend ties divided by the total number of possible friend-to-friend ties. Again, because all participants reported five friends, the number of possible ties between friends was always ten, so here we report friendship network density as the number of ties between reported friends that were reported by the participants to be either ‘friends’ or ‘close friends’ with each other.

We combined reports about ties between friends with reports of discussing sex, condom use and HIV with friends in order to operationalize Campbell’s concept of a supportive friendship group in which young people are able to discuss and reconceive norms about sex, condom use and HIV (24). This research into a young person’s HIV prevention peer education intervention in South Africa posited that health behaviours are shaped by a collective social identity, and that the reinforcement or contesting of existing norms about gender or sexuality takes place as part of an evolving group communication process. For each friendship network, we counted the number of ‘discussion triads’ in which sex, condom use or HIV was discussed. A triad consisted of two friends with whom a young woman reported discussing these topics who were also reported to be friends with each other, with a possible maximum of ten triads per participant.

The duration of each friendship was recorded categorically, from ‘whole life’ to ‘less than one month’ and frequency of contact from ‘every day’ to ‘during school holidays’ and is described in more detail in Appendix A.

Analysis

We included young women who were not missing friendship, socioeconomic or outcome data, ages of sexual partners among those who reported having had sex, or information on more than three of their five friends for the main friendship variables, which came to 2326 participants included in these analyses of the 2537 enrolled at baseline in the CCT trial (91.7%).

We described participants’ sociodemographic characteristics, sexual behaviour and partner outcomes. We then described the perceived characteristics and behaviours of friends, and examined these factors by whether or not the participant reported ever having had sex herself, examining the statistical evidence for whether these characteristics differed crudely

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using the χ^2 test. We calculated each participant's friendship density and her number of friendship 'discussion triads'. We described the proportion of friends who introduced young women to sexual partners.

Association between friendship characteristics and age difference with sexual partners—We investigated the associations between age differences in years between participants and their sexual partners and the sociodemographic characteristics of their friendship networks using linear regression. Because young women reported between one and three sexual partners each, we included a random effect for participant to account for clustering of sexual partners. Models were fit using maximum likelihood estimation and coefficient p values were obtained using likelihood ratio tests comparing models with and without each exposure. We first adjusted only for the participant's age, and then for participant (age, grade, SEP, orphanhood, mother and father's education) and friendship network sociodemographic characteristics (each friend at least one year older, at least one male friend, at least one friend out of school, number of friends who were relatives).

Association between friendship characteristics and whether participants had ever had sex an) condom use amongst participants who had had sex—To assess both the extent to which the friendship environment might affect a young woman's likelihood of having had sex, and the likelihood of condom use amongst those sexually active, we examined associations between each of these outcomes and friendship network sociodemographic characteristics, perceived sexual behaviour, density and discussion triads. We used logistic regression models, separate for each outcome, first examining each association adjusted only for the participant's age and then fully adjusted for participant and the friendship network variables above. The latter model for condom use was additionally adjusted for age difference with the most recent reported sexual partner and the total number of sex acts reported by the participant in the previous 3 months. Models were fit using maximum likelihood estimation and we obtained p-values for regression coefficients using likelihood ratio tests comparing models with and without the term in question, and otherwise identical. When investigating associations between perceived friend condom use and own condom use in the previous three months, we limited the sample to those young women who reported that they had had sex in the previous three months; and reported that they perceived at least one of their friends to have had sex (and could therefore provide a measure of their perceptions of their friends' condom use).

Assessing the effects of friendship duration and frequency of contact on associations observed between friendship characteristics and the participant ever having had sex—We compared models with and without weighting the perception that a friend had ever had sex by frequency of contact with the friend and separately by duration of friendship. We used Akaike Information Criterion (AIC) to examine whether the weighted and unweighted models differed significantly from each other, which would suggest an effect of friendship duration or frequency of contact on the association, and to select the relatively better fitting model. Likelihood ratio techniques were not possible as models were not nested. These methods and findings are described in more detail in Appendix A.

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Assessing whether the association between the number of friends perceived to have had sex and the participant's likelihood of having had sex varied by density of the friendship network—We investigated evidence for an interaction by friendship network density in the association between the proportion of friends perceived to have had sex and whether or not the participant had had sex by using a likelihood ratio test to compare models with and without the interaction term but otherwise identical.

Ethics

The HPTN 068 study trial attained ethical approval from the Ethics Committees of the University of North Carolina, the University of the Witwatersrand, Mpumalanga Province Health Research and Ethics Committee and the London School of Hygiene and Tropical Medicine.

Results

Participants

There were 2326 participants in the sample, who reported five friends each (11,630 friends in total). Participants were a mean of 15.5 years, split evenly across grades 8 to 11 at school, and one third were either single or double orphans. There were 646 (27.7%) young women who reported ever having had sex, and 636 (27.3%) also reported information about up to three most recent sexual partners. These 636 young women were older, mean 16.6 years, and in higher school grades than study participants as a whole, Table 1. Sexual partners were a mean of 2.8 years older than the young women (median 2 years). Of the 636 sexually active young women, 457 (71.9%) had had sex in the last three months, reported their condom use and perceived at least one of their friends to have had sex, and reported perceived condom use amongst friends.

Friendships

Sociodemographic attributes of friendship networks—Mean age of friends was similar to that of participants at 15.9 years and 15.5 years respectively. The proportion of young women with at least one friend one year older than themselves was 53.7% (1241/2326). Amongst those who had ever had sex and reporting sexual partner ages, 58.7% (373/636) reported having at least one friend one year older than themselves, Figure 1. The majority of friends were in school and female. Many young women had known their friends for at least five years (43.1%, 5006/11630 friendships reported by 2326 participants) and 86.7% were seen all or most days (10059/11630, see Appendix A).

Perceived romantic and sexual behaviours among friends in young women's friendship networks and connections to sexual partners—The majority of young women perceived that at least one of their friends had ever had sex, 60.7% (1413/2326), though among those reporting having had sex themselves, the percentage was 92.6% (589/636), Figure 1. Similar patterns were observed for the number of friends who had a boyfriend or girlfriend, and young women who had had sex were also more likely to have at least one friend whom they believed had ever been pregnant (56.9% 362/636 among participants reporting having had sex, compared to 32.9% 756/2326 among all participants).

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Higher condom use was reported amongst young women than was perceived of their friends: 61.1% (279/457) of young women reported always using condoms in the previous three months (zero condomless sex acts) while among friends of these young women, 15.1% (261/1728 friends) were perceived to always use condoms with a main partner. There were 72.9% of young women who perceived that none of their sexually active friends always used condoms with a main partner (not shown in table).

It was common for young women to have had at least one friend who had ever introduced them to someone who later became a boyfriend or sexual partner: 40% among all young women (930/2326) and 64.8% (412/636) among those who had had sex and reported partner ages (Figures 1A and 1B).

Friendship network density—Young women reported that most of their friends were also friends with each other, Table 1. Among all participants, the mean number of friendship ties between friends was 7.1 of a possible 10 ties, while among young women who had had sex it was 6.7.

Communication with friends about sex, condom use and HIV—Almost half of young women did not report discussing sex, condom use or HIV with any friends, (1068, 45.9%), Figure 1. Discussion of sex, condom use and HIV with friends was more common amongst young women who reported ever having had sex (519/646, 80% discussed one of these topics with at least one friend). Talking about HIV was more common (48.8% discussed with at least one friend) than talking about sex or about condoms (both 844, 36.3% discussed with at least one friend).

The median number of discussion triads was 0, (mean 1.8) though amongst young women who reported ever having had sex it was 1 (mean 2.9), Table 1.

Associations between friendship characteristics and age of sexual partner—The mean age difference between young women and their sexual partners was 2.8 years, whereby the partner was older than the participant, Table 1. Having older friends was associated with a greater age difference with sexual partners, Table 2. Among 1051 sexual partners reported by 633 participants (3 partners more than 20 years older than the participants were dropped as outliers), each additional friend at least one year older than the participant was associated with an increase in the average age difference with partners of 0.37 years, (95% CI 0.21–0.52), adjusted for participant and other friend sociodemographic characteristics. Having at least one male friend or friend out of school was not associated with age of sexual partners, Table 2.

Associations between friendship characteristics and ever having had sex—Adjusted for friendship characteristics and participant age, grade, orphanhood status, SEP quintile, and parental educational attainment, there was strong evidence that each additional friend perceived to have had sex was associated with the participant reporting having had sex themselves (adjusted OR=1.86, 95% CI 1.72–2.01, $p<0.001$), and that each additional discussion triad was associated with the participant reporting having had sex, adjusted for other participant and friendship characteristics (adjusted OR=1.05, 95% CI 1.01–1.10,

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p=0.010), Table 3. There was weak evidence that lower friendship density was associated with ever having had sex (OR 0.96, 95% CI 0.93–1.00, p=0.053 for each friend-to-friend tie).

Assessing the effects of friendship duration and frequency of contact on associations observed between friendship characteristics and the participant ever having had sex—Weighting individual friendship ties by duration of friendship or frequency of contact did not significantly improve model fit. There was not evidence that these tie characteristics affected the association between perceived friend behaviour and the participant reporting ever having had sex (see Appendix A for full details).

Assessing whether the association between the number of friends perceived to have had sex and the participant's likelihood of having had sex varied by friendship network density—We did not find evidence that the association between the number of friends perceived to have had sex and the participant reporting ever having had sex themselves varied by friendship density (interaction term for an increase in friend-to-friend ties 0.99, 95% CI 0.97–1.01, likelihood ratio test comparing models with and without the interaction p=0.471).

Associations between friendship characteristics and condom use—When adjusting only for participant age, perception of friends' condom use was weakly associated with participants' likelihood of reporting condomless sex (perceiving all sexually active friends to use condoms compared to none OR=0.36, 95% CI 0.14–0.91, p=0.064), Table 4. Each additional friend perceived to have had sex was also associated with condomless sex (OR=1.24, 95% CI 1.05–1.46, p=0.012). Each additional sex act reported by participants in the previous 3 months was associated with increased odds of an instance of condomless sex (OR=1.69, 95% CI 1.47–1.95, p<0.001) as was the most recent sexual partner's age (OR=1.06 for each year, 95% CI 1.00–1.14, p=0.029). However, once adjusted for all participant, recent sex and friend characteristics, there was little evidence for an association between friend and participant condom use (aOR=0.62, 95% CI 0.23–1.70, p=0.559 for perceiving all compared to no friends always using condoms). A greater number of sex acts in the previous three months remained associated with increased likelihood of condomless sex (aOR=1.68, 95% CI 1.45–1.95, p<0.001), as did perceiving more friends to be sexually active (aOR=1.25, 95% CI 1.00–1.56, p=0.046). There was weak evidence that a greater number of discussion triads decreased the likelihood of condomless sex, (OR=0.93, 95% CI 0.85–1.00, p=0.06 for each tie).

Discussion

This study uses a novel framework for describing and investigating different potential mechanisms of friendship influence on young women's sexual behavior and sexual partner ages in South Africa. We have described young women's friendship networks according to their sociodemographic attributes, perceived sexual behaviors, communication about sex, and density of friendship ties amongst friends. Once each friendship network characteristic was adjusted for the others and for participant sociodemographic characteristics, we found that having more friends perceived to have ever had sex and more friendship triads

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discussing sex, condom use, or HIV was associated with raised odds of young women reporting that they themselves had ever had sex. It was common for friends to introduce young women to boys or men who later became sexual partners, and having older friends was associated with increased age differences with sexual partners amongst young women who had had sex. We did not find that perceived norms about friends' condom use was associated with participant's own condom use, but found weak evidence that a greater number of discussion triads was associated with lower odds of condomless sex.

Young women did not report many male friends. Our data are not consistent with a hypothesis that friends and sexual partners are linked because friendships with young men develop into partnerships, as has been found in other settings outside of Southern Africa(34). Rather, friends might provide social connections to those who become partners, and having older friends could in turn lead to having older sexual partners. If so, this could be a mechanism for our previous finding that young women with older friends were more likely to test positive for HIV and Herpes Simplex Virus Type 2(29), given that having partners five or more years older has been associated with higher risk sexual behaviours (35) and HIV incidence in this population(36).

While the measures are not equivalent, there was a striking difference in levels of condom use self-reported by participants and what they reported of their friends. This gap could suggest biased reporting or differences between actual and perceived behaviours. Over-reporting of risky behaviours and under-reporting of protective behaviours among adolescent peers is common(37). There are interventions amongst young people in other populations that aim to close the gap between perceived norms and reported behaviours in order to reduce risky behaviours(38).

Discussion of sex, condom use or HIV amongst connected friends – 'discussion triads' – was associated with a greater likelihood that young women had had sex. There was also weak evidence that among sexually active young women, discussing sex, condom use and HIV was associated with lower odds of condomless sex. One interpretation of this finding is that young women who have never had sex are unlikely to discuss these topics with their friends, but that once sexually active, discussion with friends about sex, condom use and HIV could be protective. However, we cannot say whether discussion follows or precedes sexual experience and condom use.

Our data are from a randomised control trial, are of high quality, and have detailed information about specific friends. However, because this study is cross-sectional, we cannot detect directionality or assume causality in the associations we find. Selection effects are possible, whereby young women befriend those who are similar to themselves based on the behaviours in question (3, 6), though the majority of friendships were long in duration, while behaviours and partnerships occurred more recently. Closeness of friendships might moderate the associations between friend characteristics and young women's sexual behaviours, but unfortunately we could not assess this beyond examining frequency of contact and duration of friendships. There could be social desirability or recall bias in reporting of own and perceived friend behaviours. We tried to mitigate this bias by using ACASI for self-reported sexual behaviours.

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Our findings suggest that the co-evolution of young women's social relationships and their romantic relationships should be considered together in future research. Our study is among the first of its kind in this population and is therefore exploratory and preliminary; further strengthening in the evidence for the existence and mechanisms of friendship influence on characteristics of sexual partners and behaviours is an important next step. This means conducting longitudinal research where possible, using network designs that might allow a more detailed exploration of the effects of the friendship network structure, and validating constructs in southern African adolescent populations. Previous studies have found variation in adolescents' susceptibility to influence from their friends as they age (39). It is plausible that the individual circumstances of young women might influence this susceptibility and should be investigated, such as household factors, or being in or out of school. This study was not able to collect data about young men's friendships and behaviours, but evidence from elsewhere in sub-Saharan Africa suggests that peer relationships could be influential on their sexual behaviours also(8), so this is an important area for future study. Our study has not compared the potential influence of friends with influence from other important relationships such as those with parents or caregivers, family, or other significant adults, though we did not find that the proportion of friends who were relatives was associated with sexual behaviours. Research from other populations has sometimes, though not always, found that relationships and communication with parents can act as a 'buffer' to peer influences (40, 41).

If our initial findings are further strengthened, young South African women's friendship networks, rather than individuals, could be effective targets for health promotion(42). Interventions could consider how different environments give rise to particular friendship characteristics, such as age-mixing within friendships and the effects this might have on connections to older sexual partners and sexual behaviours. It might also be important to consider when the promotion of communication about sex, condom use and HIV could be protective and when it might not. Our research points to a potential role for friendships in helping to shape young women's romantic and sexual lives and health in rural South Africa. Friendships should be further investigated towards designing and supporting effective sexual health and HIV prevention interventions, very much needed in this population.

Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

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Abbreviations used in the text

ACASI	Audio Computer Assisted Self Interview
AIC	Akaike Information Criterion
CI	Confidence Interval
HIV	Human Immunodeficiency Virus
HIV/AIDS	Human Immunodeficiency Virus/Acquired Immune Deficiency Syndrome
HPTN	HIV Prevention Trials Network
LSHTM	London School of Hygiene and Tropical Medicine
OR	Odds Ratio
SEP	Socio-Economic Position

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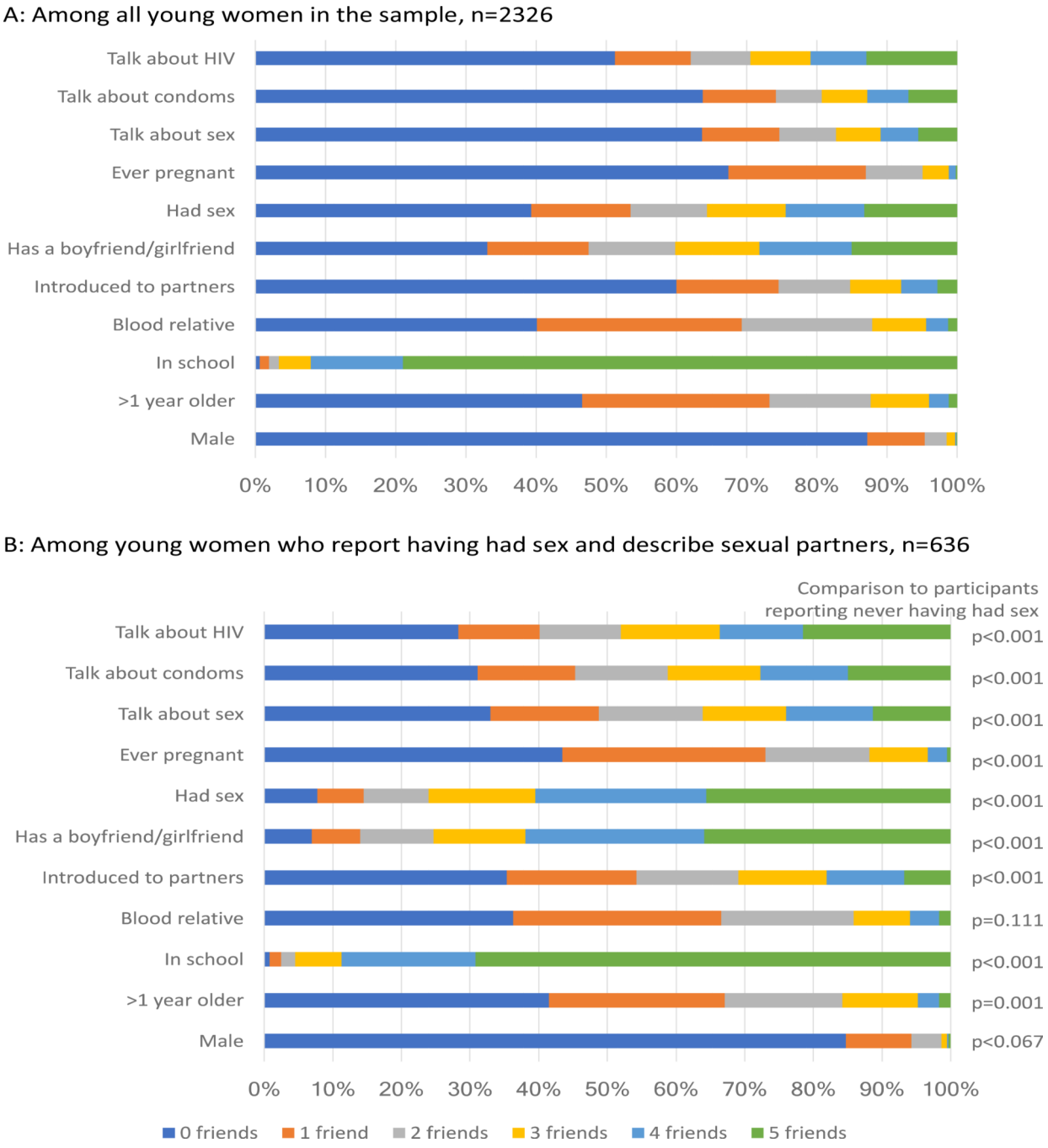


Figure 1: Distribution of friend characteristics within young women's friendship networks

Crude comparisons between the characteristics of participants' friendship networks according to whether or not they reported having had sex were conducted using χ^2 tests.

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Table 1:

Characteristics of participants in the study sample

Participant Characteristics		All Participants, n=2326		Participants reporting having ever had sex with data on up to 3 sexual partnerships, n=636		p value for difference*
		n	%	n	%	
Age (years)	Median, Mean/interquartile range	15,15.5	14–17	17, 16.7	16–18	p<0.001
Grade	8	598	25.7%	60	9.3%	p<0.001
	9	628	27.0%	123	19.0%	
	10	631	27.1%	224	34.7%	
	11	469	20.2%	239	37.0%	
Orphanhood	Both parents alive	1,581	68.0%	422	65.3%	p=0.109
	Father died/unknown	465	20.0%	137	21.2%	
	Mother died/unknown	143	6.1%	38	5.9%	
	Both died/unknown	137	5.9%	49	7.6%	
Mother's education	no education	381	16.4%	117	18.1%	p=0.007
	attended primary school	511	22.0%	157	24.3%	
	attended but not finish secondary school	636	27.3%	172	26.6%	
	finished secondary school	597	25.7%	135	20.9%	
	unknown	201	8.6%	65	10.1%	
Father's education	no education	396	17.0%	119	18.4%	
	attended primary school	421	18.1%	124	19.2%	p=0.053
	attended but not finish secondary school	431	18.5%	109	16.9%	
	finished secondary school	649	27.9%	159	24.6%	
	unknown	429	18.4%	135	20.9%	
Socio-economic position	1st quintile (poorest)	461	19.8%	134	20.7%	p=0.307
	2nd	460	19.8%	132	20.4%	
	3rd	461	19.8%	140	21.7%	
	4th	468	20.1%	121	18.7%	
	5th quintile (richest)	476	20.5%	119	18.4%	
Friendship net density, (number of friend-to-friend ties reported of a possible ten)	Median, Mean/interquartile range	9, 7.1	4–10	7, 6.7	4–10	p=0.006
No. of Discussion triads within friendship net	Median, Mean/interquartile range	0, 1.8	0–3	1, 2.9	0–5.5	<0.001
Number of lifetime sexual partners	Median, Mean/interquartile range			1, 2.15	1–2	-
Number of partners described	1 sexual partner			348	54.7%	-
	2 sexual partners			158	24.8%	
	3 sexual partners			130	20.4%	
Age difference with sexual partners in years,	Median, Mean/interquartile range			2, 2.8	1–4	-

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Participant Characteristics		All Participants, n=2326		Participants reporting having ever had sex with data on up to 3 sexual partnerships, n=636		p value for difference*
		n	%	n	%	
(positive indicates partner is older)						
Number of sex acts in the previous 3 months	Median, Mean/interquartile range			2, 3.5	1–3	-
Any condomless sex acts in the previous 3 months	no sex previous 3 months			116	18.2%	-
	no			311	48.9%	
	yes			189	29.7%	
	missing			20	3.1%	

*Differences in the characteristics of young women reporting and not reporting ever having had sex, assessed using χ^2 test for categorical variables (number of discussion triads was made a binary variable of no triads compared to at least one) and student's t test for continuous variables with the exception of density which was a left-skewed distribution: here, a χ^2 test for a binary density variable (under median value of 9 ties and 9–10 ties) was performed.

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Table 2:

Associations between friendship characteristics and age differences with up to three most recent sexual partners: n=1051 sexual partners reported by 633 participants.

Characteristics of participants and friendship nets, n=1051 sexual partners reported by 633 participants		Mean age difference with sexual partner in years	Adjusted only for participant age			Adjusted for friend and participant characteristics		
			Age difference in years	95% CI	p value	Age difference in years	95% CI	p value
Socio-demographic characteristics of participants' friendship networks								
Each additional friend at least 1 year older than participant			0.39	0.25 0.53	<0.001	0.37	0.21 0.52	<0.001
At least one male friend of the 5 friends	no	2.6	ref		0.165	ref		0.641
	yes	3.0	0.35	−0.14 0.85		0.10	−0.40 0.61	
At least one friend not in school of the 5 friends	no	2.6	ref		0.119	ref		0.678
	yes	2.8	0.31	−0.08 0.70		−0.10	−0.52 0.32	
Each additional friend who was also a relative			0.02	−0.05 0.10	0.534	−0.01	−0.09 0.07	0.780
Participant characteristics								
Age in years			−0.21	−0.33 −0.10		−0.24	−0.39 −0.09	0.003
School grade	8	2.9	ref			ref		
	9	2.6	0.07	−0.66 0.80	<0.001	−0.01	−0.73 0.72	0.009
	10	2.3	0.16	−0.56 0.88		−0.08	−0.80 0.64	
	11	3.0	0.97	0.22 1.72		0.64	−0.12 1.40	
Orphanhood	Both parents alive	2.7	ref			ref		
	Mother only alive	2.6	0.12	−0.33 0.57	0.937	0.04	−0.40 0.49	0.998
	Father only alive	2.7	0.11	−0.62 0.84		−0.03	−0.77 0.71	
	Neither parent alive	2.8	0.14	−0.53 0.81		0.06	−0.61 0.73	
Household SEP	1st quintile	2.4	ref			ref		
	2nd	2.3	−0.13	−0.68 0.43		−0.17	−0.71 0.38	
	3rd	2.8	0.25	−0.30 0.80	0.253	0.34	−0.21 0.89	0.190
	4th	2.9	0.34	−0.22 0.91		0.33	−0.24 0.89	
	5th	2.9	0.43	−0.14 0.99		0.40	−0.17 0.97	
Mother's education	no school	2.6	ref			ref		
	attended primary but not completed	2.5	−0.05	−0.60 0.50		−0.05	−0.67 0.58	

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Characteristics of participants and friendship nets, n=1051 sexual partners reported by 633 participants		Mean age difference with sexual partner in years	Adjusted only for participant age			Adjusted for friend and participant characteristics		
			Age difference in years	95% CI	p value	Age difference in years	95% CI	p value
	completed primary, some high school	2.8	0.02	−0.52 0.56	0.997	0.06	−0.56 0.67	0.980
	completed high school	2.8	−0.03	−0.61 0.54		−0.12	−0.82 0.58	
	do not know	2.6	−0.09	−0.77 0.60		−0.07	−0.96 0.81	
Father's education	no school	2.8	ref			ref		
	attended primary but not completed	2.5	−0.15	−0.74 0.43		−0.17	−0.83 0.48	
	completed primary, some high school	2.7	−0.23	−0.83 0.36	0.858	−0.29	−0.97 0.38	0.903
	completed high school	2.8	−0.10	−0.65 0.45		−0.21	−0.87 0.46	
	do not know	2.5	−0.30	−0.87 0.26		−0.34	−1.04 0.37	

Adjusted model includes all variables listed in table.

Linear regression was used, with random effects for participants to reflect clustering of partners by participant.

Three partners (and three participants) were dropped as outliers because they had an age difference with partner of >20 years.

Distribution of the outcome variable was approximately normal without these outliers.

Positive values in the age difference with sexual partners indicate that the sexual partner was older; negative values would indicate that the participant was older than her partner.

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Table 3:

Associations between friendship characteristics and a participant reporting ever having had sex (n=2326)

Characteristics of participant friendship nets		Adjusted for participant age only				Adjusted for all friendship and participant characteristics			
		OR	95% CI		p value	OR	95% CI		p value
Number of Discussion Triads		1.22	1.09	1.06	<0.001	1.05	1.01	1.10	0.010
Density (number of friend-friend ties)		0.97	0.94	1.00	0.040	0.96	0.93	1.00	0.053
Each additional friend perceived to have had sex		1.93	1.80	2.07	<0.001	1.86	1.72	2.01	<0.001
Each additional friend at least 1 year older than participant		1.37	1.26	1.49	<0.001	1.09	0.98	1.22	0.108
At least one male friend of the 5 friends	no	1.00			0.120	1.00			0.831
	yes	1.26	0.94	1.69		1.04	0.75	1.44	
At least one friend not in school of the 5 friends	no	1.00			0.010	1.00			0.707
	yes	1.40	1.10	1.78		0.94	0.70	1.27	
Each additional of friend who is a relative		1.03	0.99	1.07	0.202	1.00	0.95	1.05	0.966

Participant characteristics adjusted for but not shown include age in years (as linear), grade, orphanhood, socioeconomic position, mother's and father's education. Full model results are presented in Appendix B.

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Table 4:

Associations between friendship characteristics and condomless sex amongst participants reporting sex in the previous three months and at least one friend perceived to have had sex (n=457)

Characteristics of participant friendship nets, age of sexual partner and number of sex acts		Adjusted for participant age only				Adjusted for all friendship, recent sex and participant characteristics			
		OR	95% CI		p value	OR	95% CI		p value
Friendship network characteristics									
Number of Discussion Triads		0.97	0.92	1.03	0.320	0.93	0.85	1.00	0.060
Density (number of friend-friend ties)		0.96	0.91	1.01	0.112	1.02	0.94	1.10	0.646
Proportion of sexually active friends perceived to always use condoms	none	1.00				1.00			
	some	0.95	0.59	1.52	0.064	0.83	0.46	1.50	0.559
	all	0.36	0.14	0.91		0.62	0.23	1.70	
Each additional friend perceived to have had sex		1.24	1.05	1.46	0.012	1.25	1.00	1.57	0.046
Each additional friend at least 1 year older than participant		1.03	0.88	1.19	0.749	0.87	0.70	1.07	0.190
At least one male friend of the 5 friends	no	1.00			0.604	1.00			0.358
	yes	1.15	0.69	1.92		1.35	0.72	2.53	
At least one friend not in school of the 5 friends	no	1.00			0.561	1.00			0.402
	yes	1.13	0.75	1.70		1.26	0.73	2.18	
Each additional of friend who is a relative		1.04	0.97	1.13	0.232	1.03	0.93	1.14	0.607
Number of sex acts in the previous 3 months		1.69	1.47	1.95	<0.001	1.68	1.45	1.95	<0.001
Characteristics of recent sex									
Number of sex acts in the previous 3 months		1.69	1.47	1.95	<0.001	1.68	1.45	1.95	<0.001
Age of last sexual partner in years		1.06	1.00	1.14	0.029	1.03	0.97	1.10	0.240

Participant characteristics adjusted for but not shown include age in years (as linear), grade, orphanhood, socioeconomic position, mother's and father's education. Full model results are presented in Appendix B.