HIV and Marriage-Related Migration: A longitudinal analysis of differential risk of migration by sero-status in rural Uganda

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ABSTRACT

Migration is regarded as a key element in the transmission of HIV in sub-Saharan Africa. Previous research has centered on migration increasing susceptibility to HIV infection, and the subsequent transmission to migrants sexual partners, with a particular emphasis on male labor migration. This study investigates an alternative mechanism; hypothesizing that HIV-positive individuals may be more likely to migrate than their HIV-negative counterparts. Using annual survey data from an open population cohort in south-western Uganda, the sequence of migration and sero-conversion is examined over a 10-year period. This relationship is examined using discrete-time event history analysis, and random effects modeling. Analysis is broken down by type of migration, emphasizing the role of marriage-related migration – including marital dissolution and partnership formation – in shaping women's patterns of migration.

INTRODUCTION

Migration has long been considered a key element of HIV transmission in sub-Saharan Africa. Previous research has documented a significant relationship between migration and HIV infection, with specific focus on the role of male migrants. Analysis of HIV and migration has focused on particular migrant professions deemed to be higher risk, as well as a further analysis into mechanisms through which migration increase vulnerability to infection. Truck drivers have been a key migrant group associated with an increased likelihood of HIV infection (Bwayo et al., 1994), with an emphasis on their relationships with commercial sex workers (CSW's) along their routes, as well as the potential for inter-country transmission. Fisherman have also been found to have higher rates of HIV in East (Kissling et al. 2005) and West Africa (Decosas et al., 1995), which has been associated with their higher levels of mobility. Finally, seasonal migrantion has been identified as a mechanisms through which migrant labourers become infected while away from home and bring the virus back to their rural communities through patterns of circular migration (Lurie et al., 1997; Pison et al., 1993)

The dominating hypothesis has been that increased mobility and time away from home increases exposure to HIV through increasing sexual risk taking behaviors. Cross-sectional studies have confirmed the association between HIV and migration, with results emphasizing that "mobility is an independent risk factor of acquiring HIV" (Decosas et al., 1995). Lagarde et al (2003) found evidence supporting this hypothesis, finding that short term migrants were more likely to engage in higher-risk sexual behaviors, including women reporting casual partners in the city in the past 12 months (OR 5.61; 95% CI 1.56-20.2)

However, among a study of migrant men in sero-discordant relationships in South Africa, Lurie et al.(2003) found that over 1/3 sero-positive individuals were women remaining in the home communities. These findings refute the conventional hypothesis in the literature that migrant men are the one's responsible for bringing HIV into the marriage. Despite a large body of literature on HIV and migration, little research has focused, however, on how HIV-infection triggers migration.

This paper investigates an alternative mechanism; hypothesizing that HIV-positive individuals may be more likely to migrate than their HIV negative counterparts. Using 10 years of longitudinal data from an open-cohort population in rural South-Western Uganda, discrete time event history analysis is used to determine the extent to which sero-status increases the likelihood of migration. First, this paper asks whether HIV positive men and women in Uganda are more likely to migrate than those who are HIV negative. Second, the robustness of this relationship is examined with specific sub-segments of the population, including respondents who are sero-negative during their first wave of participation, and in-migrants. Third, analysis of marriage-related factors for migration, and in particular partnership formation and marital dissolution, are examined in determining patterns of mobility for HIV-positive individuals. In undertaking this analysis, we seek to enhance our understanding of mobility and HIV infection, and the ways in which HIV infection can trigger mobility in rural settings, and the potential this may have for further HIV transmission.

BACKGROUND

Recent research of migrants in Malawi found that migrants are more likely to be HIV positive (Anglewicz, 2010). The increased migration of HIV positive individuals was attributed to martial instability and change, including divorce, widowhood and remarriage. Research from Malawi and Uganda have both addressed the association between martial dissolution and instability and (the suspicion of) HIV infection. Reniers (2008) examined union-based risk avoidance strategies among couples in Malawi, and found evidence of negative partner selection, whereby factors associated with HIV risk were seen to increase union instability. Porter et al. (2004) looked specifically at HIV infection in Uganda, and not only suspicion of infection, and found that women's HIV status was significantly associated with a greater likelihood of divorce, or separation, and an even stronger effect was found for widowhood. They found that among sero-discordant couples, union dissolution was more likely if the woman was sero-positive, than if the man was (RR 4.28 for sero-positive women and RR 1.31 for sero-positive men). However, they found that widowhood was most likely in sero-discordant couples with a sero-positive man, or in sero-positive concordant couples. The gender-differentials found by Porter et al. (2003) suggests a highly gendered dimension of this phenomenon and the importance of examining differential trends between men and women with respect to marriage-related migration patterns. Research on marital instability and HIV in this region has also shown that HIV prevalence is greater among those widowed or separated (de Walque and Kline, 2009; Nabaitu et al, 1994).

Research from rural Tanzania confirmed similar findings on the common occurrence of marital dissolution in East Africa, but they also found common patterns of remarriage following divorce (Boerma et al., 2002). Ntozi (1997) also found remarriage was common following widowhood,

however widowers were more likely to remarry (56.1%, Chi-2=12.2) than widows (27.3%, Chi-2=35.0). de Walque and Kline (2009) also examined remarriage patterns based for 13 African countries, and found that remarriage was very common, and that those who remarried had higher HIV prevalence rates than the general population. They also found that remarried women in particular were significantly more likely to be HIV positive, even after adjusting for an array of individual characteristics. These studies suggest that alongside trends of martial dissolution, new partner selection and remarriage is also common.

Some initial research has begun to link marital patterns to migration and mobility trends. Research in Uganda has also shown evidence of widowhood being associated with patterns of migration (Ntozi, 1997). However, contrary to traditional hypothesis surrounding a healthy-migrant effect, Ntozi also found that unhealthy widows and widowers were more likely to migrant than healthy ones. Research in Tanzania also examined migration and marriage trends, with respondents reporting marriage or divorce as the most important reasons for moving households (Boerma et al. 2002). However, the majority of those moving households for marriage-related reasons moved within the same village.

Anglewicz (2010) found that marriage-related reasons made up 30% of stated reason for migration, which was more common among women (41%) than men (25%). Both male and female respondents who were HIV positive in 2004 were significantly more likely to migrate after 2004, and respondents moving for marriage-related reasons are significantly more likely to be HIV positive. Despite evidence on the relationship between HIV and migration, and HIV

and marital instability, previous research in Uganda has not combined these two fields to determine the relationship of HIV, migration and marriage.

DATA

Data for this analysis comes from the General Population Cohort (GPC) study conducted by the Medical Research Council of Uganda and the Uganda Virus Research Institute (MRC/UVRI). The GPC is an annual population census and sero-survey that has been conducted in the area since 1989. It is comprised of a rural population cohort in south-western Uganda with approximately 20,000 respondents from the 25 villages in the study site. Details of the population cohort study and methodology have been described elsewhere (Nakibinge et al. 2009; Nunn et al., 1997). This paper draws on annual data from 2000-2009 (Round 10-20). The dataset includes information on household composition and characteristics, individual demographics, sexual behavior and marriage histories, and sero-status. Using unique respondent identification numbers, individuals are followed within households, including migration out of the study site, and follow-up surveys if migrating to other households within the study site. The longitudinal nature of this data set allows for event sequencing between migration and HIV infection to be determined. Follow-up data on marriage and HIV status of new partners is also available for those who migrated within the study site.

METHODS

Two primary discrete-time hazard models are developed to estimate the effect of HIV on migration. Both models employ a complementary-log-log link to take into account the continuous nature of time under analysis, despite the measurement of data occurring in discrete intervals. In Model 1, multiple periods of exposure and migration are included for the same individual. Model 1 therefore faces the problem of non-independence across events for the same individual. Therefore, a second model has been developed which includes individual-level random effects. Both models use a one-year lagged HIV status, such that migration in time t is predicted by sero-status in time t-1. As migration and changes in sero-status can occur at any point during the year, lagged HIV status is essential to test the hypothesized sequence under investigation. Each of these models were run in three different specifications: (1) for the full sample of respondents, (2) for those who were HIV negative in their first round of participation, and (3) for in-migrants.

Model 1:

$$\boldsymbol{clog-log}(h(t_j)) = [\boldsymbol{\alpha_1 R_{i1}} + \cdots + \boldsymbol{\alpha_{10} R_{i9}}] + \boldsymbol{\beta_1 HIV_{j-1i}} + \boldsymbol{\beta_2 \gamma_i} + [\boldsymbol{\beta_3 Agegrp1_i} + \cdots + \boldsymbol{\beta_9 Agegrp2_i}]$$

$$j = time\ period$$
$$i = individual$$
$$h(t_j) = hazard\ of\ migration$$
$$R_1 + \cdots + R_9 = dummy\ variables\ for\ round\ number\ 12-20$$
$$HIV_{j-1i} = dummy\ variable\ for\ on\ year\ lagged\ HIV\ status$$
$$Agegrp_i = dummy\ for\ 10\ year\ age\ groups\ (15-24\ldots.70+)$$
$$\gamma_i = vector\ of\ control\ variables$$

Model 2:

$$\boldsymbol{clog-log(h(t_j)) = [\alpha_1 R_{i1} + \cdots + \alpha_{10} R_{i9}] + \beta_1 HIV_{j-1i} + \beta_2 \gamma_i}$$

$$\boldsymbol{+ [\beta_3 Agegrp1_i + \cdots + \beta_9 Agegrp2_i] + \delta_i}$$

$$\delta_i = individual - specific\ random\ effect$$

PRELIMINARY RESULTS

Analysis was limited to those participants 15 years or older who had participated in at least one census or survey from 2000-2009. Table 1 provides basic demographic characteristics for survey respondents in 2000-2009, as well as sero-prevalence rates which range from 7-11%. Overall mobility in the study population is high. Half of all respondents during this 10 year period moved at least once (49.21%, results not shown). While repeat migration data is only available for those moving within the study site, 12.16% of respondents were reported to have moved 2 or more times over the observation period. Marriage-related migration makes up between 5-10% of all migrations each year, including partner formation, divorce, or joining a previous spouse (Figure 1). While men make up the majority of labor migrants each year, marriage-related migrations are almost exclusively among women. Between 94-98% of marriage-related migrants each year are women (Figure 2). Given that the Buganda ethnic groups follow a patrilineal system of descent, with patrilocal residence at marriage, it is the women who join their husbands at marriage, and again move out in case the marriage dissolves (widows may continue to live in their husband's homestead) indicating a gendered process of marriage-related mobility in rural Uganda.

Table 1: Demographic Characteristics, 2000-2009

Variable	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
N	9,348	10,120	10,367	10,497	10,637	10,594	10,693	10,741	10,908	11,065
Age										
15-29	4873 (52%)	5394 (53%)	5506 (53%)	5527 (53%)	5511 (52%)	5393 (51%)	5400 (51%)	5333 (50%)	5407 (50%)	5496 (50%)
30-39	1589 (17%)	1721 (17%)	1742 (17%)	1778 (17%)	1804 (17%)	1815 (17%)	1835 (17%)	1883 (18%)	1903 (18%)	1915 (17%)
40-49	1002 (11%)	1042 (10%)	1112 (11%)	1145 (11%)	1229 (12%)	1251 (12%)	1312 (12%)	1362 (13%)	1396 (13%)	1422 (13%)
50-59	697 (7%)	718 (7%)	748 (7%)	760 (7%)	777 (7%)	797 (8%)	832 (8%)	849 (8%)	896 (8%)	906 (8%)
60-69	620 (7%)	639 (6%)	666 (6%)	679 (6%)	673 (6%)	670 (6%	655 (6%)	654 (6%)	635 (6%)	611 (6%)
70 +	567 (6%)	606 (6%)	593 (6%)	608 (6%)	643 (6%)	668 (6%)	659 (6%)	660 (6%)	671 (6%)	715 (6%)
Sex										
Male	4502 (48%)	4854 (48%)	4,985 (48%)	5,026 (48%)	5,047 (47%)	5,044 (48%)	5,039 (47%)	5,048 (47%)	5,112 (47%)	5,208 (47%)
Female	4846 (52%)	5266 (52 %)	5,382 (52%)	5,471 (52%)	5,590 (53%)	5,550 (52%)	5,654 (53%)	5,692 (53%)	5,795 (53%)	5,855 (53%)
HIV										
Negative	7,013 (93%)	7,294 (93%)	6,992 (93%)	7,049 (93%)	7,036 (92%)	6,746 (92%)	6,839 (92%)	6,634 (91%)	6,232 (90%)	5,781 (89%)
Positive	499 (7%)	540 (7%)	547 (7%)	555 (7%)	590 (8%)	590 (8%)	601 (8%)	621 (9%)	671 (10%)	713 (11%)
N	7,512	7,834	7,539	7,604	7,336	7,336	7,440	7,255	6,903	6,494
Marital Status										
Never married	1959 (35%)	2250 (36%)	1784 (29%)	2053 (35%)	2141 (34%)	1776 (31%)	1780 (32%)	1797 (32%)	1716 (32%)	1103 (22%)
Married	2657 (47%)	2809 (45%)	3015 (50%)	2705 (46%)	2883 (46%)	2704 (48%)	2717 (48%)	2666 (48%)	2597(48%)	2829 (56%)
Widowed	424 (7%)	446 (7%)	491 (8%)	459 (8%)	530 (9%)	523 (9%)	481 (8%)	454 (8%)	426 (8%)	478 (9%)
Divorced/ Separated	630 (11%)	703 (11%)	773 (13%)	660 (11%)	662 (11%)	660 (12%)	648 (12%)	655 (12%)	639 (12%)	634 (13%)
N	5,670	6,208	6,063	5,877	6,216	5,663	5,626	5,572	5,378	5,044
Tribe										
Muganda	2,392 (74%)	2,909 (73%)	3,104 (72%)	3,279 (72%)	3,427 (73%)	3,439 (73%)	3,492 (72%)	3,546 (72%)	3,761 (72%)	3,912 (73%)
Munyanrwanda	440 (14%)	571 (14%)	642 (15%)	680 (15%)	699 (15%)	709 (15%)	754 (16%)	767 (16%)	795 (15%)	830 (15%)
Other	400 (12%)	525 (13%)	550 (13%	570 (13%)	591 (13%)	582 (12%)	608 (13%)	614 (12%)	648 (12%)	641 (12%)
N	3,232	4,005	4,297	4,529	4,717	4,730	4,854	4,927	5,204	5,383
Religion										
Christian	5,005 (76%)	5,716 (77%)	6,048 (77%)	6,311 (76%)	6,601 (76%)	6,832 (76%)	7,206 (76%)	7,453 (75%)	7,956 (75%)	8,117 (75%)
Muslim	1,750 (24%)	1,750 (23%)	1,853 (23%)	1,968 (24%)	2,082 (24%)	2,126 (24%)	2,290 (24%)	2,453 (25%)	2,709 (25%)	2,770 (25%)
N	6,552	7,466	7,901	8,279	8,683	8,958	9,496	9,996	10,665	10,887

Figure 1

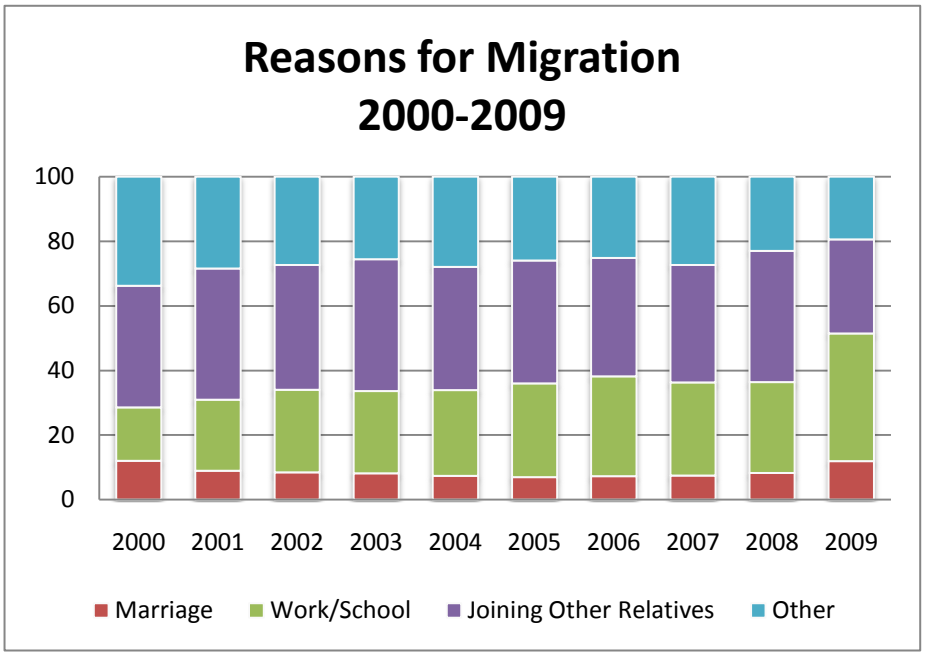
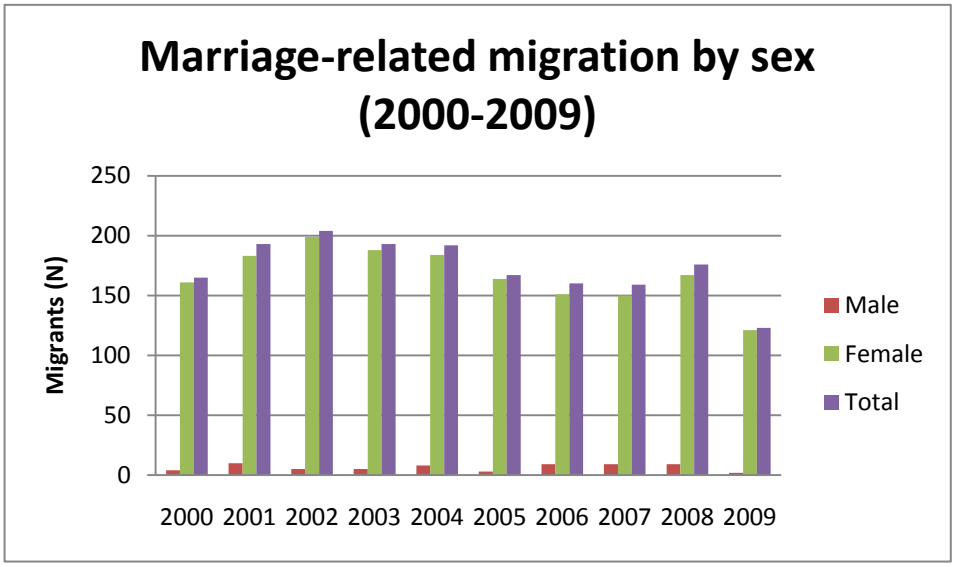


Figure 2



Looking at the full survey sample using model 1, being HIV positive increases the hazard of migration by 72%, controlling for survey round, age and sex. The high level of significance is not very noteworthy, due to the large sample size of the analysis. What is highly notable,

however, is the size of the effect on lagged HIV status which indicates a large effect of being HIV positive on increasing the hazard of migration. Even when looking at just those who sero-converted over the course of observation, we still see a large effect of HIV on increasing the risk of migration, with a 34% increase in the hazard. Those who joined the sample after round 11 were also more likely to migrate if they were HIV positive in the previous year, with a 20% increase in the hazard compared to those who are HIV negative.

Adding random effects to the model increased the strength of the association for the full sample, where HIV status in the previous round increased the hazard of migrating in that round by 87%. However, the random effects model shows an attenuation in the strength of this relationship for those who were HIV negative in their first round of observation (a 7 percentage point reduction). For in-migrants into the study site, the random effects model results in almost no change to the strength of the association, but does result in an increase in the standard errors of the estimate. These six model specifications were then examined further to examine the impact of marriage-related events and marriage-related migration. These additional results are forthcoming.

Table 2: Hazard Ratios by Model

VARIABLES	(1) Full Sample	(2) Full Sample (RE)	(3) HIV -ve in first round	(4) HIV -ve in first round (RE)	(5) In-migrant	(6) In-migrant (RE)
HIV (lagged)	**1.719*** **	**1.870*** **	**1.340*** **	**1.267** **	**1.204*** **	**1.197*** **
	(1.599 - 1.848)	**(1.688 - 2.073)**	**(1.118 - 1.606)**	**(1.007 - 1.595)**	**(1.113 - 1.303)**	**(1.079 - 1.329)**
Female	1.031	1.068**	1.017	1.050*	0.916***	0.917***
	(0.990 - 1.074)	(1.009 - 1.130)	(0.975 - 1.061)	(0.991 - 1.113)	(0.873 - 0.960)	(0.860 - 0.977)
Age Group	yes	yes	yes	yes	yes	yes
Round	yes	yes	yes	yes	yes	yes
Observations	64205	64205	60824	60824	24500	24500
*** p<0.01, ** p<0.05, * p<0.1						
RE indicates random effects						

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