Polygyny and HIV in Malawi

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Abstract

We review HIV prevalence rates among individuals in monogamous and polygynous marriages in Malawi and disentangle the process that leads to higher HIV prevalence in polygynous than in monogamous unions. We are particularly interested in two processes: first we assess whether men and women in polygynous unions more often engage in risky sexual behavior, and secondly we evaluate the selection of HIV positive women into polygynous unions.

1. Background

It is not uncommon for polygyny to be listed among a set of cultural practices that fuel the HIV/AIDS epidemic (Gausset 2001). Even though this assertion is not often empirically verified, there are several plausible reasons for considering polygyny a risk factor for HIV infection. First, polygynous marriages involve multiple partners, each of whom might introduce HIV in the household. Once one of the spouses is or becomes HIV positive, the others are exposed to HIV as well. Second, the concurrency of sexual partnerships in polygynous unions might have an independent effect on the spread of the virus: under serial monogamy earlier partners are not at risk of being infected by later partners; in concurrent relationships, the protective effect of the sequence is lost (Morris and Kretzschmar 1997). Particularly for diseases such as HIV/AIDS that have an early peak in infectivity, concurrency could be an important independent risk factor in the spread of the virus (Morris and Kretzschmar 1997; Wawer, Gray, Sewankambo, Serwadda, Li, Laeyendecker, Kiwanuka, Kigozi, Kiddugavu,

Lutalo, Nalugoda, Wabwire-Mangen, Meehan, and Quinn 2005). Though a concurrency effect on the spread of HIV and other STD's is a theoretically sound idea, the empirical evidence is mixed.[1] Thirdly, men in societies where polygyny is practiced tend to marry at a later age and more often have casual sexual partnerships in early adulthood (Caldwell, Caldwell, Ankrah, Anarfi, Agyeman, Awusabo-Asare, and Orubuloye 1993; Philipson and Posner 1995). Fourth, the institution of polygyny presumably endorses the belief that men require more than one woman for sexual satisfaction (Caldwell et al. 1993). Lastly, polygynous societies are often also characterized by high rates of marital dissolution and the easy remarriage of widows and divorcees. This could lead to an increase in the total number of sexual partners over a woman's lifetime (Halton et al. 2003; Pison 1986; van de Walle 1990).

On the other hand, it is sometimes argued that polygyny contains –the connectedness and density of– sexual networks because it reduces the incidence of casual or extra-marital sex and, therefore, that polygyny reduces the transmission of HIV (Caldwell et al. 1993; Carael, Ali, and Cleland 2001; Mitsunaga, Powell, Heard, and Larsen 2005)[2]. The empirical evidence for that is –again– not conclusive. Two studies that gathered at least partial evidence that men (and women) in polygynous unions have more extra-marital affairs than their counterparts in monogamous marriages (Carael, Ali, and Cleland 2001; Mitsunaga, Powell, Heard, and Larsen 2005). A study in Tanzania suggests that non-marital partnerships are less common in polygynous men and more frequent among women in polygynous unions (Nnko, Boerma, Urassa, Mwaluko, and Zaba 2004).

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[1] In a study on the spread of Herpes Simplex, Halton and colleagues found that the risk of infection was as high in women whose husband was polygynous as in those whose husband had a prior marriage (Halton, Ratcliffe, Morison, West, Shaw, Bailey, and Walraven 2003). This suggests that it is the number of partners one has had, and not necessarily the concurrency of these relationship that affects the spread of STD's. This was also suggested by Lagarde and colleagues who were not able to identify that concurrency of sexual partnerships facilitates the spread of HIV (Lagarde, Auvert, Carael, Laourou, Ferry, Akam, Sukwa, Morison, Maury, Chege, N'Doye, and Buve 2001). Convincing evidence for a concurrency effect on HIV incidence and prevalence in the Rakai district in rural Uganda could not be found either (Kelly 2001). In a study on Chlamydia transmission in Colorado, however, concurrency was identified as the most powerful predictor of transmission (Potterat, Zimmerman-Rogers, Muth, Rothenberg, Green, Taylor, Bonney, and White 1999).

[2] A greater permissiveness of extra-marital sex is sometimes associated with the practice of prolonged post-partum abstinence (Cleland, Ali, and Capo-Chichi 1999; Orubuloye, Caldwell, and Caldwell 1997). Men in polygynous unions could change partners within marriage, and thus have less of an incentive to engage in non-marital sex than monogamous men (Cleland, Ali, and Capo-Chichi 1999; van de Walle 1990).

In this paper, we study the relationship between polygyny and HIV infection in rural Malawi and try to disentangle the process that leads to different infection rates in polygynous and monogamous unions. To that end, we first describe the relationship between polygyny and HIV and find that prevalence is higher in polygynous unions than in monogamous marriages. With this in mind, we investigate two mechanisms that could lead to higher prevalence rates in polygynous households: 1) partners in polygynous unions have more extra-marital relationships and thus increase each other's exposure to HIV; 2) women who are recruited into a polygynous union are more likely to be HIV positive than those who are not. If neither of these hypotheses holds, variation in prevalence rates by union type are likely due to a 'polygyny-effect'; namely the fact that a person is in a household with a higher degree of sexual mixing and concurrent partnerships and thus also greater exposure to HIV.

We study the first of these hypotheses using reports of spousal infidelity and assess whether it is higher in polygynous than in monogamous unions. To test the second hypothesis we need to investigate selection of spouses into polygynous marriages based on their HIV status. Because the sample size and number of HIV positive cases is too small to permit such an analysis, we focus instead on two risk factors of HIV, namely widowhood and marriage order. We thus investigate whether widows are more often selected into polygynous households than divorcees and analyze whether marriage order correlates with selection into a polygynous marriage. Both multiple marriages and widowhood are considered risk factors for being HIV positive; an assumption for which we will provide some evidence as well.

2. Data

We use data from the adult samples of the Malawi Diffusion and Ideational Change project (MDICP)[3]. These are longitudinal survey data collected in the rural areas of three districts with approximately 1,500 ever-married women and their husbands who have been interviewed in 1998 (MDICP1), in 2001 (MDICP2) and 2004 (MDICP3). In 2004 respondents were counseled and tested for HIV[4]. HIV prevalence in the sample is 9.3 percent for women (95%-CI: 7.6-

[3] A description of the project, survey instruments and data is available at http://www.malawi.pop.upenn.edu and in a special collection of Demographic Research (Watkins, Zulu, Kohler, and Behrman 2003).
[4] The testing protocol is summarized in Bignami et al. (2004).

11.3) and 6.4 percent for men (95%-CI: 4.6-8.7). Unless stated otherwise, we rely for most analyses on retrospectively reported marriage histories collected as part of MDICP2. For each respondent, these histories contain information on the present (or most recent if not currently married), previous and first marriage. This means that the marriage histories are not complete for those who married more than three times. Because that is the case for only five and two percent of men and women respectively, we believe that this is not of great importance. For each marriage that is included in the histories, information is available on the start, duration and outcome of the marriage, as well as on a number of marriage characteristics such as the residence pattern during marriage, the age difference between the spouses, whether or not the husband is/was polygynous, and whether there was any suspicion of spousal adultery [5]. From these histories, we created a dataset of marriages that will be used in several of the analyses that are presented below. Compared to DHS surveys or censuses, which typically only provide information on current status, this is an exceptionally rich data source because it provides an insight into the marriage trajectories rather than a snapshot in time. Retrospective reporting, however, may be subject to bias because of the problematic reporting of ages and dates, the ex post facto rationalization of decision-making processes, and possibly because of a greater propensity to omit short unsuccessful unions from marriage histories as time passes. Retrospective reporting also implies that the information is confined to those who survived and were present at the time of the survey.

The sample is ethnically and religiously heterogeneous. Rumphi in the north is characterized by a predominantly patrilineal system of descent with patrilocal residence after marriage. The ethnic groups in Balaka in the south follow a matrilineal system of filiation and residence after marriage is most often matrilocal. In Mchinji, in the center of the country, descent is less rigidly matrilineal and residence may be either matrilocal or patrilocal. The southern district is predominantly Muslim; Christians are in the majority in the other two areas. The Tumbuka are the main ethnic group in Rumphi, the Chewa in Mchinji

[5] Marriage outcome (if ended) is defined as either divorced or widowed. Separation is very rare and combined with the category ‘divorced’. The measure of polygyny used in this paper is based on two questions: 1) whether or not the husband (or respondent if male) had any other wives at the time of marriage, and 2) whether the husband (or respondent) married an additional wife(ves) during the marriage under consideration. A marriage is considered polygynous if any of those two questions was answered affirmatively. The measure of suspected adultery is clarified in section 4.

and the Yao in Balaka. Because of this cultural heterogeneity, we control for district in most of our statistical models.

Marriage in Malawi is quasi-universal but divorce rates are high, with some variation across the three research sites: in the south, over 50 percent of first marriages dissolve within 15 years and in the two other districts, this figure is between 30 and 40 percent. Part of this discrepancy is related to the matrilineal system of filiation that predominates in most southern ethnic groups wherein marriage dissolution is traditionally higher (Reniers 2003).

3. Polygyny and HIV prevalence in Malawi

There are quite important regional differences in the prevalence of polygyny (table 1). It is most common in the north and least common in the southern region. For a number of reasons, the prevalence of polygyny in the sample is higher than the levels reported in the 2004 Demographic and Health Survey (DHS) (NSO and ORC Macro 2005). First, the MDICP sample is drawn from exclusively rural settings where levels of polygyny are generally higher. Secondly, in MDCIP1 the sampling frame consisted of ever-married women and their husbands. In MDICP2 other and new spouses of already sampled men and women were also interviewed, thereby increasing the share of women married to a polygynous husband. Thirdly, the measure of polygyny in the DHS reflects current status, whereas the definition used here categorizes a marriage as polygynous when the husband had another wife at any time during the marriage under consideration (see also footnote 5). Lastly, the MDICP data pertain to all (i.e. current, previous and first) marriages of men and women in the sample, which means that the marriages may have been initiated any time between the 1940s and the time of the survey. Considering that the prevalence of polygamy in Malawi has decreased over time (see table 1)[6], that is another reason why the measure used here differs from the values reported in the DHS. Rather than a nuisance, however, the over-representation of polygynous marriages in our

[6] The decline in the prevalence of polygamy between 1992 and 2004 reported in table 1 is more explicit for women than for men. That suggests that it is not the number of polygynous men that has declined, but that the *intensity* of polygyny decreased (i.e. a decline in the number of wives of each polygynyst (Van de Walle 1968)). The prevalence of polygyny is also reported to have declined in a number of other sub-Saharan African countries (Caldwell and Caldwell 1993; Frank 1992; Mitsunaga, Powell, Heard, and Larsen 2005).

sample is a convenient statistical feature because it increases the power of statistical tests.

Table 1: prevalence of polygyny and HIV in the three regions of the DHS survey and sample districts of the MDICP (in percent)

	DHS‡		
	South	Central	North
Fraction of currently married women with one or more co-wives			
1992	17.2	22.7	28.3
2004	12.8	15.5	25.9
Fraction of currently married men with more than one spouse			
1992	4.7	12.6	14.9
2004	6.1	11.3	20.7
HIV prevalence (both sexes), 2004	17.6	6.5	8.1
	MDICP		
	Balaka	Mchinji	Rumphi
Fraction of marriages in which the respondent (women's reports) had one or more co-wives at any time during her marriage	31.7	36.9	50.7
Fraction of marriages in which the respondent (men's reports) had more than one wife at any time during his marriage	23.8	29.4	45.0
HIV prevalence (both sexes)	10.6	9.1	5.7

Notes:
‡ Sources: NSO and ORC Macro (1994; 2005)

In terms of HIV prevalence, the levels in the DHS sample are higher than in the MDICP. One of the reasons is that the latter pertain to an exclusively rural population. The exception is the central region, and this is possibly due to the uncharacteristically high refusal rates in the central region in the DHS survey (particularly in Lilongwe where less than 40 percent of the respondents were tested). Noteworthy is that polygyny is most prevalent in the district (Rumphi) where HIV infection rates are lowest. In Balaka, where HIV prevalence is highest, polygyny is least common. At the aggregate level polygyny thus negatively correlates with HIV prevalence across the MDICP study regions. This is not the

case, however, at the individual level where the association is positive[7]: the odds for being HIV positive are 2.58 times (95%-CI: 1.34 - 4.94) higher among men who have ever been in a polygynous household than among men who have not had any concurrent spouses. The corresponding value for women is 2.00 (95%-CI: 1.30 - 3.08)[8].

These differences persist after controlling for district and age (table 2, model 1). Again, this is particularly so for polygynous men, for whom prevalence is more than three times as high compared to monogamously married men. The odds for being HIV positive among women who have been –or still are– married to a polygynous husband are twice those of women who have always been married to a monogamous husband.

Table 2: Risk factors of HIV+ status (odds ratios)

	Women		Men	
	Model 1	Model 2	Model 1	Model 2‡
District (vs Balaka)				
Mchinji	0.773	0.955	1.196	2.882**
	(1.01)	(0.17)	(0.46)	(2.13)
Rumphi	0.495***	0.743	0.460*	1.422
	(2.58)	(1.01)	(1.74)	(0.65)
Age	1.230*	1.172	1.410**	1.455*
	(1.91)	(1.45)	(2.02)	(1.72)
Age^2	0.997**	0.997*	0.996**	0.995*
	(2.25)	(1.93)	(2.11)	(1.87)
Ever polygynous	2.301***	1.670**	3.142***	1.568
	(3.63)	(2.10)	(3.26)	(1.07)
Marriage order (vs 1st marriage)				
Second		2.258***		ref‡
		(3.08)		
> Second		4.292***		1.895
		(4.24)		(1.51)

[7] Ezeh (1997) finds a similar discrepancy in the aggregate and individual level association between polygyny and fertility.

[8] These associations are also reproduced for each of the three districts separately. For men the relationship is only significant for Mchinji. There are, however, only 40 HIV positive men in the sample and that contributes to the low statistical power of the tests. In the MDHS, the odds that a polygynous man (current status) tested positive are lower than those for a monogamous man, but these values are not significant (OR: 0.65, 95%-CI: 0.39 - 1.14). For women, the value is closer to what we find in the MDICP sample and is significant (OR: 1.49, 95%-CI: 1.08 - 2.06) (NSO and ORC Macro 2005).

N (respondents)	1043	1043	621	306
LL	-306.69	-296.85	-137.83	-90.09
df	5	7	5	6
Pseudo R^2	0.05	0.08	0.07	0.08

Absolute value of z statistics in parentheses
* Significant at 10%; ** significant at 5%; *** significant at 1%
‡ Analysis pertains to higher order marriage only. The second marriage is the reference category.

One of the mechanisms that could produce a difference in HIV prevalence rates in polygynous and monogamous unions is a difference in the number of marriages. To test whether this has an effect on HIV status and to verify whether it absorbs some of the variance in HIV prevalence attributed to polygyny, we introduce marriage order as an additional explanatory variable in the analyses. For women, having been married more than once correlates significantly with HIV status and reduces the effect of having ever been in a polygynous marriage. Nonetheless, the latter, remains significant, implying that alternative explanations for the variance in prevalence rates by polygyny status cannot be excluded. For men the test is less straightforward as polygyny implies multiple partners by definition. In their case, we compare prevalence rates for those who have been in precisely two formal unions and those who were in at least three marriages. The effects are of a similar order of magnitude as for women, but not statistically significant; perhaps because the small sample size limits statistical power.

So far, we have presented some evidence that HIV prevalence rates are higher in polygynous unions, but this does not seem to be a simple function of the respondent's number of formal unions. In what follows we investigate two other processes that could lead to higher HIV prevalence in polygynous households, namely differences in (risky) sexual behavior between men and women in monogamous and polygynous unions and the selection of HIV positive women into polygynous households.

4. Polygyny and adultery

To test the association between polygyny and risky sexual behavior, we compare the frequency of extra-marital sex in monogamous and polygynous unions. To do so we rely on self reports of adultery and on spousal reports of –the suspicion of– adultery. The latter was operationalized via the survey question:

"During your time together, did/do you suspect or know that your husband/wife had/has sexual relations with other women/men apart from you". Women of polygynous men were told that this did not include co-wives. The suspicion of spousal infidelity is reported by women in 33.2 percent of the marriages and by men in 14.5 percent of the marriages. Self-reports of adultery are lower: men report extra-marital affairs in 19.5 percent of the marriages and women only in 2.5 percent of the cases. These percentages are virtually the same if the analysis is restricted to first marriages only.

The statistical model that we use to test the association between polygyny and adultery is a binary logistic regression where reported (suspicion of) adultery is the outcome. We do this for both men (table 3) and women (table 4). Men who are in polygynous marriages are 50 percent more likely to self-report extra-marital affairs than men in monogamous unions, an effect that remains stable while controlling for demographic, socio-economic, and residence variables. The odds that women in polygamous marriages suspect their husband of infidelity are about three times the odds of women in monogamous unions. The effect becomes even stronger after controlling for demographic and residence variables.

In terms of the control variables, we find that reports of male adultery decline with an increasing age at marriage. The effect of marriage period suggests that adultery has decreased over time. In a different report, it has been shown that the decline in reported adultery (of men) is irrespective of the marriage outcome or marriage status at the time of the interview (Reniers 2006). Educated men are about 66 precent more likely to self-report infidelity than their uneducated counterparts, but education does not seem to matter for spousal reports of adultery. Having a spouse who lives in the same village is negatively associated with reports of adultery. This probably indicates that adultery is a matter of opportunity and social control. Because its effect is only significant for spousal reports of adultery and not self-reports it may also have something to do with women's uncertainty about the behavior of their absent spouses. Regardless of the effects of all these controls, the main conclusion from this analysis remains that polygynous men more often have extra-marital affairs (measured via self reports as well as reports by their spouses), which could contribute to the difference in HIV prevalence rates between individuals in polygynous and monogamous unions.

Table 3: Predictors of adultery (odds ratios), men

	Self-reports		Wife's suspicion	
	Model 1	Model 2	Model 1	Model 2
Polygynous	1.510***	1.454*	3.007***	3.362***
	(2.90)	(1.94)	(10.74)	(10.70)
District (vs Balaka)				
Mchinji	1.127	0.891	1.238*	1.286*
	(0.75)	(-0.63)	(1.74)	(1.92)
Rumphi	0.851	0.721	0.815	0.831
	(-0.90)	(-1.49)	(-1.58)	(-1.32)
Age at marriage		0.945***		0.971***
		(-4.39)		(-2.99)
Spousal age difference		1.349**		0.796**
		(1.98)		(-2.02)
Year of marriage (vs <1979)				
1979 – 1987		0.911		0.977
		(-0.44)		(-0.15)
1988 – 1994		1.230		0.792
		(0.96)		(-1.47)
1995 – 2001		0.766		0.538***
		(-1.09)		(-3.62)
Education		1.659***		-
		(2.79)		
Ethnic homogeneous[†]		0.820		0.841
		(-1.30)		(-1.41)
Spouse lives in same village		0.720		0.481***
		(-1.53)		(-5.45)
N(marriages)	1812	1582	1848	1746
LL	-889.96	-705.64	-1109.02	-1006.37
df	3	11	3	10
Pseudo R2	0.007	0.038	0.050	0.086

Notes:
Robust z statistics in parentheses (adjusted for clustering on respondent)
* Significant at 10%; ** significant at 5%; *** significant at 1%
Variable definitions: *age at marriage*: age at the beginning of the marriage (in the analysis of self-reports, the age at marriage refers to the husbands age at marriage; in the analysis where we use the wife's suspicion of the husband's adultery, the value of the age at marriage pertains to the wife. Because the ages of spouses are positively correlated, the interpretation of the effects in the two cases is similar); *spousal age difference:* husband is more than five years older than his wife versus less than that (reference category); *year of marriage*: calendar year at the start of the marriages; *education*: a minimum of three years of education versus less than that (reference category; *ethnic homogenous marriages*: unions where both spouses are of the same ethnicity versus couples where the spouses are of a different ethnicity (reference category); *spouse lives in same village* or not (reference category).

For women there does not seem to be any substantial difference in extra-marital relationships between those in polygynous and monogamous unions. Although the parameter values point in the same direction as those for men, they are smaller and lack statistical significance (table 4). In Balaka, where the Yao follow a predominantly matrilineal system of decent, the reports of female adultery are higher than in the other two districts. This is consistent with anthropological commentary that women in matrilineal groups exercise greater control over their sexuality and offspring (Caldwell, Caldwell, and Orubuloye 1992). The other factors influencing infidelity among women are quite similar to those for men: educated women are more likely to self-report extra-marital affairs than their less educated counterparts; reports of adultery appears less common in recent marriages; and co-residence in the same village reduces the likelihood of adultery. Combined, tables 3 and 4 thus provide evidence that polygynous men (but not women) are more likely to engage in risky sexual behavior than monogamously married men and thus increase their own as well as their spouses' risk of HIV infection.

Table 4: Predictors of adultery (odds ratios), women

	Self-reports		Husband's suspicion	
	Model 1	Model 2	Model 1	Model 2
Polygynous	1.285	1.229	0.887	1.283
	(0.84)	(0.59)	(-0.73)	(1.31)
District (vs Balaka)				
Mchinji	0.347***	0.371**	0.854	0.925
	(-2.62)	(-2.55)	(-0.91)	(-0.41)
Rumphi	0.350**	0.228***	0.684**	0.706*
	(-2.37)	(-3.10)	(-2.06)	(-1.75)
Age at marriage		1.044		0.981
		(1.31)		(-1.62)
Spousal age difference		1.304		0.985
		(0.78)		(-0.09)
Year of marriage (vs <1979)				
1979 - 1987		0.646		0.794
		(-1.03)		(-1.10)
1988 – 1994		0.249**		0.905
		(-2.56)		(-0.50)
1995 – 2001		0.565		0.491***
		(-0.99)		(-2.87)
Education		1.927*		-
		(1.85)		
Ethnic homogeneous		1.062		1.041
		(0.17)		(0.25)
Spouse lives in same village		0.284***		0.477***
		(-4.25)		(-3.80)
N (marriages)	1977	1861	1712	1497
LL	-208.64	-175.70	-707.01	-607.66
df	3	11	3	10
Pseudo R2	0.028	0.090	0.004	0.036

Notes:
Robust z statistics in parentheses (adjusted for clustering on respondent)
* Significant at 10%; ** significant at 5%; *** significant at 1%
Variable definitions: see table 3

5. Selection of HIV positive women into polygynous unions

A direct assessment of the selection of HIV positive women into polygynous unions requires a measure of HIV status for all women at the time of marriage. Unfortunately, these data are not available. Instead, we examine selection processes with respect to characteristics that are measurable and that correlate with HIV status. One of them is widowhood, and we therefore compare the likelihood that widows and divorcees become part of a polygynous household. The odds for being HIV positive are about 78 percent higher (p=.12) for a widow[9] than for a divorcee, controlling for district and age. Adding an additional control for having been in a polygynous household barely changes that relationship. For adverse selection into polygynous marriages to account for (part of) the difference in HIV prevalence rates between polygynous and monogamous households, women whose previous husband(s) died should be disproportionately found in marriages with a polygynous husband[10].

The other outcome that we consider is marriage order. Here we postulate that marriage order correlates with HIV status (see table 2), and that women at higher order marriages are more frequently selected into marriages with polygynous men. In these analyses we define a polygynous husband as someone who had at least one other spouse at the time of marriage. The tests for both of these selection processes are carried out using a binary logistic regression model whereby the marriage type is the outcome of interest and widowhood (versus divorced status, table 5, model 1) and marriage order (table 5, model 2) are the main predictors of interest.

[9] In the 2004 Malawi DHS, HIV prevalence among the widowed (current status) was 35.5% (N=103) and 23.3% among the divorced and separated (N=272) (2006). See also Reniers (Reniers 2006).

[10] In a different study, remarriage rates of widows were found to be lower than those of divorcees (particularly in the 1990s); most likely because a fair share of the widows have become the surviving spouses of AIDS victims and therefore not very attractive marriage partners (Lesthaeghe, Kaufmann, Meekers, and Lesthaeghe 1989; UNAIDS 2006). In this paper, we are merely interested in explaining differences in HIV prevalence between men and women in polygynous and monogamous marriages. The analysis therefore conditions on remarriage.

Table 5: characteristics affecting marriage to a polygynous husband (women only, odds)

	Model 1‡	Model 2
District (vs Balaka)		
Mchinji	1.179	1.460***
	(0.90)	(2.67)
Rumphi	3.101***	2.826***
	(5.42)	(7.38)
Age at marriage	1.259***	1.244***
	(3.18)	(4.11)
Age at marriage2	0.997***	0.997***
	(2.75)	(3.41)
Widow (vs divorcee)	1.21	
	(0.88)	
Marriage order (vs 1st marriage)		
Second		2.781***
		(6.36)
> Second		3.500***
		(5.16)
N (marriages)	705	2232
LL	-449.83	-1037.08
df	5	6
Pseudo R2	0.06	0.13

Notes:
Robust z statistics in parentheses (adjusted for clustering on respondent)
* Significant at 10%; ** significant at 5%; *** significant at 1%
‡ Analysis pertains to higher order marriages only
Variable definitions: *Age at marriage*: age at marriage of the respondent (i.e., the wife); *widow:* whether the woman's previous marriage ended in widowhood or divorce/separation; *Marriage order*: 1st marriage (reference category), 2nd marriage, or higher order marriage of the wife.
Models selection: The interaction between marriage period and outcome of the previous marriage is not significant (indicating no change in the selection of widows into polygynous unions over time). The interaction effect between marriage period and marriage order seems to suggest that women in their third marriage or above are selected into polygynous households more often in the 1990s than was the case before that period. This effect, however, does not reach statistical significance either (z=1.04). Both interactions were omitted from the final model.

In addition to our earlier finding that the prevalence of polygyny varies by district, we learn from table 5 that the frequency of polygynous marriages increases with women's age at marriage: the older a woman, the more likely she is to marry a polygynist. The quadratic effect for age at marriage indicates that the odds of marrying a polygynous husband follow a curvilinear pattern with an

inflection point around age 36. Widows are, as expected, more likely to remarry a polygynous husband, but the effect is relatively small and not significant[11].

The effect of marriage order is much stronger and highly significant: the odds that a woman will marry a polygynous husband are about three times higher in a second marriage than in a first marriage, and the association gains strength with marriage order. Interestingly, marriage order is also a better predictor of HIV status than widowhood (when compared to divorced women). In these analyses, we thus find support for the proposition that HIV positive women are selected into polygynous marriages.

6. Discussion

We began with the observation that HIV prevalence rates in Malawi are higher among those who have been in a polygynous union compared to those who have been in monogamous marriages only. This association is related to, but cannot be fully explained by the number of formal unions one has had, suggesting that other factors contribute to the higher prevalence rates in polygynous unions. We proposed and tested two mechanisms that could produce such a difference and found evidence for each of those processes. First, polygynously married men more often engage in extra-marital affairs than monogamous men; a result that holds for both self-reports and spousal suspicion of adultery. For women, the evidence points in a similar direction but does not reach the same level of statistical significance. Our data do not allow us to investigate why polygamous men are reported to be less faithful than monogamous men. Possible explanations are that these men have a greater disposition for multiple partners, that they are searching for a new spouse, or, that they experience less objection from their current wife/wives. Selection is another avenue that produces higher HIV prevalence rates in polygynous unions. Although our evidence is indirect, women who are at higher risk of infection (i.e. those who are at higher marriage orders and those who are widowed compared to divorced), are more likely to join

[11] The lack of a strong effect is also an indication that levirate or widow inheritance is probably not very important in Malawi (at least not to the extent that it would lead to noticeable differences between widows and divorcees in their likelihood of remarrying a polygynous husband). Because levirate is uncommon in ethnic groups with matrilineal descent systems, we also tested an interaction between widowed and district, but that was not significant either.

polygynous unions. An alternative explanation to the ones investigated here, namely the concurrency of sexual relationships in polygynous unions, remains plausible and cannot be rejected nor confirmed with the available data.

An interesting feature of the study site is that the highest HIV prevalence rates are found in the district where polygyny is least common (and vice versa). Using the evidence at hand, it is not possible to explain the difference in individual and aggregate-level correlations between polygyny and HIV[12]. Unobserved heterogeneity is a likely candidate, but a more intriguing hypothesis is one that implies a strong selection of HIV positive individuals into polygynous households. As we have observed in this study, this could lead to a positive individual-level correlation between polygyny and HIV. However, if the selection is strong and the sexual networks of men and women who are in polygynous unions are sufficiently distinct from those who are in monogamous unions, they could have the potential to contain aggregate HIV prevalence rates in societies where polygyny is practiced compared to those that are more exclusively monogamous.

7. References

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[12] Incidentally, HIV prevalence is also much lower in western Africa where polygyny rates are usually much higher than in the eastern and southeastern Africa (1992). A similar observation has been made by Frank (1992).

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