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Introduction

The prevalence of HIV infection varies with age and marital status with infection rates being influenced by the age- and marital-status-related frequency of intercourse and, most obviously, the infectivity of an individual's sexual partner, or partners. Thus HIV/AIDS prevalence is generally observed to be higher among the divorced or separated than among either the single or the currently married and higher yet among widows and widowers. For example, in urban Kenya and Zambia, among both women and men aged 15-19 and 20-24 HIV was more prevalent among the ever-married than the never-married (Glynn et al., 2001). More specifically, in rural eastern Zimbabwe, HIV sero-prevalence (adjusting for such factors as age and gender) was 2.7 times higher among married than single people, 5.5 times higher among the divorced and separated, and 7.9 times higher among the widowed (Gregson et al 2001). That prevalence was highest among those whose previous spouses had died may reflect nothing more than that the spouse died of AIDS, but the interpretation of the high prevalence of HIV among the separated and divorced is unclear. Is it that their spouse divorced them because of their extramarital affairs, one of which happened to give them HIV? Is it that they divorced their spouse because of their spouse's extramarital affairs, the source of the HIV infection? Or did they contract their HIV after their previous marriage ended?

In an earlier application of the microsimulation model employed here we simulated the proportions of newly-weds in three regions of rural Malawi who were already HIV-positive. We then made a first attempt at illustrating the implications for ultimate HIV infection of whether couples subsequently maintained a sexually exclusive relationship, or not: in the latter case, both women and men had a propensity to engage in extramarital affairs, and some men had a propensity to have sex with bar girls. We found a large effect of such extramarital sex on the ultimate acquisition of HIV. In the simulations of the southern region, for example, when couples were faithful to one another after marriage, around one-twentieth of women were infected with HIV by the age of 50 (the infection having been introduced into the marriage by sexual behaviour preceding it); in contrast, when both husbands and wives had affairs and half the husbands had a tendency to obtain sex from bar girls, the proportion of women infected by the age of 50 was nearly one-quarter (Bracher, Santow and Watkins 2003).

We refer to that illustration as a "first attempt" because it incorporates two unrealistic assumptions: that marriages end only through death, and that the surviving spouse does not remarry. In actual fact, however, divorce rates are high in Malawi, as we shall go on to demonstrate, and remarriage is common. Moreover, there are indications that rural Malawians are coming to see divorce as a means to protect themselves against being infected with HIV by an unfaithful spouse (Schatz 2002; Smith and Watkins 2002).

Our goal in this paper is to assess the impact of time spent in and out of marriage on the lifetime risk of infection with HIV. There are various countervailing forces. Simply put, since intercourse is more frequent within marriage than outside it, an infected married person poses a greater risk to his or her spouse than to a casual extramarital sexual partner. On the other hand, extramarital partnerships and partnerships between marriages expose an unmarried individual to more heterogeneity in the infection status of their partners, thus increasing risk. HIV prevalence may rise in the presence of divorce and remarriage if divorce increases individuals' average

number of sexual partners because they have affairs after divorce and before they remarry, or simply because they do remarry. Conversely, HIV prevalence may fall if divorce removes a significant number of HIV-negative individuals from a marriage with an HIV-positive spouse: in the absence of divorce such individuals would be parted from a spouse only by death, thus increasing the risk that they would become infected themselves.

We investigate the following specific questions:

1. What are the implications for the lifetime probability of infection with HIV of high rates of marital dissolution over the life course?

2. What are the implications for the lifetime probability of infection of periods between marriages?

3. What are the implications for the lifetime probability of infection of trade-offs between fidelity in marriage and divorcing a partner one knows, or suspects, is HIV positive?

We address these questions by means of a microsimulation model. Microsimulation is a stochastic computer-dependent technique for simulating a set of data, one record at a time, according to predetermined probabilistic rules. The individual simulated records — life histories in the present case — are amalgamated and the resulting data set analyzed as though it had been derived in a conventional manner through prospective observation, interview, and continuous monitoring of STD and HIV status. Three characteristics of the method are that the problems to which it is applied depend in some important way on probability; that experimentation is impracticable; and that the creation of a set of realistic formulae is impossible. Each of these characteristics makes the method particularly useful in a variety of demographic applications, including the present one (Santow 2001).

The model incorporates behavioural data pertaining to marriage, divorce and remarriage, and to premarital and extramarital affairs and sexual encounters, the data sources and the data themselves being described in the following section. The model also incorporates biological data pertaining to the aetiology of HIV and other STDs and in particular their transmission probabilities and durations of infectiousness.

For the present paper we produce models only for the southern region of Malawi. We plan subsequently to construct separate models for each of the three regions surveyed because their distinctive lineage and kinship systems influence marriage. Rumphi District, in the north, follows a patrilineal system of kinship and lineage: residence is ideally patrilocal, inheritance is traced through sons, and bridewealth is required. These conditions imply later marriage, which is indeed demonstrable in our data (Bracher, Santow and Watkins 2003). Balaka District, in the south, follows the matrilineal system, ideally with matrilocal residence and with token gifts at marriage, although both patrilocal and matrilocal residence occurs; this is the region where marriage is earliest. Mchinji District, located in the central region, follows a less rigid matrilineal system whereby residence may be matrilocal or patrilocal, and, again, only token gifts at marriage. In addition, the three districts differ according to the predominant ethnicity, religion and language; the language difference, in particular, suggests that the attitudes and

behaviours in the three communities may also be distinct.

We first trawl through quantitative and qualitative data collected under the aegis of the Malawi Diffusion and Ideational Change Project to gain insights into the local meaning of marriage and divorce, the causes of divorce, and the levels and patterns of divorce and remarriage. We use these data also in an attempt to assess the extent to which women and men are sexually active with people to whom they are not married. After briefly describing the microsimulation model we exploit the experimental character of the microsimulation method by applying it to examine the effects on women's lifetime acquisition of HIV of observed patterns of marriage and divorce, and of various strategies to avoid being infected by a spouse.

Divorce, remarriage, and extramarital sexual activity

Sources of behavioural data

In 1998 the Malawi Diffusion and Ideational Change Project (MDICP) interviewed 1541 ever-married women of childbearing age (15-49) and 1065 men (husbands of those women who were currently married) in three culturally and demographically distinct rural areas of Malawi: Balaka in the south; Mchinji in the central region, and Rumphi in the north. The sampling procedures are described in detail elsewhere (www.pop.upenn.edu). Interviewing took place in a language with which the respondent was comfortable, which in most cases meant the major local language of the region. A follow-up survey (MDICP2) conducted in 2001 sought more detailed information on sexual partnerships and marriages and on sexual activity outside marriage. Respondents were asked the calendar years of the beginning and, if applicable, the end of each of their marriages, and then provided more detailed information on their current or most recent marriage, their previous marriage, and their first marriage. We concentrate in the empirical analysis on the experience of women, since they are the focus of the paper.

The reason some marriages ended is not known in cases where a woman had been married more than three times: a woman with four marriages, for example, did not provide detailed information on her second marriage. Nevertheless, this convention resulted in very little missing data since few women reported more than three marriages (see Table 1).[1] Multiple marriages are most common in the south and least common in the north.

Table 1 about here

Our interpretations of the empirical statistics derived from the MDICP2 survey are informed and indeed enriched by various types of qualitative data collected as part of the overall project. A few of the best interviewers from the first round of the MDICP were asked to keep observational journals in which they recorded conversations about AIDS that they had either overhead or participated in, although they were not to instigate such conversations nor to add to their journals until they could be alone. The journal keepers quoted here all live in the southern region of Malawi. The journals, written in English although the vast majority of conversations would have been conducted in a local language, shed light on current areas of investigation and suggest new

1 We exclude 19 teenagers from this and all subsequent tabulations.

avenues of research. When quoting from the journals we employ pseudonyms for the writers and have obscured the names of people they mention. We have edited the text only very lightly, either to enhance its readability where the meaning may be unclear, or to correct those gross errors of English grammar that, by misrepresenting the native linguistic skills of the conversationalists, may downgrade the substance of their conversations.

What is marriage? What is divorce?

The MDICP2 survey questionnaire implicitly defined marriage to include cohabitation, the English version of the first question on women's current marital status taking the form, "Are you now married or living with a man, or are you now widowed, divorced, or are you no longer living together?". This formulation, and the use of the local-language equivalent of "husband" to describe a man married to or living with a female respondent, appeared to cause respondents no difficulty. Nevertheless, what respondents understood by "marriage" appears to be quite diverse, and whether or not short marriages and cohabiting unions were under-reported, or even over-reported, cannot be known with certainty. It is conventional wisdom that rather short periods of marriage or cohabitation may be under-reported in sample surveys and, indeed, some surveys seek information only on those unions that endure for some minimum duration.

Insights can be gained from both the empirical and the qualitative data. Of the 927 marriages reported in the MDICP2, seven marriages were reported to have lasted one week (recorded as seven days), and one to have lasted three weeks (recorded as 21 days).[2] (All of these marriages ended in divorce.) Moreover, a further 61 marriages were reported to have lasted only a matter of months, and twelve, indeed, were reported to have lasted for exactly one month. Very short marriages are mentioned also in the observational journals. For example:

> After some months, he married a certain woman who he stayed with for 3 months and he divorced her because she was a CCAP[3] member and her parents refused [to let] her to join the new Salvation Army and another reason was that before he became a pastor, he was working for the ministry of agriculture as a field assistant. When he became a pastor, he was told to stop working and depend on preaching God's words.
>
> When his wife's parents heard that, they just told their daughter to divorce. (Alice, extract from journal entry 24/11/2002)

In referring to the marriages of a less respectable woman, whom he calls a prostitute, another recorder describes what sounds like a series of short affairs with commercial elements:

> This woman is our neighbor in our village and this is the only thing that she does to earn her living and even her family depends on her. She has been doing this since 1990. She has been married about six times but the marriages take only three to four months and she divorces because she is used to moving around[4] and she feels bound to move around if she

2 This information is derived from the detailed questioning on the current or most recent marriage, the previous marriage, and the first marriage, where the duration of the marriage could be recorded in either days, months, or years.

3 Church of Central Africa, Presbyterian

4 "Moving around" is a translation of the vernacular term for being promiscuous.

> has a husband at home, that's why she divorces. (Diston, extract from journal entry 21/9/2000)

It is natural to wonder whether rural Malawians define marriage or even cohabitation somewhat differently than we, who tend to view the latter as the culmination of a process whereby one partner spends an increasing proportion of nights at the other's residence, and leaves an increasing number of personal possessions there — first a toothbrush, then some clothes, and so on. More relevantly, many respondents may also have defined marriage differently from their own elites, as evidenced by the following extract from one of the project's journal keepers. She is describing a radio programme in which "some important people" — a Muslim cleric, an Anglican cleric, and a number of NGO officials — were asked their views on whether someone with AIDS should be permitted to marry. The clerics had similar views of marriage; below is that of the Muslim:

> … it needs a long process for one to get married, [an individual's] parents are concerned, his or her relatives are also concerned, the *nkhoswes* (councillors) are concerned, the sheikhs and pastors at the mosques and churches are concerned, the Government through the Courts and the District Commissioners also are concerned if you want to register your marriage. (Alice, extract from journal entry 25/10/2002).

Just as marriage may be formally defined, so may divorce. A man separated from his wife told another writer:

> We have not yet divorced because the marriage was at our Roman Catholic Church and we are waiting for our church elders to discuss the matter and after that we will go to the court of law for a final divorce. (Diston, extract from journal entry 28/3/2001)

In contrast, divorce may also be dramatically simple. Of a married woman found having sex with a third party, the same writer records:

> The woman told her husband that she was going to the garden to fetch some vegetables there, and when her husband saw that she was late, he decided to follow her and he caught her in action with the pastor. The incident was heard in the village so that the pastor is not going to his church since this happened. And the wife who was living *Chitengwa*[5] was chased away marking their divorce. (Diston, extract from journal entry 25/3/2002)

In the following journal extract the woman whose conversation has been recorded appears to define a sexual union as a marriage if the man lives with her, even for a short time; by extension, she calls the end of such a union a "divorce":

> But Abiti A_ said that she is not married but she has a boyfriend who gave her a newly born. And in addition to that Abiti A_ complained that two men came to her house to propose her for the marriage. The first man stayed with her as a marriage for three weeks and then she divorced him. The second man stayed with her for one week and she divorced him. After a few months came another man but not for marriage. He was just her sexual partner[6] and he

5 That is, living in her husband's compound.

6 Terms such as "sexual partner", derived from the English versions of the MDICP questionnaires, sit oddly

> made her pregnant which she bore a newborn daughter. (Alice, extract from journal entry 21/10/2002).

The apparent ease with which many people move into and out of marriages is reflected in confusing stories, such as the following, in which an individual moves from one spouse to another and then returns to the previous one. Such stories appear not only in the journals but, in skeletal form, in interviewer jottings on MDICP2 schedules:

> E_ asked Abiti A_ to explain how a woman can get married to two men at the same time. Abiti A_ explained that M_ was first married to a certain man from Blantyre called Mr. C_. She gave birth to a child with that man and their marriage ended. After some months, she then got remarried to a certain man from Chapoila village and she went to South Africa (Jubeck) with him. While they were there the woman was divorced and she came back home. She had given birth to two children with her second husband. After some time she went back to South Africa alone for the job and she was working there. When she met with her [second] husband who had divorced her, they remarried again and after some time, M_ came back home and she went to Blantyre to see her first husband who she gave birth with to one child and agreed to remarry again. The man from Blantyre came to his wife's home and employed piece workers to dig in his wife's land and then he went back to Blantyre where he was working. After some days some properties came from South Africa including money from her [second] husband sending her that she should be going back to South Africa. (Alice, extract from journal entry 5/11/2002)

The diversity of marriage is evident. It may be of the most recognizably old-fashioned kind — not that we feature such marriages in our selection of journal extracts — or a brief affair of a matter of a few weeks. In analyzing the marriage histories we take as marriages those that were reported to us as such. In addition, since it is clearly inappropriate to distinguish between divorce and separation, we take "divorce" to have occurred when a marriage is said to have ended but neither spouse has died.

We recognize that that there may be slippage in either direction. It is possible that some short, possibly early, marriages may have gone unreported, especially by older respondents, although such unreporting could not have been common since ages at first marriage were rather low (Bracher, Santow and Watkins 2003). On the other hand, some reported marital unions may correspond merely with the loss of virginity, while others may have involved only brief or token co-residence. It may be useful to think of a continuum ranging from a one-off sexual encounter — a "hit and run" in journal terms — to a union approved by local notables and blessed by a pastor or imam. Somewhere along this continuum lies the point at which a particular respondent says "this is a marriage", or "this is not a marriage", and the precise point may well differ from person to person. It is thus important to bear in mind the reason that we are interested in marriage in the first place, which is that it is a proxy for sexual behaviour. We expect women to be more sexually active within marriage than outside it, but to have fewer sexual partners.

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alongside the journal writers' otherwise idiosyncratic (although functional) English, but the writers universally deemed them the appropriate translations of vernacular expressions.

Perhaps the MDICP2 respondents would appreciate such a functional definition of marriage if it were couched in the appropriate language.

Reasons for divorce

The MDICP2 the questionnaire did not seek the reason a particular marriage ended in divorce. As a result, we cannot tell in individual cases which partner instigated the separation, or why. For a general picture we therefore turn once again to the observational journals, in which various reasons are mentioned. One is conflict over religious affiliation, as appeared in the first journal extract we quoted. Another is apparent infertility, in this case of the husband:

> She stayed with him for three years and divorced the marriage because Mr M_ was a barren man. He was not bearing children with her therefore our grandparents were not happy about that and they told my Aunt to divorce her husband. (Alice, extract from journal entry 17/11/2002)

Another is drunkenness:

> I_ said that her husband told her that she should stop drinking and if he will once hear that she is still drinking beer, she will be divorced. (Alice, extract from journal entry 2/8/2002)

Like anywhere else in the world where divorce occurs, a common catalyst is infidelity. Such infidelity may be merely suspected or it may be proved, as in the journal extract in which an adulterous woman was driven away from her husband's compound. Infidelity of a husband may not be a sufficient cause for divorce on its own since it may carry a financial penalty for the wife: the example below suggests that, although the man implies he was the instigator of the divorces, the man's wives had taken matters into their own hands by seeking new partners who would be better providers:

> K_ told me that he got married two times but divorced these two marriages and the reasons are that he doesn't care for the wife properly and the wives do go out of his hands because his system of not sleeping at home when he receives his pay and instead he sleeps with bar girls at the rest houses until the money runs out. (Diston, extract from journal entry 23/12/2000)

The importance of infidelity as a reason for divorce is highlighted not just in the journals but by the responses to some general questions posed by the MDICP2. Respondents were asked whether they thought it was proper for a wife to leave her husband under the following five circumstances (in the order posed): if he did not support her and the children financially, if he beat her frequently, if he was sexually unfaithful, if she thought he might have AIDS, and if he did not allow her to use family planning. Table 2 presents the proportions of women approving various justifications for divorce, ranked in order of the level of approval.

Table 2 about here

Of the five hypothetical situations, the most commonly approved justification for divorce was a husband's sexual infidelity, with approval ranging between 78 per cent in the south to 66 per cent in the north. Wife beating followed fairly closely behind, but the remaining three

justifications gained less approval. Most significantly for the present paper, between two-fifths (south) and one-quarter (centre and north) of women approved of a wife's leaving her husband if she thought he might be infected with AIDS.

The five sets of proportions are clearly differentiated by region, with greatest approval of divorce for one of the stated reasons in the south, and least in the north. In contrast, the proportions are not clearly differentiated by current marital status, number of times married, or, with two exceptions, current age (not shown).[7] As a result, it is not possible to infer from these data that the expressed opinions either derive from the respondents' own experience or influenced that experience.

Smith and Watkins (2003) provide insights into change in the approval of various grounds for divorce by matching respondents in the original 1998 survey and the 2001 follow-up survey. The proportion of women reporting that it was proper for a wife to leave her husband if he was unfaithful rose between 1998 and 2001 from 68 per cent overall — they do not distinguish by region — to 76 per cent. Thirteen per cent of women changed their answer from "Yes" to "No" over the three-year period, but fully 21 per cent moved the other way, from believing divorce was unjustified in such circumstances to believing it was justified. A similar hardening in attitudes is apparent from responses to the companion question that explicitly mentioned AIDS. Although women who reported that a woman was justified in leaving her husband if she believed he was infected with AIDS remain in the minority — 18 per cent in 1998 and 29 per cent in 2001 — the proportional increase over the three-year period is marked. Of the women who changed their minds between the surveys, two out of three evinced a new acceptance of divorce in the case of a husband who was probably AIDS-infected. In contrast, the proportion of women reporting wife-beating as sufficient grounds for divorce did not increase between the surveys. On the basis of this contrast, Smith and Watkins (2003) argue that tolerance of divorce in general did not increase between the surveys, but tolerance of divorce to rid oneself of an unfaithful husband, and as a strategy to protect oneself from infection with HIV.

The journals, too, make it plain that divorce in the case of a straying husband is not merely a reaction to the evidence of his infidelity, but may be a strategy to avoid being infected oneself. In the following extract a friend of the writer has contracted gonorrhoea from her husband, who had slept with another woman:

> My friend told her husband that it was better to divorce because he will get the AIDS disease and she will be infected. She also said that this time she was lucky because she received treatment and she was sure that she will recover. But if it will be AIDS, she will not receive any treatment that will help her to recover, therefore it is good to divorce their marriage before it was too late. (Alice, extract from journal entry 18/11/2002)

Divorce as a means of protecting oneself from contracting AIDS from an unfaithful spouse is a strategy not just of women, but of men. For example:

> One day in November, 2001 I went to a bread baking factory to buy some bread there, and I

7 Women in their twenties appear less tolerant than older women of husbands who are bad providers, and of ones who forbid the use of family planning, but these issues fall outside the focus of the present paper.

> met some men on the factory gate who were also waiting to buy some bread, we were about five men and while there at Portuguese bakery at Chirimba in Blantyre, there came a certain woman who was looking unhealthy (sick) and one man whom I don't know his name said that woman could be suffering from AIDS, he further said that this disease is claiming many lives of people, he said that he divorced his wife two years ago because he was afraid that she could infect him with AIDS. He said that this decision came into his mind when he realized that his wife had started having sex with her extra-marital partner while they were under post-partum abstinence. He said that he instantly divorced her the same day he noted that, and that he is not thinking of getting remarried because he is afraid that he might face the same problem and get AIDS. And another man said that these days of AIDS, when your wife is sexually misbehaving you better just divorce her and live alone without any sexual partner the whole rest part of your life. The gate was then opened for us so that we entered into the factory before the other men said their ideas on that. (Diston, extract from journal entry 8/03/2002)

These men do not see just divorce as a protection from AIDS, but divorce followed by subsequent abstinence. Certainly, they say they are apprehensive of remarrying.

Our final journal extract concerns a case in which a man excites disapproval for divorcing and remarrying too often:

> A certain man who is rich in Dowa District failed to attend his daughter's funeral at his home, fearing that his relatives were going to accuse him about his system of divorcing women frequently. The relatives said they were ready to accuse him of this because nowadays there is AIDS and if he keeps on changing women he might get it. To avoid all this they said they want to talk with him to change his system so that he should be safe from getting AIDS, as the changing of women can be one way that he might catch AIDS. The man has maize mills and cars. He is married to a fifth wife currently. (Diston, extract from journal entry 18/02/01)

As his critics recognize, this man's behaviour may be risky. Divorce can be protective only if the individual who divorces a suspect spouse does not form sexual relationships with other suspect individuals, whether these be affairs or marriages.

Without another empirical investigation it is impossible to quantify the extent to which some divorces in rural Malawi now occur not just because of a spouse's infidelity but because of the fear that such infidelity poses a risk of infection with HIV. Certainly, the journals give the impression that neither the fear, nor such divorce, is rare, while the quantitative data derived from the MDICP2 indicate the increasing acceptability of this justification for divorce. One of the questions we investigate later in the paper is the extent to which the strategy of divorcing a spouse who may be infected may be successful.

Levels of divorce and remarriage

Table 3 presents the marital-status composition of women in the three surveyed regions, according to age, as reported in the MDICP2. In each regional sample, around nine out of ten

women are married, and divorced or separated women are about twice as common as widows.[8] As was to be expected, widows are more common among older than younger women, but an age pattern among separated and divorced women is less clear.

Table 3 about here

Since the static picture created by such statistics reflects only dimly the dynamics of divorce because divorced women disappear from the divorced population when they remarry, we next estimated life-table survival functions of remaining in a first marriage. The underlying life tables were calculated in the conventional way, censoring on widowhood or, if an individual was still married to her first husband at the time of the survey, at interview. First marriages with unknown start or stop dates, numbering 57 in the south, four in the central region and a mere one case in the north, were perforce excluded from the analysis.[9]

The calendar years delimiting each marriage, although sought, were certainly not easily obtained. In many cases they were calculated by interviewers from reported ages at the event in question, and since a degree of error is to be expected more attention should be paid to the broad features of the following analysis than the fine detail.

Divorce is indeed common in rural Malawi, and divorce patterns are clearly region-specific. First marriages are least stable in the south and most stable in the north, which mirrors the regional gradient in approval of divorce (Table 2). As many as 26 per cent of first marriages in the south end in divorce within five years, compared with 19 per cent in the central region and 14 per cent in the north. By the tenth anniversary these proportions rise to 40, 30 and 25 per cent respectively, and by the fifteenth to 49, 38 and 31 per cent.

Table 4 about here

Table 4 shows the proportions divorcing by the time of selected anniversaries not just overall for each region but by marriage cohort. Not only is this a fairer way to examine the time to divorce, given that only women who have been married for a considerable period can contribute to the survival functions at the long durations, but we were curious whether any recent rise in divorce — possibly as a response to HIV/AIDS — was detectable in the MDICP2 data. An apparent recent rise is detectable in the south where the proportion of women divorcing within five years rose from 24 per cent among women who first married between 1982 and 1991 to 36 per cent of women who first married between 1992 and 2001, and also in the north, with comparable figures of 14 per cent and 21 per cent, but in each case the numbers are small. No such trend is evident in the central region.

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8 There are no never-married women because this is a follow-up survey of a sample of ever-married women.

9 The excess of unreported dates in the south, the first region to be surveyed in 2001, may have resulted at least in part from interviewers' willingness to accept "Don't know" answers rather than probe and calculate from other time-related information such as the respondent's age and age at first marriage which they commonly did when interviewing in the centre and the north. Such cases, which amount to 11% of first marriages, comprise 3% of those of women in their 20s, 8% for women in their 30s, 17% for women in their 40s and 24% for women in their 50s.

Table 5 reveals that just as women in the south are the swiftest to divorce — or be divorced — so are they the swiftest to remarry; likewise women in the north, the slowest to divorce, are the slowest to remarry. No trends were evident when separate life tables were estimated according to the calendar period during which the first marriage ended. Indeed, remarriage rates appear to have been rather constant over recent decades..[10]

Table 5 about here

To sum up, just as the regions differ according to the timing of first marriage (Bracher, Santow and Watkins 2003), so do they differ according to their patterns of divorce and remarriage. Of the three regions, marriage comes earliest in the south, divorce is the most likely, and remarriage is the swiftest. In contrast, marriage comes latest in the north, divorce is the least likely, and remarriage is the slowest.

Extramarital sexual activity

In the detailed marriage-history section of the MDICP2 questionnaire women were asked whether they had had a boyfriend while they were married to their current or most recent husband, their previous husband, or their first husband, or had had sex with anyone else other than that husband. We first tabulate the responses using each marriage as the unit of observation and categorizing according to whether the marriage in question ended in divorce or the husband's death, or was still current, in order to see whether affairs were reported more often when the marriage in question had ended in divorce (Table 6). Overall, the question elicited few positive reports: affairs were reported in not quite four per cent of marriages in the south and not quite two per cent of marriages elsewhere. Women were indeed more likely to report that they had been unfaithful to an ex-husband than to their current husband, but the differences are slight and may result merely from less complete reporting of more recent than of distant affairs.

Table 6 about here

Taking respondents as the unit of observation, tabulating according to the number of times married, and designating respondents according to whether they reported ever having been unfaithful produced a clearer gradient, with reports of infidelity increasing with the number of marriages (Table 7). Nevertheless, even in the south, no more than eleven per cent of women who had been married three or more times reported ever having sex with someone else while they were married to their husband.

Table 7 about here

Women were considerably less reluctant to report that their husbands had been unfaithful to them (Table 8). Depending on the region, between one-fifth and one-quarter of women volunteered that they knew that their husbands had had sexual relations with other women, and around three in ten said that they either knew or suspected. Women were more likely to report

10 Preliminary analysis revealed no difference in the rate of remarriage according to whether the first marriage ended in divorce or widowhood, and we therefore do not distinguish according to the cause of marital dissolution.

that divorced husbands had been unfaithful than either dead or current husbands, and less likely to affirm that they had "probably not" been unfaithful.

Table 8 about here

The general picture, then, is that married men have more extramarital sexual partners than married women. This is the impression we gain also from the journals. In the following example, one writer overhears a discussion at a hospital about a young woman who is clearly very ill, people think with AIDS:

> Some people who were near the three women who were speaking about the patient were also talking about the same story. Some people were saying that faithfulness is very important only to those who are lucky that their husbands were born faithful. But it is very rare to have a husband who is faithful and someone said that there is no man who just depends[11] on his wife alone. All men have other sexual partners and those who claim to be faithful have only one other sexual partner but many of them have several sexual partners in addition to their wives. But always women are stupid people because they are usually faithful in their marriages because they fear their husbands will beat them when their husband hear that they have the extramarital status.[12.] She said that there are other women who have other sexual partners apart from their husbands but they are not many and they don't have several sexual partners as men do. Most women have [only] one other sexual partner at a time. Women who have several sexual partners are those who are not married because they fear nobody and they need much help from all their partners. (Alice, extract from journal entry 11/12/2002).

This raises the important additional question of women's sexual behaviour after one marriage has ended but before the next one has begun. In the MDICP2, women were asked how many sexual partners they had had after their most recent marriage, after their previous marriage and after their first marriage. If they had remarried since the marriage in question they were instructed to include their next husband if they had had sex with him before they married. We used this question to tabulate the proportions of women who reported any such extramarital sexual partner (Table 9). The baseline population is a mix of divorcees, widows, and women in a second or subsequent marriage.

Table 9 about here

The proportions of women who report ever having had an extramarital sexual partner ranges from a high of nearly one-quarter in the south down to a low of nearly ten per cent in the central region. At least in the north and the south it appears that women who have been married only once were more likely to have an extramarital partner after that marriage ended than women who had remarried, but the lower panel of the table reveals that the proportions are based on very few women. The reason for this is swift remarriage: the table must perforce be based on women

11 That is, in a sexual sense.
12 See footnote 6.

whose first marriage is no longer intact, but these women are likely to have moved on to a second or subsequent marriage.

An additional interpretational difficulty is introduced by the questionnaire's including a subsequent spouse among a woman's extramarital partners. We have no way of knowing whether interviewers and respondents heeded this direction, but if they did then from the point of view of gaining an understanding of women's sexual behaviour between marriages, the number of extramarital partners will be over-reported. After all, if a woman reported that she had one sexual partner after her first marriage ended but subsequently married this man, it is simplest to think of her as having not an extramarital partner but a second marriage that started somewhat earlier than she had originally reported.

In an attempt to circumvent this problem we restricted the baseline population to current divorcees and widows. Of those who reported a post-marital affair, most reported only one, but two (of 13) in the south reported two affairs as did one (of four) in the centre. In the north, two women (of nine) reported multiple affairs: one divorcee of 14 years reported three affairs; and one of six years reported five affairs.

Overall, around one in five divorcees and widows in the south and north report such an affair, and one in ten women in the central region (Table 10). Any clear trend according to the length of time for which women had been divorced or widowed is obscured by various selection factors. On the one hand, one might expect the proportions to fall with marriage duration (as they do in the south and the centre), since embarking on a post-marital affair may be a way of finding a new husband; as a result, those at the longer post-marital durations may be selected for not having such affairs. On the other hand, one might expect the proportions to rise with marriage duration (as they do in the north) since the longer the duration, the longer the period of "exposure to risk", in a demographic sense, of an affair. An overriding problem is that of small numbers. Given swift remarriage when divorce is common (as in the south) or comparatively low divorce rates (as in the north), there are simply very few unmarried women.

Table 10 about here

The conversations recorded by the journal writers reveal no hesitation among conversational partners in discussing their own or other people's sexual adventures: either people were chatting and the writer overheard them, or they were chatting with a friendly individual — our journal keeper — who did not take notes in front of them. Under-reporting of extramarital sexual activity in the MDICP2, however, is a very real possibility: respondents were faced with a stranger with an interview schedule and, given the physical situations in which interviews were conducted, privacy could not always be guaranteed. Nevertheless, the pictures painted by the quantitative and the qualitative data are in broad agreement. Married women have fewer affairs than married men, and fewer affairs than divorced or widowed women. Some regional differences emerge, although less clearly than in the case of divorce and remarriage. Women's reports of their own infidelities are most common in the south and least common in the north. Women's reports of their husbands' infidelities, on the other hand, are not clearly distinguished

according to region. Affairs between marriages are reported most commonly by women in the south, but least commonly by women in the central region.

The model

We try to capture in the microsimulation model both these behavioural processes and the rates at which various behaviours, events, and changes of status occur.

The basic model is a conventional woman-based microsimulation model of human reproduction and mortality. It differs from earlier models (for example, Santow 1978) in terms of the heterogeneity of various input parameters and distributions, of the greater complexity and realism of the physiological processes that are taken into account, of its taking into account selected attributes (such as age) of sexual partners and husbands, and in terms of the ease with which the user can incorporate variations in such factors as nuptiality, breastfeeding practices, and infant and child mortality. The basic model of human reproduction is "female-dominant" in the sense that men are taken into account only implicitly: sterility, for example, is actually an attribute of couples rather than women although treating it as an attribute only of women is both conventional and does not invalidate the model.

This model was subsequently extended by including the sexual transmission of disease, including HIV, so that coitus carries not just a risk of pregnancy to (fecund) women but a risk to all women (whether fecund or not) of disease transmission and acquisition, and also a risk to all men. A novel and useful feature of the model is that simulated disease outcomes are therefore consistent with simulated fertility outcomes.

The simulation takes individuals through their lives, decisions being constantly made, conditional on their past experience and current status, about what will happen next. Women engage in premarital affairs, marry, divorce and remarry according to probability distributions derived from the MDICP data. Both they and their husbands may seroconvert or die, either from AIDS or, since the model incorporates background mortality[13], from some other cause. Some women have affairs while they are married, and some have affairs after one marriage has ended and before the next one begins. At the same time, women conceive, bear, breastfeed, wean, and lose children, although related tabulations are not shown here because this aspect of their lives is not the focus of the current investigation. The present application of the model is merely one of many. More detail about the workings of the model is presented elsewhere (Bracher, Santow and Watkins 2003), only the essential features of the present application being presented here.

Table 11 summarizes the input parameters and distributions that govern the simulation of women's nuptial and sexual behaviour. The timing of their first marriage is simulated according to a region-specific Coale-McNeil marriage model fitted to the MDICP2 data, while that of their husband is derived from the reported age difference between spouses (Bracher, Santow and Watkins 2003). After they divorce or are widowed, women remarry according to the remarriage functions of Table 5. In the absence of strong evidence to the contrary and for the sake of

13 West level 11, implying e_0 of 45 years for women and 42.1 for men, levels that approximate to pre-AIDS expectation of life in Malawi.

simplicity we assume that second and subsequent marriages dissolve at the same rate as first marriages, and that remarriage rates are also undifferentiated by marriage order.

Table 11 about here

Table 12 summarizes the parameters directing women's sexual activity outside marriage and their affairs while married. Ninety per cent of women have the propensity to have sex before marriage or after a marriage has ended; ten per cent do not, and will not engage in such affairs. A woman with such a propensity, which is a lifetime characteristic that is assigned just once, has a small annual probability of conducting an affair if she is not currently married, rising to a maximum at age 17 and remaining fixed thereafter. Note that it is not inevitable that a woman with such a propensity will actually embark on such an affair: we might expect, for example, that 63 (0.90 x [1.00-0.30]) per cent of unmarried 17-year-olds will not.

Table 12 about here

The assigned propensity to engage in extramarital relationships is considerably lower than that of having an affair while unmarried, but extramarital affairs are simulated in a similar manner to non-marital affairs except that the schedule of annual probabilities of entering such a relationship is duration-specific rather than age-specific. In each case, coital frequency is set at half the marital level.

Men's median age at premarital sexual debut is set at 17 years. We simulate their sexual activity while unmarried differently from the way we simulate the sexual activity of unmarried women because it is portrayed in the journals more as a series of opportunistic encounters than of affairs as such, and also because there is no clear analogue to the bar girl. We posit separate propensities to have sex with casual partners, or "peers", and with bar girls, and give men with such a propensity a monthly probability, rising from age 15 to age 20, of at least one sexual encounter during that month, and a randomly assigned coital frequency within certain pre-defined limits (Table 13).

Table 13 about here

The affairs of married men are simulated in a similar manner to those of married women, although naturally the values of parameters are rather different. Once married, men are less likely to have affairs and less likely to visit bar girls, and their monthly probability of visiting bar girls declines as they age.

For simplicity's sake, and because condom use is low in rural Malawi, the models assume no use of condoms and no use of contraception more generally.

To introduce infection into the simulated population we posit the existence of a group of women external to the simulated population among whom certain proportions are infectious with various diseases, not just HIV: three discharge (non-ulcerative) STDs (gonorrhoea, chlamydia and bacterial vaginosis), and three ulcerative STDs (syphilis, chancroid and herpes) (Table 14). These women — in the real world, casual partners and bar girls — form the "reservoir of

infection" from which disease is introduced into the population at large: they infect men, and these men in turn infect other women. These non-HIV STDs differ according to their effects on HIV transmission and acqusition, and exhibit a degree of heterogeneity in terms of their transmission probabilities, their duration of infectiousness, the likelihood (as with herpes) of spontaneous recurrence, and their conferring of immunity to subsequent infection (significant with syphilis but not, for example, with gonorrhoea). A highlight of the table is the tiny transmission probability of HIV both in absolute terms and in comparison with that of the other diseases included in the model; it therefore remains rather small even in the presence of those other diseases. The table is discussed at length elsewhere (Bracher, Santow and Watkins 2003). Suffice it to say here that, although many of the parameters are not well known, the proportion of bar girls set to be HIV positive is drawn directly from Malawian studies.

Table 14 about here

The properties of the non-HIV diseases we include in our simulations imply that, even when couples are faithful after marriage, it is possible for a disease to travel from one to the other and then back again: a husband can infect his wife with gonorrhoea, for example, and if she remains infectious for long enough she can re-infect him once his initial infection has passed. It is also possible, except for genital herpes and HIV, for an infection to die out from a marriage if spouses are faithful to one another

Findings

Strategic divorces

We are at last in a position to simulate the effects of divorce and remarriage on the lifetime risk of HIV infection in rural Malawi. We focus in this paper on the southern region where marriage is earliest, divorce is most common, and remarriage is swiftest. This is also the area where because of the activities of the journal keepers we have the best insights into sexual activity outside marriage although, even so, the relevant behavioural input parameters for the model are admittedly speculative.

We first construct two baseline models incorporating the first-marriage patterns of the southern region. We hold constant the parameters governing the sexual activity of unmarried people and the affairs and sexual encounters of married people (see Tables 12 and 13) so that the observed differences stem entirely from divorce and remarriage, mediated, of course, by the extent of sexual activity with non-marital partners. The models differ in that the first does not allow for any divorce or remarriage — marriages are permitted to end only through the death of a spouse, and the survivor does not remarry — whereas the second incorporates the southern region's patterns of divorce and remarriage.

The models produce a lifetime probability of HIV of 25 per cent in the absence of divorce and remarriage, and of 34 per cent when divorce and remarriage occur according to the regional patterns of Tables 4 and 5. However, that divorce and remarriage according to the patterns observed in the south have the nett effect of adding nine percentage points to the probability of lifetime HIV infection does not greatly advance our understanding of the mechanisms by which

the effect is produced. Most critically, divorce is generated in the second model merely by reference to the regional divorce schedule: we pick a random probability, and where it falls on the probability distribution of the time to divorce dictates whether, and when, a divorce occurs. Thus, divorce is simulated to occur independently of spouses' sexual activity with other people, a grossly unrealistic assumption given that, as we documented earlier, people may take steps to separate themselves from a risky spouse. What we need to do instead is simulate divorce as a function of such extramarital sexual behaviour.

We define two such strategies. The first is to divorce a spouse once he or she has developed AIDS. Most Malawians do not know their HIV status because testing for HIV is uncommon, especially in rural areas, but people do recognize the symptoms of AIDS and it is likely that at this point some married AIDS sufferers are abandoned by their spouses.[14] The model activates divorce according to a user-defined probability at the point at which either a husband or a wife is simulated to progress to full-blown AIDS.

The second strategy is to divorce a spouse on the basis not of disease status but of behaviour. To operationalize this, we input a threshold number of months for which people in the simulation will tolerate spousal infidelity, and set up a counter for each spouse with a minimum value of zero. If a person has extramarital sex in a particular month, the counter is incremented by a value of one, but if a month goes by without extramarital sex, the counter is reduced by one (although it is not permitted to fall below zero which would imply that people could bank their virtuous months and draw on the accrued credits at a later date). When the counter reaches a threshold number of months and if the individual has had extramarital sex in the current month, there is a possibility (operationalized by a user-defined probability) that a divorce will occur. If it does, it occurs promptly, just like the actual strategic divorces described in the journals. The rule targets repeat offenders but, given that the counter goes backwards in months when a spouse does not misbehave, it also gives people a chance to redeem themselves in the eyes of their spouse by remaining faithful after an affair has been discovered. The present simulations incorporate a threshold for wives' tolerance of their husband's infidelity of six months, and a lower threshold of husbands' tolerance of their wife's infidelity of four months.

To demonstrate the contrasts most clearly, in simulations in which the HIV-avoidance strategies were activated the probabilities of divorcing an AIDS sufferer or an unfaithful spouse, which are defined by the user, were set to one.

Simulations of each of these strategies were varied further according to whether there was no underlying divorce, meaning that all divorces were the result of strategies to avoid HIV, or whether there was a low level of background divorce. This latter is the more realistic option since, as described earlier, divorces are caused by many factors other than fear of infection. We do not use the observed regional pattern of divorce because it is likely that many of the divorces in the real population were produced by real-life strategies to avoid infection, and application of our simulated HIV-avoidance strategies to that baseline would lead to excessively high divorce rates. On the basis of no empirical evidence whatsoever but a hunch that the risk of divorce for

14 Indeed, a term for AIDS in northern Malawi translates as "go to your mother" [Susan Cotts Watkins, personal communication, January 2003].

reasons other than the fear of infection would decline rather rapidly with duration we posited an annual probability of divorce of 0.03 in the first year of marriage, 0.02 in the second, and 0.01 in each subsequent year; this implies that five per cent will divorce within two years of marriage, seven per cent within ten years, and nine per cent within 20 years.

Finally, the simulations were distinguished according to whether remarriage is permitted. Simulations which do not allow for remarriage provide a useful basis of comparison for ones in which it does occur. In addition, apprehension, if not fear, of the surviving spouses of AIDS victims is widespread, so the no-remarriage assumption given an AIDS death or AIDS-related divorce is not entirely unrealistic although the strategy may better be viewed as pertaining to a potential new spouse rather than to the divorcing individual.

Simulated lifetime probabilities of HIV infection are shown in Table 15. Columns a and b pertain to simulations with no underlying divorce, column a not permitting remarriage and column b permitting remarriage at the observed level for the southern region. Columns c (without remarriage) and d (with remarriage) incorporate divorce at our hypothetical low background level. The numbered rows distinguish the strategies adopted, with the first row showing the results of baseline simulations which did not incorporate any HIV-avoidance strategies. In the absence of divorce, people remarrying in model 1b are the widows and widowers of people who died either of AIDS or of some other cause. With low background divorce, people remarrying in model 1d are ones who divorced according to the input level — we call these non-strategic divorce — as well as people whose spouses have died. Row 2 shows what happens when additional divorce occurs if a spouse develops AIDS, row 3 shows what happens when additional divorce occurs if a spouse has been designated unfaithful according to the rule described earlier, and row 4 shows the effect of people's using either rule to precipitate divorce. The additional divorces occuring in these three rows of the table we call strategic divorces.

Table 15 about here

Table 15 reveals that the strategy of divorcing a spouse who develops the signs of AIDS is ineffective in reducing the lifetime probability of HIV infection (compare comparable pairs of runs in rows 1 and 2, and rows 3 and 4). In a bid for realism the model assumes that sexual activity ceases once when an individual progresses to AIDS, but we had anticipated that this divorce strategy might actually increase lifetime HIV infection because the divorcing spouse would re-enter the marriage market a little sooner if marriage ended through AIDS-related divorce rather than an AIDS death. In addition, the divorcing partner might already be infected.

In contrast, the strategy of divorcing a spouse who has been caught having sex with other people is effective (compare comparable pairs of runs in rows 1 and 3, and rows 2 and 4). In the absence of remarriage, lifetime HIV infection falls by between six and eight percentage points, depending on the level of background divorce (compare, for example, runs 1a and 3a, and runs 2c and 4c). The gains are smaller — between two and three percentage points — when remarriage is allowed to occur (compare runs 1b and 3b, and runs 2d and 4d).

Thus, remarriage is risky. The extent of the risk can be gauged by comparing runs that differ only according to whether remarriage may occur. With no non-strategic divorce (runs a and b), remarriage adds four percentage points to lifetime risk if there is either no divorce at all, or divorce only when a spouse develops AIDS (which has no effect on lifetime infection) (compare 1a with 1b, 2a with 2b), but it adds eight or nine percentage points to lifetime risk if divorce occurs in response to a partner's unfaithfulness (compare 3a with 3b, 4a with 4b). This implies that when there is strategic divorce, about half the increase in lifetime risk caused by remarriage is attributable to remarriage *per se*, irrespective of whether the previous marriage ended through death from any cause, including AIDS, or through divorce because a spouse had AIDS. The other half of the increase in lifetime risk is attributable to the re-entry into the marriage market of people who have experienced a strategic divorce on the grounds of spousal infidelity.

A similar conclusion can be drawn from a comparison of runs in the presence of non-strategic divorce, that is, with background divorce (runs c and d). Remarriage *per se* adds five percentage points to lifetime risk (compare 1c with 1d, 2c with 2d), but remarriage after additional divorce because of spousal infidelity adds ten or eleven percentage points (compare 3c with 3d, 4c with 4d). Thus divorce because of spousal infidelity is a reasonable strategy, but not remarrying thereafter is an even better one.

The risk remarriage poses to women is particularly noteworthy because each simulation incorporates a certain amount of sexual activity outside marriage. Even though, according to the specifications of Table 12, 90 per cent of divorcees and widows have the propensity to have an affair with an annual probability of 0.30 (beyond age 17), it appears that women are overall at lesser risk of infection if none remarries than if some do. Although affairs expose women to a greater variety of sexual partners than does marriage, only slightly more than one-quarter of women (0.90 x 0.30) embark on an affair in any year, the rate of partner change is not excessive since affairs last on average for one year, and coital frequency within such affairs is only half that within marriage. In contrast, the coital frequency of the remarried female population is many times higher, and with that increase comes an elevated risk of HIV infection from new husbands.

No lifetime probability of HIV infection shown in Table 15 is as high as the 34 per cent (reported earlier in the text) that we obtained from an initial simulation with the regional pattern of divorce and remarriage, in which divorce occurred independently of spousal disease or activity, that is, all divorces were non-strategic. This might seem to suggest that divorcing according to any of the HIV-avoidance strategies we have defined is preferable to not so divorcing, even if remarriage is permitted thereafter. However, a factor contributing to the lower figures in the table than produced by the regional simulation is that the table's simulations were produced with either no or low underlying divorce. This means not only that correspondingly fewer people in the table's simulations divorced, but that, as a result, fewer remarried. Table 15 should therefore be examined in conjunction with Table 16, which shows the simulated divorce schedules corresponding to each of the models of Table 15, as well as the divorce schedule actually observed in the southern region of Malawi.

Table 16 about here

Naturally enough, the proportions divorced at each exact duration of marriage rise with the stringency of the divorce strategy but they also rise, slightly, if remarriage is permitted after a spouse has developed AIDS (models 2 and 4), although they do not rise if remarriage is permitted after divorce because of infidelity. Presumably remarriage after an AIDS-related divorce increases HIV infection among married women and hence increases divorce itself.

The shift in the divorce schedules from the top to the bottom of Table 16 is remarkable. Even without background divorce (columns a and b), when strategic divorces are precipitated by disease or infidelity, the proportions divorcing within ten years of marriage reach 30 per cent with no remarriage (4a), and 34 per cent with remarriage (4b). As expected, the highest proportions in the table are achieved by incorporating a low level of background divorce. It was not expected, however, that one of the simulated divorce schedules would strikingly resemble the actual regional schedule. This schedule was simulated with low background divorce, with additional divorce precipitated by either AIDS or infidelity, and with a possibility of remarriage after such strategic divorces (4d, shown in bold in Table 16).

The serendipitous correspondence between the actual divorce schedule and this simulated one does not mean that this particular simulation captures the "truth" either about sexual activity with non-spouses in southern rural Malawi or about spouses' recourse to strategic divorce in a bid to forestall infection with HIV. On the contrary, other combinations of input could lead to the same result. Rather, the correspondence suggests a degree of consistency between reality and the particular simulation: <u>if</u> women marry and remarry according to the observed pattern, and <u>if</u> women's and men's sexual behaviour corresponds to the model input, both inside and outside marriage, and <u>if</u> couples divorce according to the strategies we have devised, <u>then</u> women's divorce patterns will look very like the ones actually observed in this population, and their lifetime probability of HIV infection will be 27 per cent.

Moreover, identifying this particular run gives us an appropriate point of comparison with the initial regional model. Divorce and remarriage occur at the same rate in each population. In one, divorce occurs without reference to spouse's behaviour, and women's lifetime risk of HIV infection is 34 per cent. In the other, some divorces are triggered by a spouse's developing AIDS or being unfaithful, and the lifetime risk is 27 per cent. The strategy represents a 20 per cent reduction in risk.

Finally, recalling our introductory remarks concerning other studies' observations of the variation in HIV prevalence according to marital status we show for this simulation (4d) the proportion of women of each marital status and at each single year of age who are HIV positive (Figure 1). In line with those studies, married women are more likely to be infected than the never-married, especially at young ages, although comparison is difficult at the older ages because so few older women remain unmarried. Likewise, widows and divorcees, in turn, are more likely to be infected, age for age, than married women. That divorcees are more likely to be HIV positive than widows stems from the simulation's high, but unfortunately realistic, level of background (pre-AIDS) mortality: widows are not necessarily AIDS widows. A simulation (not shown) identical in every way except that background mortality was set with female life

expectancy of 60 years rather than 45 years[15], as in the present simulations, produced a higher prevalence of HIV among widows than divorcees at single years of age until the early thirties.

Figure 1 about here

Faithful couples

Despite the emphasis in this paper on sexual infidelity, the notion that rural Malawian spouses might be faithful to one another is far from fanciful. The journals are replete with references to people who do not manage to "depend" only on their spouse, meaning that they have other sexual partners as well, but there are also many references to the opposite, to people who do manage to "depend" on their spouse, meaning that at least in terms of the "depending" partner, the relationship is a sexually exclusive one. One frequently mentioned motivation for such fidelity is fear of AIDS.[16]

In order to examine the implications for women's lifetime infection with HIV we next constructed some models in which all couples maintained a sexually exclusive relationship. In terms of model input parameters this means that the propensity for married women to have affairs, previously 0.25 (Table 12), and the propensities for married men to have affairs and visit bar girls, both previously 0.50 (Table 13) are now set to zero. The parameters guiding individuals' sexual behaviour outside marriage (that is, before first marriage and between marriages) we leave untouched.

We show the lifetime risks of HIV infections derived from the resulting simulations in Table 17, and the corresponding simulated divorce schedules in Table 18. In these variants, background divorce is set first to the low level (columns c and d) and then to the actual regional level (e and f). Baseline simulations, with and without remarriage, are summarized in the first row (model 5). Simulations incorporating one of the HIV-avoidance strategies already simulated, that people divorce a spouse who develops AIDS, are shown in the second row (model 6). The other strategy, of divorcing an unfaithful spouse, is inapplicable in these simulations because all couples are faithful.

Tables 17 and 18 about here

The lifetime probability of HIV infection is non-zero (seven per cent) when all couples are faithful and remarriage does not occur (c and e). Some of this infection is acquired before the first marriage, and some after that marriage has ended: our couples may be faithful once they are married but they have the same patterns of sexual activity when they are not married as the people in our earlier simulations..

Some familiar patterns emerge, although — and this is the most striking feature of the table — at a lower level than before. As before, divorcing a spouse with AIDS has no effect on women's

15 West level 17 rather than level 11.

16 We have already implicitly recognized the existence of faithful spouses by setting below one the propensities for married women and married men to have affairs, although since these propensities are not correlated such sexual fidelity refers not to couples but to married individuals.

lifetime risk of HIV acquisition (compare 5 with 6 in Tables 17 and 18). Likewise, remarriage is risky, the level of risk rising with the level of divorce and hence the numbers remarrying (compare c with d, e with f).

Unlike before, no simulation produces a divorce schedule resembling the actual one. Undoubtedly, an intermediate level of background divorce could be devised to do the job, but the essential point of the simulations is that, with remarriage, a population looking otherwise rather like that of rural southern Malawi, in which all couples are mutually faithful can expect to demonstrate a lifetime risk of HIV infection of somewhere between ten and seventeen per cent. The latter figure is probably too high because it is achieved with too much divorce. Moreover, it is questionable whether our simulated Darby-and-Joan couples could be expected to divorce at a rate as high as is observed in the actual population given the absence of spousal infidelity as a catalyst.

In conclusion, since the proportions of women ultimately infected with HIV are merely the endpoints of a process of HIV acquisition over the life course we next show graphically, for a selection of simulations, the evolution with age of the cumulative proportions of the original cohort of women who are HIV positive (Figure 2). The simulation that best fits the rural southern Malawian population (4d) is the second from the top. The effect of no remarriage, everything else being the same (4c), is evident. The effect of spousal fidelity, even with remarriage (6d) is pronounced.

Figure 2 about here

In each model the rate of HIV acquisition decelerates beyond a certain age, but this age comes earlier the more stringent the HIV-avoidance strategies that are imposed. Indeed, in terms of HIV infection, the faithful couples (6d and 6c) already look different from the others by the time they turn twenty.

Conclusions

In this paper we set out to examine by means of microsimulation the effect of patterns of divorce — specifically high levels of divorce — and remarriage, and of spousal fidelity, on the lifetime risk of women's acquiring HIV in rural southern Malawi. Although our investigation is undeniably incomplete, some interesting findings have already emerged,

When extramarital sexual activity is both common (although by no means universal) and sometimes precipitates divorce, the resulting divorce rates may be substantial, just as they are in the actual population. Nevertheless, even if strategic divorce separates partners one of whom believes that the other's illicit sexual behaviour may bring HIV infection to the marriage, the reduction in women's lifetime risk of HIV acquisition may be rather modest. The problem is that women may be already infected when they divorce and, once divorced, may have affairs with men of various disease statuses, and once remarried they will be exposed to any infections possessed by their new, possibly philandering, husband, and in some additional cases to the infections of their own extramural sexual partners. Given the levels of extramarital sexual activity and marital infidelity assumed in the models, and the same level of divorce we achieved

a 20 per cent reduction in the lifetime risk of HIV (from 34 per cent to 27 per cent) when spouses divorced on the basis of AIDS or infidelity. In the absence of remarriage after divorce or widowhood we achieved a reduction of about one-half (34 per cent to 16 per cent). This is an encouraging result but the scenario, in a society that places so much importance on the institution of marriage, is unrealistic.

The picture changes when we impose marital fidelity on our simulated couples. In this case, a prevalence of 17 per cent is the highest the simulations can achieve. It occurs with regional background divorce, with no additional divorce if a spouse develops AIDS, and with remarriage. Once again, however, the scenario is unrealistic because the strategy creates as much divorce as in the real population where divorces are undoubtedly sometimes brought on by marital infidelity, which does not exist in our models. This time, however, an unrealistic scenario creates lifetime risk that is too high rather than too low. Lifetime risk, given uniformly faithful couples, is likely to be lower than this 17 per cent, although no lower than about eleven per cent.

We can comment only on the HIV-avoidance strategies we have tested. Of these, divorcing an unfaithful spouse is a reasonable strategy. Not remarrying thereafter, or after any other marriage has ended, for whatever reason, is better still. But marital fidelity is the best.

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Table 1
Percentage distribution of number of marriages, women, by current age and region

	Number of times married							
	1	2	3	4	5	6	7	N
South (Balaka)								
20-24	59.3	35.6	5.1	0.0	0.0	0.0	0.0	59
25-29	66.3	26.3	7.4	0.0	0.0	0.0	0.0	95
30-39	40.9	39.9	16.1	2.6	0.5	0.0	0.0	193
40-49	34.6	32.3	28.3	3.1	0.8	0.0	0.8	127
50-59	41.4	34.5	20.7	3.4	0.0	0.0	0.0	58
Total	46.1	34.6	16.7	2.1	0.4	0.0	0.2	532
Centre (Mchinji)								
20-24	81.7	18.3	0.0	0.0	0.0	0.0	0.0	115
25-29	67.0	31.2	1.8	0.0	0.0	0.0	0.0	109
30-39	56.0	34.9	6.0	2.4	0.6	0.0	0.0	166
40-49	45.5	38.6	10.9	4.0	0.0	1.0	0.0	101
50-59	42.9	42.9	7.1	7.1	0.0	0.0	0.0	28
Total	61.3	31.6	4.8	1.9	0.2	0.2	0.0	519
North (Rumphi)								
20-24	81.8	16.9	1.3	0.0	0.0	0.0	0.0	77
25-29	80.0	18.2	1.8	0.0	0.0	0.0	0.0	110
30-39	69.8	27.8	2.5	0.0	0.0	0.0	0.0	162
40-49	60.9	33.0	6.1	0.0	0.0	0.0	0.0	115
50-59	65.4	34.6	0.0	0.0	0.0	0.0	0.0	26
Total	71.6	25.5	2.9	0.0	0.0	0.0	0.0	490

Table 2
Percentages of women who approve of various justifications for divorce, by region

	South	Centre	North
Husband:			
Is sexually unfaithful	78.4	77.3	65.5
Beats wife frequently	72.9	71.1	68.4
Does not support financially	36.3	37.8	29.8
Might have AIDS	38.9	25.0	23.7
Forbids family planning	31.6	25.8	12.0

Table 3
Percentage distribution of women by marital status by current age, by region

	Married	Separated	Divorced	Widowed		N
South						
20-24	89.8	1.7	6.8	1.7	100.0	59
25-29	89.5	0.0	9.5	1.1	100.0	95
30-39	95.9	0.5	2.1	1.6	100.0	193
40-49	81.1	0.0	11.8	7.1	100.0	127
50-59	75.9	1.7	5.2	17.2	100.0	58
Total	88.3	0.6	6.6	4.5	100.0	532
Centre						
20-24	95.7	0.9	3.5	0.0	100.0	115
25-29	93.6	1.8	1.8	2.8	100.0	109
30-39	94.6	0.6	3.0	1.8	100.0	166
40-49	86.1	4.0	5.9	4.0	100.0	101
50-59	89.3	0.0	3.6	7.1	100.0	28
Total	92.7	1.5	3.5	2.3	100.0	519
North						
20-24	96.1	0.0	2.6	1.3	100.0	77
25-29	91.8	0.0	8.2	0.0	100.0	110
30-39	90.1	1.2	3.1	5.6	100.0	162
40-49	88.7	1.7	6.1	3.5	100.0	115
50-59	80.8	0.0	7.7	11.5	100.0	26
Total	90.6	0.8	5.1	3.5	100.0	490

Table 4
Life-table percentages of women's first marriages that have ended in divorce by selected anniversaries, by year of first marriage and region

			Anniversary						
Region	Marriage Cohort	N	1	2	5	8	10	15	20
South	1992-01	104	7.7	14.5	36.0	47.4			
	1982-91	167	3.0	9.1	23.8	30.1	37.1	50.3	
	1972-81	137	2.2	10.9	25.9	32.9	35.3	42.6	49.5
	-1971	67	3.0	4.5	19.4	33.2	41.1	47.5	49.3
	Total	475	3.8	10.1	26.4	35.0	40.3	48.9	54.1
Centre	1992-01	177	1.1	6.9	20.6	26.5			
	1982-91	173	1.2	5.2	21.6	27.7	33.9	41.1	
	1972-81	118	0.8	5.9	17.9	24.1	28.7	36.1	42.9
	-1971	47	0.0	2.1	8.8	13.4	17.9	29.3	36.4
	Total	515	1.0	5.7	19.3	25.3	30.3	38.1	44.2
North	1992-01	157	3.2	10.6	20.6	24.1			
	1982-91	166	1.8	4.2	14.0	22.9	26.7	29.4	
	1972-81	120	0.8	2.5	10.1	15.3	19.7	30.2	34.8
	-1971	46	2.2	4.4	4.4	11.1	15.7	22.8	27.6
	Total	489	2.1	5.8	14.1	20.7	24.5	31.1	35.8

Table 5
Life-table percentages of women who have remarried by years since the end of their first marriage, by region

		Years since end of first marriage						
Region	N	1	2	5	8	10	15	20
South	268	22.2	53.2	89.6	96.5	96.5	98.8	99.4
Centre	217	14.9	40.3	80.6	93.1	95.4	98.0	99.3
North	172	9.4	30.6	69.2	86.5	90.7	93.9	93.9

Table 6
Percentages of marriages in which women reported being unfaithful, according to the status of their husbands

	Divorced	Dead	Current	All
Percentages of marriages				
South	3.7	6.6	3.0	3.6
Centre	2.6	4.2	1.2	1.8
North	3.8	0.0	0.9	1.6
Number of marriages				
South	376	76	470	922
Centre	228	48	481	757
North	158	41	444	643

Table 7
Percentages of women who reported ever being unfaithful, by number of marriages

	1	2	3+	All
South	2.9	5.4	10.7	5.3
Centre	1.6	3.7	5.4	2.5
North	1.1	3.2	7.1	1.8
Number of women				
South	245	184	103	532
Centre	318	164	37	519
North	351	125	14	490

Table 8
Women's reported beliefs about whether their husbands had been sexually active with other women during their time together, by husband's status, by region

	Divorced	Dead	Current	All
South				
Yes, know	23.1	9.2	16.0	18.3
Suspect	11.4	17.1	10.6	11.5
Can't know	16.8	13.2	19.8	18.0
Probably not	43.4	57.9	49.1	47.5
Don't know	5.3	2.6	4.5	4.7
Centre				
Yes, know	36.0	20.8	22.0	26.2
Suspect	7.9	6.2	7.3	7.4
Can't know	13.2	10.4	17.5	15.7
Probably not	32.9	52.1	41.4	39.5
Don't know	10.1	10.4	11.9	11.2
North				
Yes, know	42.4	17.1	16.4	22.9
Suspect	12.7	0.0	5.4	6.8
Can't know	11.4	22.0	21.6	19.1
Probably not	31.0	61.0	53.6	48.5
Don't know	2.5	0.0	2.9	2.6

Table 9
Percentages of women whose first marriage has ended who report having sex between marriages, by number of marriages and region

	Number of times married			
	1	2	3+	All
Percentages				
South	36.4	19.6	26.2	23.0
Centre	5.6	7.9	13.5	8.7
North	24.2	18.4	7.1	18.6
Number of women whose first marriage has ended				
South	22	184	103	309
Centre	18	164	37	219
North	33	125	14	172

Table 10
Percentages of divorcees and widows who report an affair since their last marriage ended, by duration and region

	Years since end of last marriage			
	0-4	5-9	10+	All
Percentages				
South	25.9	22.2	11.8	21.0
Centre	17.6	0.0	6.7	10.5
North	7.7	55.6	12.5	19.6
Number of divorcees and widows				
South	27	18	17	62
Centre	17	6	15	38
North	13	9	24	46

Table 11
Microsimulation input parameters for nuptiality, women only, by region

	South	Centre	North
First marriage			
Median age	17.1	18.0	18.9
Minimum age	13.0	14.5	14.2
Compression factor	0.5	0.4	0.5
Spousal age difference at:			
Minimum age	3.2	5.0	5.5
Minimum age + 15	2.5	3.2	3.5
Percentage of marriages ending in divorce within			
2 years	10.1	5.7	5.8
5 years	26.4	19.3	14.1
10 years	40.3	30.3	24.5
Percentage of divorcees and widows remarrying within			
1 year	22.2	14.9	9.4
2 years	53.2	40.3	30.6
5 years	89.6	80.6	69.2

Table 12
Microsimulation input parameters for women's sexual activity with men other than their husbands

Sex outside marriage	
Propensity	0.90
Annual probability at age 13	0.10
15	0.20
17	0.30
Average duration of affair (months)	12
Median age difference (years)	3.0
Coital frequency relative to marriage	0.5
Affairs while married	
Propensity	0.25
Probability at duration 1	0.05
5	0.20
Average duration of affair (months)	6
Median age difference (years)	3.0
Coital frequency relative to marriage	0.5

Table 13
Microsimulation input parameters for men's sexual activity with peers and bar girls

			Peers	Bar girls
Sex outside marriage				
Propensity			0.80	0.80
Monthly probability at age 15			0.10	0.05
at age 20	0.50	0.40		
Coital frequency per month			1-8	1-4
Affairs with peers while married				
Propensity			0.50	
Annual probability at duration 1			0.20	
5			0.30	
Average duration of affair (mths)			6	
Coital frequency per month			2-10	
Sexual encounters with bar girls while married				
Propensity				0.50
Monthly probability before age 25				0.40
beyond age 60				0.10
Coital frequency per month				3-8

Table 14
Model input parameters related to STDs and HIV

	Gonorrhoea	Chlamydia	BVaginosis	Syphilis	Chancroid	Herpes	HIV
Proportion infectious among							
men's casual partners	0.20	0.20	0.20	0.05	0.20	0.20	0.20
bar girls	0.40	0.40	0.50	0.10	0.40	0.60	0.75
Infection/unprotected coitus							
Male-to-female	0.5000	0.1000	0.1000	0.1500	0.1000	0.0100	0.0030
Female-to-male	0.2000	0.0500	0.0500	0.1500	0.0500	0.0050	0.0015
Increased susceptibility (relative risk) to HIV if infectious with	2.0	2.25	1.5	2.5	2.0	2.75	
Increased infectiousness of HIV if infectious with	2.0						
Increased susceptibility if HIV+ to				2.0	2.0	2.0	
Increased infectiousness if either recently infected or symptomatic							3.0
Proportion recently infected among							
men's casual partners							0.40
bar girls							0.40
Mean infectious period (months)	6.0	6.0	6.0	12.0	3.0	1.0	
Weibull shape parameter	4.0	4.0	4.0	4.0	4.0	4.0	
Mean duration of episode (months)	12.0	12.0	8.0	60.0	4.0	∞	
Weibull shape parameter	4.0	4.0	4.0	4.0	4.0	NA	
Mean survival with HIV (yrs)							7.5
Weibull shape parameter							5.0
Mean survival with AIDS (yrs)							1.0
Weibull shape parameter							1.0

For sources see Bracher, Santow and Watkins (2003)

Table 15
Couples divorce to avoid AIDS: simulated lifetime probabilities of HIV infection per 100 women in southern rural Malawi, according to strategy adopted, level of background divorce, and whether there is remarriage, N=10,000

		No divorce		Low divorce	
		Remarriage		Remarriage	
		No (a)	Yes (b)	No (c)	Yes (d)
Baseline	(1)	25.3	29.1	24.1	29.9
In addition divorce occurs if:					
Spouse develops AIDS	(2)	25.0	29.3	23.8	29.3
Spouse is deemed unfaithful	(3)	17.4	26.4	17.0	27.0
Either of these	(4)	17.8	26.2	16.4	27.1

Note: With regional divorce and remarriage, and divorce independent of spousal disease or behaviour, lifetime probability of HIV infection is 33.9%

Table 16
Simulated and observed percentages of women who have divorced within various durations of marriage, simulations summarized in Table 15

				No divorce		Low divorce	
				Remarriage		Remarriage	
				No (a)	Yes (b)	No (c)	Yes (d)
			Observed				
Baseline	(1)	1	*4*	N/A	N/A	3	3
		2	*10*	N/A	N/A	5	5
		5	*26*	N/A	N/A	6	6
		10	*40*	N/A	N/A	7	7
		15	*49*	N/A	N/A	8	8
		20	*54*	N/A	N/A	8	9
<u>In addition divorce occurs if</u>:							
Spouse develops AIDS	(2)	1	*4*	0	1	3	4
		2	*10*	1	2	6	7
		5	*26*	4	7	10	12
		10	*40*	11	13	16	19
		15	*49*	14	17	21	23
		20	*54*	16	20	24	26
Spouse unfaithful	(3)	1	*4*	0	0	4	3
		2	*10*	2	2	7	7
		5	*26*	11	11	16	16
		10	*40*	24	24	28	28
		15	*49*	32	32	37	36
		20	*54*	39	38	44	42
Either of these	(4)	1	*4*	1	2	4	**5**
		2	*10*	3	5	8	**10**
		5	*26*	15	19	20	**24**
		10	*40*	30	34	35	**40**
		15	*49*	39	42	43	**47**
		20	*54*	46	48	50	**53**

Table 17
All couples are faithful and divorce to avoid AIDS: simulated lifetime probabilities of HIV infection per 100 women in southern rural Malawi, according to strategy adopted, level of background divorce, and whether there is remarriage, N=10,000

		Low divorce		Regional divorce	
		Remarriage		Remarriage	
		No (c)	Yes (d)	No (e)	Yes (f)
Baseline	(5)	6.9	10.7	6.7	16.7
In addition divorce occurs if:					
Spouse develops AIDS	(6)	7.0	10.2	6.2	16.3

Table 18
Simulated and actual percentages of women who have divorced within various durations of marriage, simulations summarized in Table 17

			Low divorce		Regional divorce	
			Remarriage		Remarriage	
			No (c)	Yes (d)	No (e)	Yes (f)
		Actual				
Baseline	(5)	1 *4*	3	3	4	4
		2 *10*	5	5	10	9
		5 *26*	6	6	25	25
		10 *40*	7	6	39	39
		15 *49*	7	7	49	48
		20 *54*	8	8	54	53
In addition divorce occurs if:						
Spouse develops AIDS	(6)	1 *4*	3	4	4	5
		2 *10*	6	7	11	12
		5 *26*	10	12	29	32
		10 *40*	14	16	44	47
		15 *49*	15	17	53	54
		20 *54*	16	18	57	59

Figure 1: Percentage of women HIV+ according to marital status, model 4d

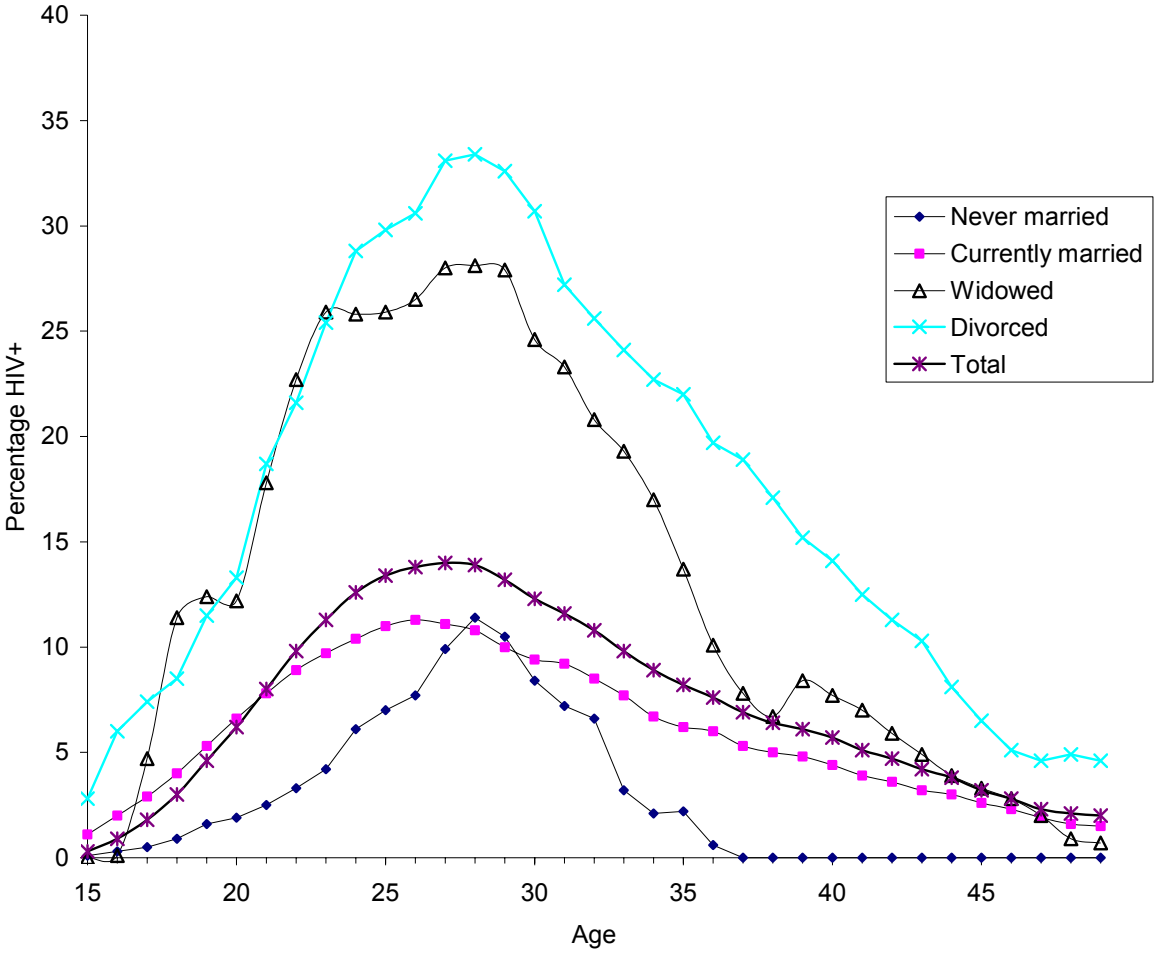

Figure 2: Cumulative proportions of women infected with HIV by age, various models