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The influence of social networks on ART initiation among HIV-infected ART-naïve youth in rural Kenya and Uganda

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Abstract

Background—HIV-infected youth in sub-Saharan Africa are less likely to initiate antiretroviral therapy than older adults.

Setting & Methods—Adult (≥ 15 years) residents enumerated during a census in 32 communities in rural Kenya and Uganda named social contacts in five domains: health, money, emotional support, food, and free time. Named contacts were matched to other enumerated residents to build social networks among 150,395 adults; 90% were tested for HIV at baseline. Among youth (15–24 years) who were ART-naive at baseline (2013–2014), we evaluated whether having ≥1 network contact who was HIV-infected predicted ART initiation within 3 years, and modification of this association by age and strength of contact, using logistic regression with robust standard errors.

Results—Among 1,120 HIV-infected youth who were ART-naive at baseline, 805 remained alive and community residents after 3 years. Of these, 270 (33.5%) named at least one baseline HIV-infected contact; 70% (569/805) subsequently initiated ART. Youth with ≥1 HIV-infected same-age baseline contact were more likely to initiate ART (aOR 2.95; 95% CI 1.49–5.86) than those with no HIV-infected contact, particularly if the contact was a strong tie (named in > 1 domain; aOR 5.33; 95% CI 3.34 – 8.52). When non-household contacts were excluded, having an HIV-infected same age contact who was a strong tie remained associated with ART initiation (aOR 2.81; 95% CI 1.76 – 4.49).

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Conclusions—Interventions that increase and strengthen existing social connections to other HIV-infected peers at the time of HIV diagnosis may increase ART initiation among HIV-infected youth.

Keywords

HIV/AIDS; sub-Saharan Africa; Social Networks; Youth; antiretroviral therapy

Introduction

An estimated 2.2 million youth (aged 15 – 24 years) were living with HIV in sub-Saharan Africa (SSA) in 2015 and youth account for 37% of all new HIV infections in the region.[1] The expansion of antiretroviral therapy (ART) across SSA has led to improved quality of life and greater life expectancy and has prevented new infections[2,3]. However, youth are half as likely to initiate ART as older adults,[4–6] placing them at risk of poor health outcomes and ongoing transmission.

High levels of stigma and lack of social support have been shown to contribute to this age disparity,[7–9] suggesting that the social networks of youth may play an important role in determining whether and when they link to HIV care and initiate ART. Social networks, or the connections between and among people, impact health behavior and outcomes through the spread of ideas, social influence, and access to resources[10] and may influence an individual's behavior above and beyond the influence of his/her own attributes. Social network analyses have demonstrated the importance of peer behavior to HIV risk behaviors in older adults in SSA, including HIV testing[11], partner concurrency[12], and condom use[13]. In addition, data suggest peer influences are important to HIV testing[14] and linkage to care among adolescents.[15] However, social network analyses of HIV+ youth in sub-Saharan Africa are sparse, and peer effects on ART initiation in adolescents have yet to be demonstrated directly. Therefore, an improved understanding of how the social networks of youth contribute to their engagement in ART care could suggest effective interventions to increase the proportion of HIV-infected youth on ART.

The SEARCH HIV test-and-treat study (NCT01864683) collected social network data on 150,395 adults in 32 communities in rural Kenya and Uganda, of whom 89% were tested for HIV. We examined whether baseline social network characteristics predicted ART initiation among ART naïve HIV-infected youth. We hypothesized that youth whose immediate social network included contacts who were also HIV-infected would be more likely to initiate ART than those without HIV-infected contacts, and that the association would be stronger for contacts who were ART-experienced, of the same age, and who were named multiple times as sources of social support (strong ties).

Methods

SEARCH Study

The overall objective of the SEARCH study was to evaluate the impact of "universal test and treat" on HIV incidence and health using a multi-disease approach. The parent study

enrolled 32 rural communities in: western Kenya (12 communities, baseline HIV prevalence 19%), southwestern Uganda (10 communities, baseline prevalence 7%), and eastern Uganda (10 communities, baseline prevalence 4%)[16]. Each community was composed of geopolitical units just above village level (a 'parish' in Uganda and a 'sublocation' in Kenya) with a combined population of approximately 10,000 people, of whom approximately 50% were ≥15 years of age. A door-to-door household census conducted at study baseline (June 2013 – June 2014) collected demographic information from all residents, including age, sex, marital status, education level, income, and occupation. Census enumeration was followed by HIV and multi-disease testing using a hybrid model that combined multi-disease community health campaigns with home-based testing for non-attendees, and which reached 90% of the population[16,17]. Residents found to be HIV-infected were referred to their local health facility where they received ART based on country guidelines (16 control communities) or immediately (16 intervention communities).

Social Networks

A name generator adopted from earlier work by Perkins et al in rural Uganda[18] was administered to adults aged ≥ 15 years during the hybrid testing. Residents were asked the name up to 6 contacts in each of 5 different social domains: with whom, over the last 12 months, they 1) shared food with outside of their household; 2) spent free time; 3) discussed money matters; 4) discussed health issues; and 5) went to for emotional support [Appendix 1]. Residents could name contacts in more than one domain. An example of the question used to elicit contacts in the health domain is "Over the last 12 months, with whom have you discussed any kind of health issue?". Contact names, village, and age were collected by field staff on tablet computers. Using these raw data, sociocentric networks for each community were constructed by matching named contacts to census enumerated community residents; the matching algorithm, which weighted the different attributes (names, village, age) and determined a threshold for a match is described in detail in Chen et al[19]. Among named contacts reported to live within the community, 85% were successfully matched in Southwest Uganda, 74.8% were matched in East Uganda, and 35.4% were matched in Kenya[19]. The average degree of the networks were 5.8 in Southwest Uganda, 5.7 in East Uganda, and 1.6 in Kenya[19].

Study population

Youth who were i) between the ages of 15 – 24 years, HIV-infected, ART-naïve, and stable residents of a study community (in the community ≥ 6 of the preceding 12 months) during baseline testing and ii) still alive and resident in the community 3 years later were included in this analysis. Individuals were considered to be ART-naïve at baseline if there was no Ministry of Health HIV medical record indicating prior or current ART and they did not have an undetectable plasma HIV RNA level.

Measures

Patient demographics were obtained during the baseline census. Patients who self-reported no previous HIV diagnosis and did not have a Ministry of Health HIV medical record at the time of baseline testing were considered new HIV diagnoses. Point of care CD4+ cell count measurements (Pima, Alere, Waltham, MA) were performed at the time of baseline testing.

Plasma HIV-1 RNA viral load was measured at time of baseline testing from finger-prick capillary or venous blood collection by commercial real-time PCR assays at multiple reference laboratories. ART initiation between hybrid testing at baseline and three years later was determined through Ministry of Health HIV medical records and HIV RNA level at year 3.

Contact demographics, HIV status, and ART status were determined identically (network construction allowed for linkage to study records for matched contacts). Participants were considered to have at least one HIV-infected contact if ≥ 1 matched contact was documented to be HIV-infected through baseline testing. For this analysis a contact was considered a strong tie if named in ≥ 1 social network domain by the participant.

Statistics

Demographic variables at baseline were described overall and stratified on sex. Among participants with at least one HIV-infected contact, we evaluated the proportion who named at least one HIV-infected contact in the same age group (15 – 24 years) as the participant, the proportion ART-experienced at baseline, and the proportion who initiated ART between baseline and follow-up year 3. We further evaluated tie strength (number of domains in which an HIV-infected contact was nominated) and sex concordance (same sex vs opposite sex of participant) of HIV-infected contacts.

Logistic regression with robust standard errors (treating communities as independent) was used to evaluate the association between contact type and ART initiation before follow-up year 3. Sex, prior diagnosis, study arm, total number of contacts, and region were included as covariates in multivariate models *a priori*, based on their known relationship to ART initiation.

Ethics

The Makerere University School of Medicine Research and Ethics Committee (Uganda), the Ugandan National Council on Science and Technology (Uganda), the Kenya Medical Research Institute Ethical Review Committee (Kenya), and the University of California San Francisco Committee on Human Research (USA) approved the study protocol including the consent procedures. All participants provided verbal informed consent in their preferred language with fingerprint biometric confirmation of agreement.

Results

Characteristics of ART-naïve youth

Among 1,120 HIV-infected youth who were ART-naïve at baseline, 805 remained alive and resident in the community after 3 years of follow-up [Figure 1]. These 805 HIV-infected ART-naïve youth were approximately 80% women (646/805); 75% (600/805) were age 20–24, 67% were married (535/805), and 67% (538/805) resided in one of the 12 communities in Kenya. The majority of youth in these rural communities were employed in farming (41%, 331/805) and 13% (107/805) were students at the time of the baseline survey. Baseline viral load was >10,000 copies/mL in 75% (604/805), most (59%, 471/805) had a

CD4+ count > 500 cells/mm^3, and 71% (569/805) were new diagnoses. Approximately 70% (569/805) initiated ART before follow-up year three [Table 1].

Overall, 81% (651/805) of youth named at least one contact; 75% (602/805) named at least one contact who was successfully matched to another SEARCH participant; 63% (507/805) named at least one contact who was successfully matched to another SEARCH participant outside the same household. One-third (270/805, 33.5%) matched at least one HIV-infected contact and 18% (144/805) matched at least one HIV-infected non-household contact [Table 1, Figure 1]. Compared to HIV-infected youth who matched at least one contact, youth who did not match any contacts were slightly more likely to be 15 – 19 years old, single, and reside in Kenya [Supplemental Table 1].

Characteristics of HIV+ first degree network contacts

Among the 270 ART-naïve youth with at least one HIV-infected contact, 147 (54.4%) had at least one HIV-infected contact of the same sex and 154 (57%) had at least one HIV-infected contact of the opposite sex. ART-naïve youth with at least one HIV-infected contact were more likely to have at least one older (≥25 years) HIV-infected contact than to have at least one same-age HIV-infected contact (80.0% vs. 27.8%). Among both men and women, most same age contacts were women; 66% (35/53) of women with a same-age HIV-infected contact had a contact who was a same-age HIV-infected woman and 82% (18/22) of men with a same age HIV-infected contact had a contact who was a same-age HIV-infected woman. Less than half (119/270, 44%) had at least one HIV-infected contact who was on ART at baseline; 53.7% (145/270) had at least one HIV-infected contact who initiated ART between baseline and follow-up year 3 [Table 2a].

Among those with at least one HIV-infected contact, 43% (117) had at least one HIV-infected contact who was a strong tie. Of these, most had an opposite sex HIV-infected strong tie: 79/104 (76%) of HIV-infected ART naïve women and 9/13 (69%) of HIV-infected ART naïve men with an HIV-infected strong tie had an opposite sex HIV-infected strong tie [Table 2a].

Characteristics of HIV+ non-household first degree network contacts

When household contacts were excluded, it was more common overall for ART-naïve youth with at least one non-household HIV+ contact (N=144) to have an HIV+ contact of the same sex (117/144, 81%), than to have an HIV+ contact of the opposite sex (34/144, 24%). This pattern was consistent for all types of contacts across age groups, ART status, and strong ties [Table 2b].

Association between contact type and ART initiation

After adjusting for sex, region, new diagnosis, total number of contacts named, and study arm, ART-naïve youth with at least one same-age HIV-infected contact were almost 3 times as likely to initiate ART within three years than those without a same-age HIV-infected contact (aOR 2.95; 95% CI 1.49, 5.86); the association was stronger if the same age HIV-infected contact was a strong tie (aOR 5.33; 95% CI 3.34, 8.52). ART-naïve youth with a contact who initiated ART between baseline and follow-up year 3 were also twice as likely

to themselves initiate ART, compared to youth without such a contact (aOR 2.01; 95% CI 1.17, 3.45). Having an older age (≥ 25 years) HIV-infected contact or an HIV-infected contact who was on ART at the time of baseline testing was not associated with ART initiation before 3 years among ART-naïve youth [Table 3a].

When household contacts were excluded, the, the magnitude of associations between contact characteristics and ART initiation was reduced. However, ART-naïve youth with at least one same-age non-household HIV-infected contact who was a strong tied remained significantly more likely to themselves initiate ART by 3 years (aOR 2.81; 95% CI 1.76, 4.49) [Table 3b].

Discussion

HIV-infected youth age 15 – 24 years in SSA have not benefited from the expansion of life-saving ART to the same degree as older adults, in part because they are less likely to start treatment after diagnosis than older adults[4–6]. We examined the role that the immediate social network of HIV-infected ART-naive youth plays in predicting whether or not these youth initiate ART. We found that ART initiation was more likely among ART-naïve youth who had at least one contact in their first-degree social network who was also HIV-infected and in their same age group (15 – 24 years) and that this association was stronger if the HIV-infected contact was named in more than one domain of a youth's social network (i.e. was a strong tie). Furthermore, ART initiation was also more likely among those who had an HIV-infected first-degree social network contact who also initiated ART, most of whom were same-sex contacts. These social relationships between HIV-infected persons may have important effects on clinical outcomes that can leveraged for interventions.

The population of ART naïve youth in our study communities was mostly female, aged 20–24 years, and married, reflecting the demographics of the HIV epidemic in eastern Africa[20]. Overall, most HIV-infected social connections of both men and women were with members of the opposite sex and the majority of these connections were with members of the same household, many of them spouses. Disclosure to spouses and spousal support is associated with improved initiation, adherence, and retention to ART among pregnant and post-partum women,[21] and men experience increased social support following disclosure which facilitates ART initiation and retention in care[22]. Some of the protective association we observed between having an HIV-infected contact and ART initiation may have been mediated by spousal support, and efforts to promote such disclosure and support should continue.

Importantly, however, our results are also consistent with an even more important role played by peer-support, including support of same age and same-sex HIV-infected peers. Among young women in particular, same age HIV-infected social contacts (the type of contact most strongly associated with ART initiation) were more likely to be of the same sex. Moreover, having a strong tie with a same-age non-household HIV+ peer more than doubled youths' probability of initiating ART. Efforts to promote support (and possibly disclosure) should extend to peers outside of the household.

Prior qualitative studies have found peer support to be a facilitator to adherence[23], and adolescent support groups during clinic hours have been associated with improved clinic attendance[24]. Our results provide longitudinal quantitative evidence that peer support also plays an important role in initial linkage to care and ART initiation. Peers who provide support in more than one domain may play a particularly important role. Interestingly, network contacts who were ART-experienced or were HIV-infected older adults were not associated with ART initiation among youth. The age, sex, and ART status of peers should be considered when designing peer-based interventions for HIV-infected youth.

Our results also shed new light on the design of youth-specific peer-based interventions to support HIV care. While some data suggest that trained peer navigators can support high rates of linkage to care following community-based testing in Sub-Saharan Africa,[25] and WHO recommends peer counselling and navigation be offered to all HIV-infected individuals following diagnosis to promote timely linkage to care,[26], current evidence supporting the effectiveness of such peer-based interventions on engagement in HIV care, particularly among youth, is mixed.[27] When this approach was implemented in East Africa, overall linkage to HIV care and ART initiation among youth age 15 – 24 years continued to lag behind adults[28]. More effective peer navigation systems for youth are thus needed. Current peer navigation systems are imposed upon social networks; i.e., peer supporters are assigned to patients. This model should be re-examined in light of our findings, which indicate the importance of endogenous support via existing relationships in facilitating care among youth populations. Following linkage to care and ART initiation, continued engagement in care is essential to realize the benefits of ART. Social support groups are associated with higher retention in care and adherence to ART[4,29]. Our results also suggest that support groups composed of other, same-age, ART initiators may be the most effective to promote ART initiation and prevent early drop-out of ART programs.

Several plausible mechanisms may explain our findings. The presence of other HIV-infected youth, in particular those who are also initiating ART, may promote self-efficacy for starting ART through vicarious efficacy, in line with precepts for the adoption of new behavior in Social Cognitive Theory[30]. Through seeing others attending clinic and staying healthy on ART these ART-youth may expect that they too can successfully take ART. In addition, both social instrumental and emotional support may play a role in influencing the decision for ART-naïve youth to start ART[31,32]. Other HIV-infected youth may provide instrumental support through facilitating transportation to clinic, picking up medications, or sharing food that enables taking medication. They may provide emotional support that motivates youth to participate in ART programs. Future work will address these mechanisms through qualitative evaluation and measuring the resources youth have in their social network, including the emotional, cognitive, tangible, and physical support that they perceive themselves to receive from others. The association between social network attributes and ART initiation may also be due to other network mechanisms. Social networks have been associated with social-multiplier effects that reinforce HIV prevention messages in Kenya and Malawi[33] and similar amplifying effects may be operating in the networks of these HIV-infected youth. Understanding additional network effects beyond first degree contacts, such as network density and diffusion, will also be important to understanding the mechanism of network influence, which will inform intervention design. For example, in Kenya social

learning was the dominant mechanism influencing contraception choice in highly dense social networks whereas social influence was more important in more moderately dense networks[34]. Future work will investigate these potential influences on ART initiation and engagement in ART care.

Our study had several limitations. The study population is limited to those individuals who are still alive and living in a study community after 3 years of follow-up and thus our results cannot be generalized to youth who migrate out to other communities. Compared to those who remained alive and in the study community after 3 years of follow-up, the 281 youth who out-migrated before follow-up year 3 were slightly less likely to name a matched contact (71% vs 75%) and name at least 1 HIV+ contact (23.8% vs 33.5%) suggesting that those who remain in the community may have stronger social ties. Both HIV status and network relations likely contribute to migration patterns[35], and network strength may play an important role among this selected population of youth than those who out-migrated. We were only able to incorporate information about matched contacts and may be missing contacts who reside outside the community, who were not matched, or who were not named by youth. While links to HIV+ contacts missing to the same extent among ART initiators and non-initiators is likely to bias our findings towards the null; however, if persons who initiated ART were less likely to have missed HIV+ contacts then the magnitude of association may be overestimated. While we have data on marital status, we do not have data on whether named contacts were spouses; however, non-household same-age contacts were important determinants of ART initiation. The observed association between network characteristics and ART initiation may reflect homophily (i.e. HIV-infected individuals who are likely to start ART are more likely to associate with each other). We controlled for some of these factors (sex, prior diagnosis, total number of contacts), but latent homophily may still be present. Network selection may also have played a role among youth previously diagnosed with HIV but not yet on ART (30% of the study population) if those who were better able to access care and had fewer barriers to ART initiation were also those who reached out and formed relationships with other HIV-infected individuals after their diagnosis. Finally, we do not know about the quality of the relationships or the content of either perceived or received support. However, identifying potentially important relationships through social network analysis is a first step towards understanding mechanisms of support.

HIV-infected youth are at risk of being left behind in the Global AIDS response. Leveraging peer relationships is an opportunity to mitigate the negative effects of stigma and poor social support that are cited as important barriers to effective engagement in HIV care in among youth[7–9]. Understanding the influence of social networks on youth engagement in HIV care, including network type, network structure, and provision of support within the network, will suggest innovative network-based interventions to improve clinical outcomes in this vulnerable population.

Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

Acknowledgments

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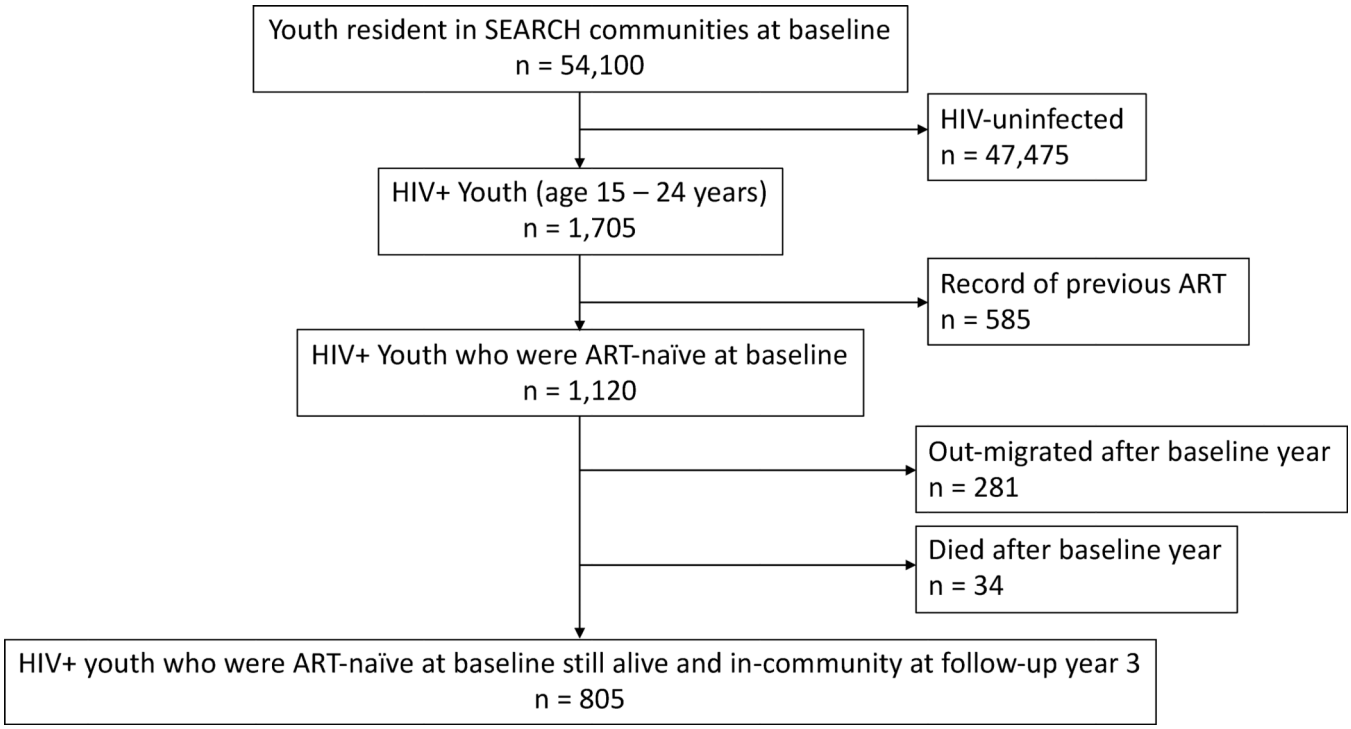

Figure 1.

Study population of HIV+ youth resident in SEARCH communities who were ART-naïve at baseline and still alive and in the community at follow-up year 3

Table 1.

Demographics of HIV-infected antiretroviral (ART) naïve youth in SEARCH communities at baseline overall and by sex (N = 805)

	Women (n = 646)	Men (n = 159)	Overall (N = 805)
Age [median(IQR))]	21 (19, 23)	22 (20, 24)	21 (19, 23)
15 – 29 years	172 (26.6%)	33 (20.8%)	205 (25%)
20 – 24 years	474 (73.4%)	126 (79.2%)	600 (75%)
Occupation			
Farmer	279 (43.2%)	52 (32.7%)	331 (41.1%)
Fisher	21 (13.2%)	35 (5.4%)	56 (7%)
Shopkeeper/market vendor	56 (8.7%)	5 (3.1%)	61 (7.6%)
No job	95 (14.7%)	11 (6.9%)	106 (13.2%)
Student	73 (11.3%)	34 (21.4%)	107 (13.3%)
Other	122 (18.9%)	22 (13.8%)	144 (17.9%)
Marital Status			
Single	148 (22.9%)	82 (51.6%)	230 (28.6%)
Married	464 (71.8%)	71 (44.7%)	535 (66.5%)
Divorced/Separated	19 (2.9%)	0	19 (2.4%)
Widowed	14 (2.2%)	5 (3.1%)	19 (2.4%)
Region			
E Uganda	59 (9.1%)	20 (12.6%)	79 (2.8%)
W Uganda	134 (20.7%)	54 (34.0%)	188 (23.4%)
Kenya	453 (70.1%)	85 (53.5%)	538 (66.8%)
Intervention community	347 (53.7%)	85 (53.5%)	432 (53.7%)
Baseline (pre-ART) viral load (copies/mL)			
400 – 10,000	176 (27.2%)	25 (15.7%)	201 (25.0%)
10,000 – 50,000	156 (24.2%)	29 (18.2%)	185 (23.0%)
50,000 – 100,000	48 (7.4%)	20 (12.6%)	68 (8.5%)
>100,000	73 (11.3%)	25 (22.0%)	108 (13.4%)
Missing	193 (29.9%)	50 (31.5%)	243 (30.2%)
Baseline (pre-ART) CD4+ count (cells/mm^3)			
<50	3 (0.5%)	0	3 (0.4%)
50 – 199	18 (2.8%)	9 (5.7%)	27 (3.4%)
200 – 349	62 (9.6%)	19 (12.0%)	81 (10.1%)
350 – 499	114 (17.7%)	24 (15.1%)	138 (17.1%)
>500	389 (60.2%)	82 (51.6%)	471 (58.5%)
missing	60 (9.3%)	25 (15.7%)	85 (10.6%)
New Diagnosis	435 (67.3%)	134 (84.3%)	569 (70.7%)
Initiate ART before FUY3	472 (73.1%)	90 (56.6%)	562 (69.8%)
Median contacts matched (IQR)	2 (0; 3)	2 (1; 5)	2(0; 3)
Matched ≥ 1 contact	481 (75%)	121 (76%)	602 (75%)
Matched ≥ 1 HIV+ contact	223 (34.5%)	47 (29.6%)	270 (33.5%)

	Women (n = 646)	Men (n = 159)	Overall (N = 805)
Matched ≥ 1 non-household contact	399 (62%)	108 (68%)	507 (63%)
Matched ≥ 1 non-household HIV+ contact	118 (18.3%)	26 (16.4%)	144 (17.9%)

Table 2a.

Number and proportion with first degree network contacts by sex, age, ART status, and strength of tie among ART naïve youth with >= 1 matched HIV+ contact (n = 270)

	HIV+ contacts of female youth (n = 223)	HIV+ contacts of male youth (n = 47)	Overall (N = 270)
≥ 1 Same sex contact	115 (51.6%)	20 (42.6%)	147 (54.4%)
≥ 1 Opposite sex contact	134 (60.1%)	32 (68.1%)	154 (57.0%)
≥ 1 Same age (age 15 – 24 years) contact	53 (23.8%)	22 (46.8%)	75 (27.8%)
Same sex	35 (15.7%)	4 (8.5%)	
Opposite sex	18 (8.1%)	18 (38.3%)	
≥ 1 Older adult (age >= 25) contact	184 (82.5%)	32 (68.1%)	216 (80.0%)
Same sex	90 (40.4%)	18 (38.3%)	
Opposite sex	118 (52.9%)	16 (34.0%)	
≥ 1 contact on ART at baseline	101 (45.3%)	18 (38.3%)	119 (44.1%)
Same sex	62 (27.8%)	7 (14.9%)	
Opposite sex	48 (21.5%)	10 (21.3%)	
≥ 1 HIV+ contact who initiated ART between baseline and FUY3	112 (50.2%)	33 (70.2%)	145 (53.7%)
Same sex	51 (22.9%)	12 (25.5%)	
Opposite sex	62 (27.8%)	22 (46.8%)	
≥ 1 HIV+ contact who is strong tie	104 (46.6%)	13 (27.7%)	117 (43.3%)
Same sex	30 (13.5%)	3 (6.4%)	
Opposite sex	79 (35.4%)	9 (19.1%)	
≥ 1 HIV+ contact who is strong tie (age 15 – 24)	19 (8.5%)	5 (10.6%)	24 (8.9%)
≥ 1 HIV+ contact who is strong tie (age >= 25)	87 (39.0%)	9 (19.1%)	96 (35.6%)

Table 2b.

Number and proportion with first degree non-household network contacts by sex, age, ART status, and strength of tie among ART naïve youth with >= 1 matched non-household HIV+ contact (n = 144)

	HIV+ contacts of female youth (n = 118)	HIV+ contacts of male youth (n = 26)	Overall (N = 144)
≥ 1 Same sex contact	99 (84%)	18 (69%)	117 (81%)
≥ 1 Opposite sex contact	25 (21%)	9 (34%)	34 (24%)
≥ 1 Same age (age 15 – 24 years) contact	33 (28.9%)	5 (19.2%)	38 (26.4%)
Same sex	32 (27.1%)	4 (15.4%)	
Opposite sex	1 (0.8%)	1 (3.8%)	
≥ 1 Older adult (age >= 25) contact	93 (78.8%)	23 (88.5%)	116 (80.6%)
Same sex	76 (64.4%)	16 (61.5%)	
Opposite sex	25 (21.2%)	8 (30.8%)	
≥ 1 contact on ART at baseline	64 (54.2%)	12 (46.2%)	76 (52.8%)
Same sex	52 (44.1%)	8 (30.8%)	
Opposite sex	14 (11.9%)	4 (15.4%)	
≥ 1 HIV+ contact who initiated ART between baseline and FUY3	51 (43.2%)	15 (57.7%)	66 (45.8%)
Same sex	47 (39.8%)	11 (42.3%)	
Opposite sex	6 (5.1%)	4 (15.4%)	
≥ 1 HIV+ contact who is strong tie	27 (22.9%)	5 (19.2%)	32 (22.2%)
Same sex	22 (18.6%)	3 (11.5%)	
Opposite sex	5 (4.2%)	1 (3.8%)	
≥ 1 HIV+ contact who is strong tie (age 15 – 24)	5 (4.2%)	1 (3.8%)	6 (4.2%)
≥ 1 HIV+ contact who is strong tie (age >= 25)	22 (18.6%)	4 (15.4%)	26 (18.1%)

Table 3a.

Association between contact type and ART initiation before FUY 3 among HIV+ ART-naïve youth (n = 805)

	OR (95% CI)	aOR (95% CI)
Covariates		
Sex		
Male	0.48 (0.34, 0.69)	
Female	1.0	
Region		
East Uganda	0.95 (0.57, 1.60)	
West Uganda	0.87 (0.61, 1.23)	
Kenya	1.0	
Previous Diagnosis	6.96 (4.27, 11.34)	
Number of contacts named	1.01 (0.96, 1.06)	
Intervention Community	3.24 (2.36, 4.45)	
Contact type		
Has contact with HIV	1.72 (1.23, 2.39)	1.32 (0.91, 1.92)
Same age contact with HIV	2.71 (1.40, 5.23)	2.95 (1.49, 5.86)
Older contact with HIV	1.42 (1.00, 2.01)	0.99 (0.76, 1.30)
HIV+ contact on ART at baseline	1.21 (0.79, 1.87)	0.82 (0.62, 1.08)
HIV+ contact who initiated ART between baseline and FUY3	2.37 (1.49, 3.75)	2.01 (1.17, 3.45)
HIV+ contact who is strong tie	2.18 (1.32, 3.59)	1.49 (1.01, 2.19)
Same age HIV+ strong tie	4.91 (1.14, 21.1)	5.33 (3.34, 8.52)
Older HIV+ strong tie	1.87 (1.11, 3.17)	1.11 (0.72, 1.71)

Table 3b.

Association between non-household contact type and ART initiation before FUY 3 among HIV+ ART-naïve youth (n = 805)

	OR (95% CI)	aOR (95% CI)
Covariates		
Sex		
Male	0.48 (0.34, 0.69)	
Female	1.0	
Region		
East Uganda	0.95 (0.57, 1.60)	
West Uganda	0.87 (0.61, 1.23)	
Kenya	1.0	
Previous Diagnosis	6.96 (4.27, 11.3)	
Number of contacts named	1.02 (0.96, 1.07)	
Intervention Community	3.24 (2.36, 4.45)	
Contact type		
Has contact with HIV	1.25 (0.84, 1.88)	1.05 (0.82, 1.36)
Same age contact with HIV	1.66 (0.75, 3.67)	1.77 (0.70, 4.52)
Older contact with HIV	1.16 (0.75, 1.80)	0.91 (0.58, 1.42)
HIV+ contact on ART at baseline	1.07 (0.63, 1.80)	0.80 (0.55, 1.18)
HIV+ contact who initiated ART between baseline and FUY3	1.67 (0.91, 3.07)	1.45 (0.78, 2.69)
HIV+ contact who is strong tie	1.92 (0.78, 4.72)	1.50 (0.31, 7.30)
Same age HIV+ strong tie	2.17 (0.25, 18.7)	2.81 (1.76, 4.49)
Older HIV+ strong tie	1.85 (0.69, 4.96)	1.24 (0.19, 8.08)

*multivariate analysis modeled each contact type separately and adjusted for sex, previous diagnosis, number of contacts named, study arm, and region