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Predictors of Linkage to Care Following Community-Based HIV Counseling and Testing in Rural Kenya

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Abstract

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Conflicts of interest We wish to declare a potential perceived conflict of interest and the measures taken to ensure this has not influenced our findings. Funding for this study was provided by the HIV counseling and testing (HCT) campaign implementer, Vestergaard Frandsen. The sponsor did not have any role in the study design, analysis or interpretation of the data. However, as is good practice in implementation science, two authors from Vestergaard Frandsen (L.K. and A.D) were included in the final review of the manuscript to ensure accurate presentation of the HCT campaign and the study setting.

Despite innovations in HIV counseling and testing (HCT), important gaps remain in understanding linkage to care. We followed a cohort diagnosed with HIV through a community-based HCT campaign that trained persons living with HIV/AIDS (PLHA) as navigators. Individual, interpersonal, and institutional predictors of linkage were assessed using survival analysis of self-reported time to enrollment. Of 483 persons consenting to follow-up, 305 (63.2%) enrolled in HIV care within 3 months. Proportions linking to care were similar across sexes, barring a sub-sample of men aged 18–25 years who were highly unlikely to enroll. Men were more likely to enroll if they had disclosed to their spouse, and women if they had disclosed to family. Women who anticipated violence or relationship breakup were less likely to link to care. Enrollment rates were significantly higher among participants receiving a PLHA visit, suggesting that a navigator approach may improve linkage from community-based HCT campaigns.

Keywords

Linkage to care; Antiretroviral treatment; Community-based testing; HIV-1; Sub-Saharan Africa; Survival analysis; HIV counseling and testing

The advent of antiretroviral therapy (ART) has increased quality of life and life expectancy for persons living with HIV/AIDS (PLHA) [1–3]. However, those in resource-constrained settings tend to start ART treatment with more advanced disease than those in resource-rich settings [4]. Late diagnosis is associated with HIV-related morbidity and mortality in sub-Saharan Africa [5], as are late presentation into care [6] and delayed ART initiation [5, 7–16]. Delays in diagnosis, linkage to care, and subsequent ART initiation also pose a higher risk of HIV transmission to others, since treatment reduces viral load and infectivity [17–21].

Understanding the dynamics of linkage to care in sub-Saharan Africa is particularly salient amidst recent calls for universal HIV testing and immediate treatment [22]. In alignment with a ‘test and treat’ approach, new strategies for HIV counseling and testing (HCT), such as community-based testing via mobile clinics, have proven to be cost-effective and successful at reaching previously untested individuals [23–28]. At the same time, these innovative testing strategies may increase the challenges of linking individuals to the healthcare facility to receive care and treatment [29].

Much of the research around linkage to care has occurred in resource-rich settings, such as the United States and Europe, where delayed uptake of care is associated with long wait times for initial appointments [30], testing for the first time [19, 31], rural residence [32], or being diagnosed at an early stage of disease while still feeling well [33]. Few sub-Saharan Africa programs routinely assess the proportion of HIV-diagnosed patients who successfully link to care or treatment. Those that have measured linkage achieve strikingly poor results: between 30–62% of persons receiving HIV positive test results successfully link to care [34–39]. A recent systematic review estimates that if studies were to track patients from HIV testing to CD4 count results, clinic enrollment, and initiation of ART, between 17–33% of patients would complete all three linkage steps [40]. The dearth of studies identified by the systematic review highlights the urgent need for better research on linkage to care.

Of the few recent studies that examine linkage to care in sub-Saharan Africa, only one [39] has studied linkage from community-based HCT. This gap in the literature is crucial to fill, because a significant portion of HIV testing in the coming years will likely be community- and home-based strategies, particularly in light of recent findings that community-based HCT detects almost four times more HIV cases than standard clinic-based testing [41].

All existing studies, to our knowledge, examine clinical and demographic predictors of linkage. However, in resource-constrained settings, issues beyond demographics are likely to shape linkage. For example, research shows that broader gender dynamics [35, 42], entrenched poverty [43–45], and HIV-related stigma [46–49] inhibit uptake of HIV care and treatment, even as ART has become more available. This research adds to the knowledge base by exploring the interpersonal and institutional factors that determine linkage to care.

Methods

This paper presents a cross-sectional study of linkage to care following a community-based HCT campaign conducted in Nyanza Province, Kenya during August–September, 2009. Described fully elsewhere [26], the Integrated Prevention Demonstration (IPD) model combines community-based HIV testing with distribution of long-lasting insecticidal nets and point-of-use water purifiers, and was implemented by Vestergaard Frandsen in partnership with the Kenyan Ministry of Health. During the three-day campaigns, mobile tents were established in six community sites outside Kisumu, an urban center, and near Kisii, a hillside town.

HCT was offered in accordance with the Kenyan national guidelines and adhered to key principles of informed consent, confidentiality and privacy. Each client was registered and given a unique client number delinked from identifiers. A nationally certified HCT counselor provided individual pre-test counseling and obtained verbal informed consent. Finger prick blood samples were screened for HIV infection using serial rapid ELISA testing, as per national guidelines [50].

Clients testing HIV positive were provided with a referral to care and were offered a rapid CD4 count using Guava AutoCD4 system (Guava technologies, Massachusetts, USA). In most cases, patients received their CD4 count results within 3 h, with about 30% of the population asked to return the following day for results. Newly diagnosed clients were also invited to receive a follow-up home visit by a trained PLHA navigator. Those who consented were guided through completion of the locator form. Following the campaign, PLHA navigators attempted to conduct home visits with all persons providing locator information, in order to offer support for enrolling into HIV care.

Data Collection

Data presented here were collected by a separate team of trained researchers who conducted follow-up interviews 10 months after the HCT campaign. These interviews were separate from the home visits conducted by PLHA navigators, but relied on the same locator form information collected at the campaign by consenting participants. To conduct the 10-month follow-up interview, researchers liaised with PHLA navigators to invite eligible clients to participate via personal visit or cell phone. The researchers then used locator information to trace and consent interested clients. Individuals were eligible for our study if they were more than 18 years of age, had tested positive during the HCT campaign, were not previously enrolled in HIV care or treatment at the time of HCT campaign, and consented to be traced at their home. Persons who were not located successfully at the first visit received one additional visit by research staff.

Measurements

There were two primary outcomes for this study. The first outcome, linkage to care, was based on participant self-report of clinic enrollment up to the time of interview 10 months after the HCT campaign (Y/N). The second outcome, time to linkage, was measured in months from the first day of the month diagnosed at the HCT campaign (August or September) to the first day of the month participants reported that they enrolled in care.

Based on an extensive review of the literature, we used a social-ecological framework [51–53] to identify covariates of linkage to care at individual, interpersonal, and institutional levels. At the individual level, a number of *socio-demographics* were collected (sex, age, education, ethnicity, religion, marital status, and occupation). *Health status* was measured using one item from the SF-36 health survey that is highly predictive of many health behaviors and outcomes: “In general, would you say your health is excellent, good, fair or poor?” [54]. To measure *mental health*, we used the PHQ-9 clinical depression scale, a measure that has been validated in Kenya [55] and has internal consistency in this sample (Cronbach alpha (α) = 0.86). *Substance use* was measured through self-report of frequency of alcohol and drug use.

At the interpersonal level, we assessed *PLHA Navigator home visits* by asking whether the client received a home visit and number of visits received. We asked clients about *disclosure of HIV status* to friends, family, or healthcare workers. To understand *gender dynamics*, we used three items from the power in relationships scale concerning household decision-making [56]. We measured participant perceptions of HIV-related stigma using measures that have been validated and used in the study setting [57]. *Anticipated stigma* ($\alpha = 0.78$) was measured using a 9-item scale of a person’s anticipation of experiencing stigma because of enrolling in HIV care [58] *Community stigma* ($\alpha = 0.84$) was measured using the mean of 7 items from the ‘perceived discrimination’ sub-scale of a measure developed by NIMH Project Accept [59]. *Self-stigma* ($\alpha = 0.80$) was measured using the ‘self-stigma’ sub-scale from the HASI-P stigma instrument [60]. Consistent with other studies in HIV-positive populations [61], we asked about three dimensions of *social support:* (1) having a confidante; (2) having people to depend on (social network); (3) having instrumental support (financial help, a place to stay, or assistance visiting the doctor). Social support variables were converted to binary (agree vs. disagree) for analysis.

At the institutional level, we asked questions about the logistics of linkage to care. *Transportation* was assessed by asking the distance (in kilometers), time (in minutes), and cost (in Kenya shillings) of travel by public transportation to the clinic. *Associated costs* were explored by asking the total amount spent monthly (in Kenya shillings) on medication, clinic costs, or missed income [62]. Questions around *knowledge of ART* and *ART availability* were drawn from the Kenyan ARTIS study [63] and those who responded “don’t know” to these items were considered to have uncertainty around ART knowledge/availability. Participants were asked about the type of *ART medications* they used, if any, and these were listed by prompting participants to gather the medication bottles and show them to the researcher.

Statistical Analysis

All analyses are presented separately for men and women, as we hypothesized that the factors associated with enrollment into care would differ by sex. We compared descriptive characteristics of men and women using χ^2 tests for categorical variables. Bivariate analyses assessed differences in time to enrollment for each predictor variable using Cox proportional hazard models for time-to-event data with censoring. Variables were selected for inclusion in bivariate analysis provided there was enough variability in responses (>5%/binary response option) separately among male and female respondents. For inclusion in the multivariate model, variables had to be associated with linkage to care ($P < 0.10$) in the bivariate Cox regression models. All models accounted for the clustering of data within site.

Cox regression assumes that each predictor has an equal effect throughout the time of observation. We observed several violations of this assumption in bivariate analyses. We created interaction terms between predictors and the natural log of time to enrollment to address violations in multivariate models. Final models did not violate the proportionality assumption. All statistical analyses were performed using Stata 10.0 for Windows (StataCorp, Texas).

Ethical Review

Ethical approval was obtained from the Kenya Medical Research Institute Ethical Review Committee (SSC#1776) and the University of California, San Francisco Committee on Human Research (CHR#10035623).

Results

Out of 10,203 persons tested in the community-based HCT campaign, 808 persons were over 18 years of age, tested HIV-positive during the HCT campaign, and were not already enrolled in HIV care at time of HIV testing. A total of 702 (86.8%) HIV-infected persons had a CD4 test conducted, among whom 603 (85.9%) had CD4 counts above 250 cells/μl (89.4% of women and 75% of men; Pearson $\chi^2 = 18.59$ for high CD4 by sex, $P < 0.001$).

Of the eligible population, 684 (85%) provided locator information. A total of 547 (80.0%) were located 10 months later at time of follow-up interview. Of those who were traced, a total of 158 clients in Kisii consented to the interview (7.6% refusal rate), as did 342 in Kisumu (9.0% refusal rate). Of the 500 completed surveys, 17 individuals were subsequently excluded from analysis as they reported that they enrolled in care prior to testing HIV-positive at the IPD campaign.

Similar to the overall population of campaign attendees, the 483 individuals in our study constituted a sample (Table 1) with more women than men (73.7 vs. 26.3%) and more residents of Kisumu than Kisii (68.7 vs. 31.3%). Less than one-third were educated beyond primary school, though two-thirds could read a local language newspaper. Two-thirds of respondents owned either a cell phone or a radio (half had both). Although many characteristics were similar across sexes, women were more likely to be widowed, to have no formal education, and to state housework as their primary occupation than men. While less than 10% of men reported being polygamous, nearly 30% of women reported that they were married to a polygamous man.

Cumulative linkage to HIV care and treatment was high: 63.2% enrolled within 3 months of the campaign; 81.4% enrolled by time of follow-up interview 10 months later (83.4% of women and 75.6% of men; Pearson $\chi^2 = 3.79$ for linkage by sex, $P = 0.052$). Median time to enrollment was one month and interquartile range was 0–6 months. A total of 72 men (56.7%) and 217 women (61.0%) received PLHA visits during the 10-month period. Neither proportion nor frequency of PLHA visits differed significantly between men and women.

The Kaplan–Meier survival curves (Fig. 1) illustrate the significant relationship over time between receiving a PLHA navigator visit and linkage to care for men and women. In bivariate analysis, factors significantly associated with time to linkage (Table 2) for both men and women included: older age, being widowed, greater knowledge around ART, disclosure to family, and receiving a PLHA navigator home visit. For men, additional factors were occupation, marital status, alcohol use, self-stigma, disclosure to spouse, and having a confidante. For women, additional factors were education, physical health, occupation, and anticipating a negative reaction from a partner in the form of relationship breakup or physical violence.

For several variables analyzed, the association with linkage to care was not consistent over time. Much of this effect in men was due to a subset of men (aged 18–25 years) who were unlikely to enroll in care. Only 2 of 14 (14.3%) young men linked to care, and differed from the larger sample in several ways: they were more likely to be single (66.7 vs. 3.5% of older men) and use alcohol (78.6 vs. 33.6%), and less likely to disclose their HIV status (14.3 vs. 84.1%). Because of these differences, the subsequent multivariate survival analysis was restricted to men over 25 years of age ($n = 104$).

Multivariate analyses for men and women produced adjusted associations of predictors of linkage to care (Table 3). The model for men included all eligible males over 25 years with complete data (80.3% of total sample, 92.0% of men over 25 years). The multivariate model suggests that greater age was associated with higher likelihood of linkage to care, while uncertainty around ART knowledge was associated with lower likelihood. Higher perceived discrimination was associated with a higher rate of linkage over time. Disclosure of HIV status to spouse was associated with higher likelihood of linkage. This association increased over time, as indicated by the interaction term, to 2.41 at 5 months (95% CI 1.74–3.35), and 2.83 at 10 months (95% CI 1.77–4.52). As with the unadjusted Kaplan–Meier curves, receiving a PLHA visit remained associated with linkage in the multivariate model, and the association likewise increased over time to 1.77 at 5 months (95% CI 1.47–2.13) and 1.99 at 10 months (95% CI 1.52–2.60).

The multivariate model for women included all women with complete data (82.3% of total sample). The model suggests greater education, being older, and being widowed/single were associated with higher rates of linkage per month, while lack of HIV knowledge was associated with lower rates. Women who anticipated a negative response from their partner, in the form of breakup or violence, were less likely to link to care. Similar to men, receiving a PLHA visit was associated with a higher rate of linkage among women. Women who had disclosed to family had rates of linkage that were 1.33 (95% CI 1.10–1.61), 1.47 (95% CI 1.38–1.58), and 1.54 (95% CI 1.40–1.70) times as high as non-disclosers at 1, 5, and 10 months, respectively. The association between better health and enrolling in care strengthened over time to 5 months (AHR = 1.62; 95% CI 1.55–1.69) and 10 months (AHR = 1.71; 95% CI 1.60–1.82). There was also a positive association between travel time to a clinic of choice and enrollment (AHR = 1.26; 95% CI 1.04–1.54), meaning women who reported a farther distance to the clinic were more likely to enroll over time.

Discussion

The cumulative proportions of patients in our sample linked to care by three months (63.2%) and by the time of the interview (81.4%) were high, matching linkage rates of cohorts in resource-rich settings [29]. One challenge of mobile testing is that it targets people at an earlier stage of HIV infection [64–67], potentially inhibiting linkage for those who wait for signs of illness to emerge before seeking care [68–70]. Though selection bias in our study may have played a role, the high enrollment rates suggest that aspects of the HCT campaign were successful in encouraging linkage even among early-diagnosis patients.

At the time of the HIV testing campaign, Kenyan National Guidelines recommended ART for patients with a CD4 count <250 cells/μl (current guidelines use a cutoff of <350 cells/μl). Knowledge of a low CD4 count may have motivated patients to go earlier for HIV care than patients with higher CD4 counts. Since we were unable to link CD4 testing data to follow-up interviews, we cannot ascertain precisely how CD4 counts influenced time to linkage in our sample. This will be an essential component of future studies on linkage to care as ART is scaled-up.

Home visits by PLHA navigators seem to be a successful linkage strategy in sub-Saharan Africa, where research has already shown that lay community health workers (CHW) can increase HIV testing uptake [71], reduce linkage delays [64], improve ART adherence [72, 73], and improve clinical indicators such as CD4 cell count [74]. Called a ‘navigation model’, similar methods are being employed widely in the United States [75–77]. The PLHA navigator strategy deserves further attention to HIV care and treatment programs in resource-constrained settings.

Contrary to some studies [6, 7, 78, 79], but aligned with others [39], older clients in our sample were more likely to link to care each month. In particular, young men were highly unlikely to ever enroll in care, and exhibited a range of traits (single marital status, low disclosure, higher prevalence of alcohol use) that differed strongly from the rest of the men interviewed. Though it is difficult to generalize from this small sample of young men ($n = 14$), this study suggests that PLHA visits were not a successful strategy for this group and that alternative approaches should be considered for recruiting young, HIV-positive men into care. This finding is consistent with other studies that suggest men enroll at a slower rate than female counterparts [42, 79]. However, studies in Kenya have found healthcare utilization around HIV testing and treatment of sexually transmitted infections slower amongst women than male counterparts [80–82]. These discrepancies underscore the importance of disaggregating data by sex and age in future studies on uptake of HIV care.

Similar to other studies [78, 83–85], women with less formal education were less likely to link to care, as were both men and women with less HIV knowledge. Lack of information about ART is associated with delayed care [49], high-risk HIV sexual behaviors among both men and women [86], and HIV seroprevalence among women [63]. It may be challenging for newly diagnosed clients to take in nuanced information about ART treatment at the time of HIV testing [87–89]. Employing CHWs or PHLA navigators to distill information, answer questions, and support treatment literacy following HIV testing may address the information gap.

Women were less likely to link to care over time when they anticipated a negative partner reaction, in the form of intimate partner violence or breakup of a relationship. Disclosure was associated with greater linkage among both men and women, although for men the main association derived from disclosure to a spouse, while for women it was disclosure to family. Non-disclosure to partners has been recognized as an impediment to enrollment in other studies in Africa, in terms of timely presentation to HIV care [79], initiation of ART [35, 46], and treatment adherence [90]. Women, in particular, often choose not to disclose their HIV status for fear their male partner will react with abuse or abandonment [91–95], and partner disclosure has been shown to lead to a loss of economic support, blame, stigma, and violence [96–99].

As in other sub-Saharan African settings [46, 47, 68, 100–103], HIV-related stigma shaped decisions regarding uptake of care and treatment. The surprising finding that higher perceived discrimination was associated with higher rates of enrollment among men could be a result of men encountering additional discrimination following the decision to enroll, or could have resulted from other unmeasured associations. Likewise, we found that longer travel time was associated with higher rates of enrollment into care among women—perhaps a consequence of the fact that the greater the distance to a facility, the less likely a client was to risk a potentially stigmatizing encounter with a neighbor or relative. Distance and transportation costs associated with accessing care have been shown to be a determinant of healthcare utilization in other studies [46, 48, 104]. Findings from this study suggest that motivation to engage in care may overcome logistical barriers, at least at the beginning of care and treatment, but it is unclear whether this remains the case as individuals confront the cost of care over time.

Study Limitations

Findings from our study should be reviewed in light of study design limitations. We followed HIV-positive persons prospectively from time of diagnosis, but had access to only a minimal amount of data collected by the HCT campaign at the time of testing. The lack of exact date of diagnoses and enrollment decreased the precision of our measure of time to enrollment. Many individuals testing HIV-positive at the campaign did not participate in the study because they were ineligible (e.g. already on ART), were untraceable (e.g. chose not to provide locator information), or refused the interview. The latter two subsets may be at particular risk of not linking to care, since stigma or other social factors may have caused them to decline the opportunity to be followed at home. This sampling bias may overestimate enrollment rates and potentially underestimate the extent to which the various social and interpersonal predictors inhibited enrollment.

The data reported here are comprised of follow-up interviews conducted 10 months after testing, when clients may have had difficulty recalling their exact date of linkage to care. We were unable to systematically triangulate findings from our data with clinic enrollment data. Social desirability bias may have influenced self-reports on the part of clients. In addition, the retrospective nature of data collection makes it difficult to ascertain the direction of causality for the associations observed. Because this study took place within a single cohort in two sites, the findings may not be generalizable to other settings.

Recommendations

There is an urgent need to better understand the reasons for delays in linkage to care, particularly in sub-Saharan Africa, where only a select few studies have examined linkage from HIV testing to clinic enrollment [64, 105–107]. The social-ecological approach used in this study may provide a useful theoretical framework for future research and interventions. In exploring social-ecological drivers of linkage, we found that interpersonal dynamics strongly informed time to linkage for both men and women. In future studies, interpersonal issues such as spousal disclosure, fear of relationship break-up or violence, and access to social support should be included. We posit that expanding beyond individual level clinical characteristics in HIV linkage research will be a necessary step for designing effective interventions.

High enrollment rates among our sample suggest that a ‘navigator model’ may be supportive of early linkage to care following community-based HCT campaigns. The population attending this HCT campaign had relatively high CD4 counts, suggesting that this HCT approach could be used to identify PLHA earlier in disease progression. Significant gains in prevention of morbidity and vertical transmission can be expected when patients initiate ART earlier [108], highlighting the urgent need for interventions, like the navigator model, that speed linkage to care.

Beyond the navigator model, two further recommendations should be considered by future programs. First, partner dynamics should form a central part of future HIV testing campaigns, especially since less than 10% of PLHA globally know the HIV status of their partners [109]. Couple-centered testing is a promising strategy for improving disclosure to partners [110] and increasing uptake of HIV treatment [111]. At a minimum, HIV testing campaigns should address real concerns about HIV status disclosure, risk of intimate partner violence, and social support. Second, campaigns need to build strategies for reaching and linking young, single individuals to HIV care, since these are populations that may be at greatest risk of transmitting HIV and are least likely to enroll in care.

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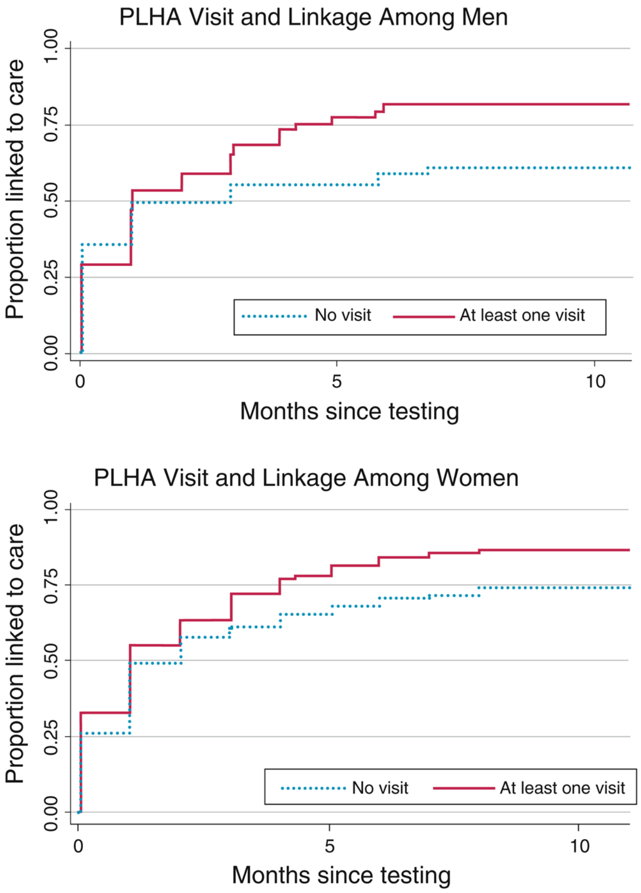

Fig. 1.

Time to linkage following HIV testing for those receiving and not receiving a PLHA navigator home visit, by sex

Table 1

Respondent characteristics compared by sex

Characteristic	**Men**		**Women**	
	Number	**Valid percent**	**Number**	**Valid percent**
Sex (n = 483)	127		356	
Age (n = 463)[†]				
25 and under	14	11.2	75	22.2
26–35	41	32.8	146	43.2
36–45	45	36.0	81	24.0
46 and over	25	20.0	36	10.7
Marital status				
Ever married (n = 478)	116	91.3	334	95.2
Current marital status (n = 475)[†]				
Single	12	9.6	27	7.7
Married/partnered	99	79.2	217	62.0
Separated	6	4.8	24	6.9
Widowed	8	6.4	82	23.4
Polygamy: men with multiple wives, women whose husbands have multiple wives (n = 478)[†]	11	8.6	100	28.5
Have children with current partner (n = 479)	104	81.9	263	74.7
Ethnic group (n = 480)				
Luo	85	67.5	242	68.4
Kikuyu	0	0.0	1	0.3
Kisii	40	31.8	108	30.5
Luhya	1	0.8	3	0.9
District (n = 483)				
Kisumu	87	68.5	245	68.8
Kisii	40	31.5	111	31.2
Education status (n = 481)[†]				
Never attended school	0	0.0	22	6.2
Primary school	82	65.1	250	70.4
Secondary school	29	23.0	68	19.2
Post-primary/Vocational	12	9.5	9	2.5
College/University	3	2.4	6	1.7
Local language reading (n = 458) [*]				
Not at all	6	4.9	24	7.1
Can read with difficulty	22	18.0	94	28.0
Can read easily	94	77.0	218	64.9
Religion (n = 245)[a]				
African independent churches	28	45.9	71	38.6
Protestant	11	18.0	49	26.6
Roman catholic	15	24.6	39	21.2

Characteristic	Men		Women	
	Number	Valid percent	Number	Valid percent
Other	7	11.5	25	13.6
Type of employment ($n = 467$)[b]				
Housework[†]	1	0.8	52	15.3
Selling things[†]	16	12.7	111	32.6
Farming or horticulture	44	34.9	149	43.7
Manual labor[†]	32	25.4	24	7.0
Fishing[†]	4	3.2	1	0.3
Teacher or health worker	1	0.8	6	1.8
Driver[†]	8	6.4	0	0.0
Other[†]	33	26.2	25	7.3

[*] $P < 0.05$ for test of hypothesis that male and female subgroups are from the same population (χ^2 tests)

[†] $P < 0.01$ for test of hypothesis that male and female subgroups are from the same population (χ^2 tests)

[a] Response rates to this question were low because original list of possible religions was not accurate

[b] Employment percentages do not add to 100% across categories because multiple responses permitted

Table 2

Bivariate associations of demographics, health status, social factors, and PLHA visits with time to linkage for men and women

Variable	Men						Women					
	N	Enrolled within 3 months		HR for time to enroll (95% CI)[a]	Z	*P* value	N	Enrolled within 3 months		HR for time to enroll (95% CI)[a]	Z	*P* value
		No.	%					No.	%			
Socio-demographics												
Age (standardized to mean 34.7 ± 9.2)	120			1.64 (1.23–2.19)	3.36	0.001	318			1.20 (1.05–1.37)	2.67	0.008
Education level	122						333					
None or primary school	80	51	63.8	1			256	164	64.1	1		
Secondary and above	42	27	64.3	1.11 (0.72–1.73)	0.48	0.631	77	63	81.8	1.63 (1.18–2.25)		0.003
Marital status	120						327					
Married	95	64	67.4	1			202	126	62.4	1		
Single	11	2	18.2	0.15 (0.04–0.51)[b]	−3.00	0.003	27	19	70.4	1.09 (0.84–1.41)	0.63	0.529
Widowed or separated	14	12	85.7	1.57 (0.99–2.50)	1.91	0.056	98	78	79.6	1.59 (1.47–1.72)	11.40	<0.001
Farming	121						318					
No	81	45	55.6	1			178	110	61.8	1		
Yes	40	32	80.0	1.95 (1.51–2.52)[b]	5.10	<0.001	140	106	75.7	1.29 (0.95–1.75)	1.64	0.100
Housework only	0						318					
No							276	192	69.6			
Yes							42	24	57.1	0.67 (0.60–0.76)	−6.23	<0.001
Manual labor	121						318					
No	89	60	67.4	1			295	201	68.1			
Yes	32	17	53.1	0.69 (0.62–0.77)	−6.87	<0.001	23	15	65.2	0.96 (0.56–1.65)	−0.15	0.879
Religion[c]	61						172					
Protestant	10	7	70.0	1			46	32	69.6	1		
African independent	28	14	50.0	0.45 (0.36–0.56)[b]	−7.23	<0.001	62	33	53.2	0.65 (0.45–0.93)	−2.32	0.020
Roman catholic	14	10	71.4	0.74 (0.35–1.57)	−0.78	0.433	39	30	76.9	1.13 (0.72–1.77)	0.54	0.591
Other	7	6	85.7	1.53 (0.62–3.77)	0.93	0.353	25	20	80.0	1.19 (0.78–1.81)[b]	0.79	0.427
Health status	122						330					
Self-evaluation of overall health												

Variable	Men						Women					
	N	Enrolled within 3 months		HR for time to enroll (95% CI)[a]	Z	*P* value	N	Enrolled within 3 months		HR for time to enroll (95% CI)[a]	Z	*P* value
		No.	%					No.	%			
Poor-fair	35	20	57.1	1			112	70	62.5	1		
Good–excellent	87	58	66.7	1.23 (0.86–1.76)	1.14	0.256	218	156	71.6	1.14 (0.98–1.33)	1.68	0.093
Alcohol use in past 4 weeks	122						333					
No	74	59	79.7	1			323	220	68.1	1		
Yes	48	19	39.6	0.43 (0.26–0.71)	−3.34	0.001	10	7	70.0	1.35 (1.02–1.80)	2.09	0.037
Social factors												
Has a Confidante	122						331					
No	29	12	41.4	1			98	56	57.1	1		
Yes	93	66	71.0	1.94 (1.09–3.44)	2.25	0.025	233	170	73.0	1.64 (0.89–3.02)[b]	1.60	0.11
Total anticipated stigma	121			0.87 (0.22–3.43)[b]		0.846	317			0.45 (0.20–1.00)[b]		0.049
Anticipated stigma from family	121						327					
No	101	66	65.4	1			247	174	70.5	1		
Yes	20	12	60.0	0.81 (0.45–1.45)	−0.19	0.484	80	47	58.8	0.68 (0.43–1.07)[b]	−1.97	0.095
Anticipated negative reaction from partner	122						333					
No	83	55	66.3	1			171	119	69.6	1		
Yes	14	10	71.4	0.98 (0.58–1.69)[b]	−0.04	0.967	71	46	64.8	0.70 (0.50–0.99)	−2.04	0.041
Missing (includes N/A)	25	13	52.0	0.69 (0.41–1.18)[b]	− 1.35	0.178	91	62	68.10	0.92 (0.68–1.24)	−0.54	0.592
Self-stigma scale	122			0.71 (0.51–1.01)	−1.93	0.054	330			0.93 (0.84–1.02)	−1.60	0.110
Disclosure to spouse	122						333					
No	48	24	50.0	1			176	125	71.0	1		
Yes	74	54	73.0	1.86 (1.28–2.69)[b]	1.86	0.001	157	102	65.0	0.96 (0.70–1.30)	−0.29	0.775
Disclosure to family	122						333					
No	77	40	52.0	1			193	120	62.2	1		
Yes	45	38	84.4	2.02 (1.28–3.17)	3.02	0.002	140	107	76.4	1.45 (1.11–1.90)[b]	2.71	0.007
Perceived discrimination scale	122			1.29 (0.95–1.77)	1.61	0.107	330			0.87 (0.57–1.32)	−0.64	0.520
ART beliefs												
Uncertainty around ART knowledge	120			0.11 (0.03–0.40)[b]	−3.40	0.001	329			0.26 (0.09–0.71)	−2.61	0.009

Variable	Men						Women					
	N	Enrolled within 3 months		HR for time to enroll (95% CI)[a]	Z	*P* value	N	Enrolled within 3 months		HR for time to enroll (95% CI)[a]	Z	*P* value
		No.	%					No.	%			
Uncertainty around ART availability	114			0.046 (0.01–0.27)	−3.42	0.001	291			0.221 (0.09–0.56)	−3.16	0.002
PLHA navigator												
Received a visit	122						333					
No	50	28	56.0	1			116	71	61.2	1		
Yes	72	50	69.4	1.48 (1.08–2.04)[b]	2.41	0.016	217	156	71.9	1.34 (1.10–1.63)	2.87	0.004

[a] Table includes hazard ratios (HR) for all variables with *P* value <0.10 for at least one of the groups (men or women) and is adjusted for clustering by site, otherwise unadjusted

[b] Association is not proportional

[c] Low response rate to this question due to inaccurate initial categories

Table 3

Multivariate associations among demographics, health status, social factors, PLHA visits, and time to linkage among men (> 25 years) and women

	AHR[a] (95% CI)	**Z**	***P* value**
A: Multivariate Cox regression for men over 25 years (*n* = 104)			
Age (standardized values)	1.30 (1.09–1.55)	2.97	0.003
Education greater than primary school	0.86 (0.55–1.33)	−0.69	0.487
Uncertainty around ART knowledge	0.23 (0.10–0.54)	−3.39	0.001
Perceived discrimination	1.29 (1.11–1.51)	3.22	0.001
Disclosure to spouse	1.67 (1.07–2.61)	2.24	0.025
Interaction of disclosure and time	1.26 (1.03–1.54)	2.21	0.027
PLHA visit	1.35 (0.97–1.87)	1.81	0.071
Interaction of PLHA visit and time	1.18 (1.05–1.33)	2.86	0.004
	AHR (95% CI)[b]	*Z*	*P* value
B: Multivariate Cox regression for women (*n* = 293)			
Age (standardized values)	1.08 (1.05–1.15)	4.98	<0.001
Education above primary school	1.54 (1.11–2.14)	2.58	0.010
Uncertainty around ART knowledge	0.36 (0.19–0.70)	−3.04	0.002
Health status of good or excellent	1.43 (1.19–1.72)	3.82	<0.001
Interaction of health status and time	1.08 (1.05–1.11)	5.46	<0.001
Marital status: widowed or separated	1.36 (1.19–1.56)	4.53	<0.001
Anticipated negative partner response (break-up or intimate partner violence)	0.64 (0.51–0.79)	−4.08	<0.001
Disclosure to family	1.33 (1.10–1.61)	2.89	0.004
Interaction of disclosure and time	1.07 (1.02–1.12)	3.00	0.003
Distance to HIV care facility (in hours)	1.26 (1.04–1.54)	2.32	0.021
PLHA visit	1.20 (1.00–1.43)	1.99	0.047

[a] *AHR* adjusted hazard ratio, *CI* confidence interval. Schöenfeld test for final model for men = 2.12; degree of freedom = 5; *P* = 0.833

[b] In addition to variables listed, model is adjusted for missingness in anticipated partner response. Schöenfeld test for final model for women = 3.92; degree of freedom = 5; *P* = 0.561