

# Perceptions of risk and strategies for prevention: responses to HIV/AIDS in rural Malawi

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## Abstract

This paper combines quantitative and qualitative data to investigate changes in perceived risk of contracting HIV/AIDS in rural Malawi. Using longitudinal survey data, we find that Malawians worried less about contracting HIV/AIDS in 2001 than in 1998. According to qualitative interviews and observational journal accounts, HIV/AIDS and strategies to prevent it are a frequent topic of conversation amongst married Malawians. Women report worrying most about their husbands as a possible source of infection, discussing with them the importance of avoiding infection, and, increasingly, using divorce to reduce their risk. Men report worrying most about their extramarital partners and adopting preventive strategies such as fewer partners and more careful partner selection. We show that the decline in perceived risk is significantly associated with declines in the behaviors that Malawians worry most about and perceptions of risk in individuals' social networks. We interpret these findings as evidence that Malawians are changing their behavior in ways that may reduce the spread of HIV/AIDS.

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## Introduction

It seems reasonable to expect that where deaths from AIDS are common people would be worried and would attempt to protect themselves against infection. It is thus surprising that so many articles, both by academics and journalists, claim that Africans facing the AIDS epidemic deny their risk or respond with fatalism. For example, Caldwell (2000, pp. 123 and 126), a demographer with decades of experience in Africa, has written of “an extraordinarily stoical attitude toward death” and a pervasive belief that people cannot confine sex to marriage, attitudes aggravated by “extraordinary” silence. Similarly, the New York Times published a series on AIDS in South Africa entitled “Death and

Denial” (e.g., McNeil, 2001). It seems unlikely, however, that there would be no response where HIV prevalence is relatively high (estimated at 16% of adults in Malawi, UNAIDS/WHO, 2000), and the vast majority know someone suspected to have died from AIDS.

Using a variety of data, we find that, contrary to the prevailing wisdom, rural Malawians are indeed responding to the AIDS epidemic. We focus on changes in perceived risk of HIV infection rather than changes in behavior because the standard behavioral measures—extramarital partnerships and condom use—are so poorly reported. Our longitudinal survey data show that perceptions of risk declined between 1998 and 2001, and that this decline is systematically related to strategies of prevention formulated collectively and evaluated in local social networks. We believe that others have missed these strategies because, for the most part, they are not those promoted by HIV prevention programs or commonly assessed in studies of behavior

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change. Without biomarker data, we cannot evaluate the effectiveness of these strategies. Nonetheless, in the aggregate, their adoption—despite their imperfections—may slow the spread of HIV.

In this paper, we contribute to the literature on responses to the epidemic in three ways: (1) we use qualitative data to identify strategies of HIV prevention that go beyond those promoted by HIV prevention programs; (2) we use rare longitudinal survey data on rural married couples, who constitute the bulk of the population exposed to the risk of HIV in Malawi and elsewhere in sub-Saharan Africa; (3) we take into account the influence on individuals of social interactions. We begin by briefly summarizing three relevant literatures: issues regarding (1) measuring behavior change, (2) the association between perceived risk and behavior change, and (3) the influence of social interactions. After describing our methodology, we then go on to use qualitative data to show that local social networks provide an important mechanism for identifying sources of risk and developing strategies to prevent HIV/AIDS. Finally, we use survey data to examine the association between change in sources of risk and change in perceived risk of HIV infection.

## Background

### *Measures of behavior change*

Studies of HIV/AIDS-related behavior change typically focus on self-reports of sexual partnerships and condom use. Although these behaviors are often used without comment on their validity, they are subject to social desirability bias; consequently, face-to-face interviews may not be the best source of information (Aral & Peterman, 1996). Self-reports may be particularly problematic for behaviors that are targeted (or encouraged) by government prevention campaigns. Perhaps as a result, a study in four African cities that compared reported sexual behavior to STI and HIV biomarkers found that some respondents who reported never having had sex nonetheless tested positive for an STI (Caraël & Holmes, 2001). Similarly, a study in Malawi found no consistent relationship between reported condom use, sexual activity, and STI incidence (Taha et al., 1996). In our own data, 2.5% of female and 11% of male respondents reported committing adultery in the past year; however, a comparatively whopping 18% and 26%, respectively, said their best friends did so. Casting further doubt, in-depth re-interviews with a sub-sample of respondents found that extramarital affairs were underreported (Tawfik, 2003). Although 3% of female and 17% of male respondents reported condom use, because condoms are heavily promoted by prevention programs and are associated in the qualitative data with

extramarital sex, we expect condom use to be similarly misreported, although the direction of bias is unclear.

To circumvent the problem of systematic misreporting of sexual behaviors, we do four things. First, to get a sense of other strategies of prevention that are under consideration locally, we rely on qualitative sources, which then inform the variable selection for our quantitative models. Second, our quantitative models utilize variables that we expect will be more accurately reported because they are not the target of HIV prevention campaigns and are less subject to social desirability bias. Third, we use a measure of risk perception rather than behavior as the dependent variable in our models under the assumption that it will decline when people have adopted prevention strategies, or rise when they have engaged in risky behavior. The persuasiveness of this tactic depends on whether there is evidence that respondents know what risky behavior they or their spouse have engaged in and are willing to report their perceived risk honestly. We provide evidence for the former. That systematic relationships exist between perceived risk and factors that the qualitative data suggest should be associated with perceived risk, constitutes evidence for the latter. Lastly, we use multiple sources and types of data to corroborate our findings.

### *Perceived risk*

In most models of health behavior, perception of risk is a prerequisite for behavior change, a supposition supported by empirical studies (e.g., Ajzen & Fishbein, 1980; Weinstein & Nicolich, 1993). However, due to the complicated reciprocal relationship between perceived risk and behavior change, causality is difficult to determine using cross-sectional data. In contrast, measuring perceived risk both prior to and subsequent to change as we do permits us to interpret associations as evidence that individuals have undergone change that they believe alters their risk.

To measure risk perception, we used responses to a question, “How worried are you that you might catch AIDS?” instead of the more typical question asking respondents to evaluate their likelihood of infection. We made this substitution because worry is more emotion-laden and thus more likely to motivate change; in addition, because worry is more prevalent than infection, it can be expected to motivate change among a larger proportion of the population. Nonetheless, perception of risk and worry are closely related in the sample, with a correlation of 0.41 in 2001.

Some researchers have questioned the assumption implicit in studies of perceived risk that people assess their risk accurately. However, a study in rural Uganda found that patterns of HIV risk perception by age and gender mirrored actual sero-prevalence patterns,

suggesting that respondents had a reasonably accurate sense of their true risk of infection (Kengeya-Kayondo et al., 1999). While we lack data on actual seroprevalence in our study, we do have evidence that respondents are knowledgeable about their personal risk, as will be discussed shortly. The considerable awareness of HIV/AIDS and knowledge of risk factors amongst respondents (see Tables 1 and 2), combined with the results of the Uganda study, lead us to regard reported worry as reflecting actual risk of infection.

### *Social interaction*

Although examination of the influence on individuals of social networks is unusual in studies of HIV/AIDS, on both theoretical and empirical grounds we expect responses to a health threat to be formulated at a collective level rather than by individuals in isolation. Van Campenhout, Cohen, Guizzardi, and Hausser (1997) note that, despite interventions typically targeting individuals, people participate in social networks with complex interactions in which norms are negotiated. Because concerns about the threat of HIV/AIDS and ideas about how it can be prevented are shared and evaluated collectively in networks,<sup>1</sup> we take social interactions into account.

## **Data and methods**

### *Data*

Our quantitative data consist of two waves (1998, 2001) of a longitudinal survey conducted in rural Malawi. The sampling frame was ever-married women ages 15–49 and their spouses (if currently married). Attrition between waves was substantial due to death, temporary labor migration, and divorce followed by the relocation of one of the spouses,<sup>2</sup> although the sample was augmented in 2001 with new spouses. In 1998, 1541 women and 1198 men were interviewed; in 2001, the respective figures were 1571 and 1097. We restricted the analytic sample to respondents interviewed in both waves with no missing data for the variables of interest, yielding 878 women and 675 men.

Frequency distributions for the full and the analytic sample did not differ significantly, and analyses conducted by the authors (not shown) and Bignami,

Reniers, and Weinreb (2003) suggest that the restrictions did not bias our findings. Although the sample is not strictly representative of Malawi, comparison with a nationally representative survey shows that it is close to being nationally representative of the rural population (Watkins, Zulu, Behrman, & Kohler, 2003; see also [www.ssc.upenn.edu/Social\\_Networks](http://www.ssc.upenn.edu/Social_Networks)).

In addition to standard questions about knowledge, attitudes, and behavior, respondents were asked in the survey about their social networks: first about the number with whom they had chatted about AIDS, and then questions about a maximum of four of these conversational, or network, partners, including how worried each is about contracting AIDS. We calculated the average level of worry in each respondent's network by summing levels of worry across all network partners and dividing the total by the number of partners.

Qualitative data were used to provide insights into what people in the rural areas are saying to others much like themselves about acceptable and unacceptable ways of responding to the epidemic. Most importantly, these data provide indication of innovative responses to the epidemic. We draw on four qualitative sources, three of which are semi-structured interviews with male and female sub-samples of the 1998 survey sample: (1) interviews conducted in 1999 with 156 randomly selected respondents regarding social interactions, HIV/AIDS, and family planning (Zulu & Chepngeno, 2003); (2) interviews conducted in 1999 and 2000 with 50 purposely selected respondents regarding marital change and women's status and autonomy (Schatz, 2001); and (3) interviews conducted in 2000 with 120 randomly selected respondents regarding sexual debuts and partnerships (Tawfik, 2003).

The fourth source of qualitative data is a set of observational field journals kept from 1999 until the present by a small number of local interviewers who were asked to recall and record conversations about HIV/AIDS overheard in public spaces (e.g., the village center, on a bus, at a funeral). There are approximately 150 journals, each about 7500 words. The number of conversations in each journal ranges from one to a dozen, with most involving three or more participants. Conversations took place in local languages but were recorded, typed, and analyzed in English.

Although the number of people represented in the journals is large, the population is not, of course, representative. Nor can we assume that participants were always telling the "truth". Despite these limitations, the journals are useful for providing an impression of what some people are saying about HIV/AIDS in informal conversations. Moreover, the informal nature of the data collection renders the journal data less susceptible than formal interview or survey data to social desirability bias resulting from the interview context. Nonetheless, because these data may be more

<sup>1</sup>Space considerations preclude our discussing this issue in depth, but interested readers should consult Kohler (2001), Kohler, Behrman, and Watkins (2001), and Smith (2003).

<sup>2</sup>Specifically, 18% (19%) of the original male (female) sample was lost to follow-up; of these, 11% (14%) died, and 1.5% (1.4%) could not be re-interviewed due to illness or hospitalization.

Table 1  
Change in risk perceptions, 1998 and 2001, women and men

	Frequencies—women		Frequencies—men	
	1998 <i>N</i> = 878	2001 <i>N</i> = 878	1998 <i>N</i> = 675	2001 <i>N</i> = 675
<b>Worried about getting AIDS</b>				
Very worried	61%	49%	52%	37%
Moderately worried	22%	26%	21%	21%
Not at all worried	17%	26%	27%	42%
<b>Perceived risk</b>				
Cumulative risk of acquiring AIDS <sup>a</sup>				
None	<i>n/a</i>	32%	<i>n/a</i>	48%
Some		64%		50%
Do not know		5%		2%
Likelihood that already infected				
None	<i>n/a</i>	54%	<i>n/a</i>	69%
Low		19%		16%
Medium		7%		5%
High		9%		3%
DK		11%		6%
Likelihood of infection if have sex once with infected person				
None/low	<i>n/a</i>	3%	<i>n/a</i>	3%
High		30%		29%
Certain		67%		68%
<b>Social interactions</b>				
Know someone who died of AIDS <sup>b</sup>	96%	98%	96%	98%
# Known who died of AIDS (median) <sup>c</sup>	5	5	5	6
<i>Increased</i>		49%		45%
<i>Decreased</i>		43%		43%
# Of funerals attended in last month				
0	<i>n/a</i>	4%	<i>n/a</i>	5%
1–3		49%		37%
4–6		31%		38%
7+		16%		21%
Median		3		4
#Talked with about AIDS (median)	4	4	4	5
<i>Increased</i>		57%		48%
<i>Decreased</i>		30%		39%
≥ 1 network partner worried	90%	84%	87%	81%
<i>No</i> → <i>yes</i>		8%		10%
<i>Yes</i> → <i>no</i>		14%		16%
Average level of network partner worry <sup>d</sup> (median)	2.7	2.0	2.7	2.0
<i>Increased</i>		23.8%		23%
<i>Decreased</i>		60.4%		58%
# Network partners worried (median)	2	2	3	2
<i>Increased</i>		33%		30%
<i>Decreased</i>		43%		46%

Note: Variables in italics signify change in values from one wave to the next.

<sup>a</sup> Respondents' reports of the likelihood that they currently have or in the future will acquire HIV/AIDS.

<sup>b</sup> Calculated from a question regarding the number of acquaintances suspected to have died from AIDS. Regards answers of "Do not know" as knowing someone who died of AIDS.

<sup>c</sup> Excludes respondents who answered "Do not know" (32 in 1998, 19 in 2001).

<sup>d</sup> Values range from 1 (all partners "not worried") to 3 (all partners "very worried").

Table 2  
Marital relationship as source of concern, 1998 and 2001, women and men

	Frequencies—women		Frequencies—men	
	1998 <i>N</i> = 878	2001 <i>N</i> = 878	1998 <i>N</i> = 675	2001 <i>N</i> = 675
Married <sup>a</sup>	92.1%	91.9%	99.6%	97.6%
<i>Married<sup>a</sup> → not married</i>		4.0%		1.9%
<i>Not married → married<sup>a</sup></i>		3.8%		0%
Any change in marital status between waves <sup>b</sup>		14.2%		17.6%
Married		9.7%		13.0%
Separated		1.1%		0.4%
Divorced		6.8%		10.2%
Widowed		2.5%		1.5%
Source of possible infection worried most about				
Sexual	81%	72%	78%	61%
Non-sexual (injections/transfusions/other)	19%	28%	22%	39%
<i>Sexual → non-sexual</i>		22%		28%
<i>Non-sexual → sexual</i>		13%		12%
Opinion of fidelity of spouse				
Knows/suspects unfaithful	28%	27%	7%	4%
Cannot/do not know spouse's behavior	21%	27%	15%	16%
Probably faithful	51%	46%	78%	80%
<i>Became &gt; suspicious</i>		27%		15%
<i>Became &lt; suspicious</i>		29%		18%
Polygynous union <sup>c</sup>	23.0%	22.9%	13.9%	16.9%
<i>Monogamous → polygynous</i>		5.2%		5.3%
<i>Polygynous → monogamous</i>		5.4%		2.3%
Divorce justified if husband unfaithful	70%	77%	<i>n/a</i>	<i>n/a</i>
<i>Agrees → disagrees</i>		13%		
<i>Disagrees → agrees</i>		21%		
Divorce justified if think husband has AIDS	16%	28%	<i>n/a</i>	<i>n/a</i>
<i>Agrees → disagrees</i>		10%		
<i>Disagrees → agrees</i>		22%		

Note: Variables in italics signify change in values from one wave to the next.

<sup>a</sup> Includes separated respondents.

<sup>b</sup> A larger sample is used for the marital change models than for the other regression models, but the variable frequencies are approximately the same as those shown here.

<sup>c</sup> Restricted to respondents married or separated in both waves.

susceptible to other biases, we use the more traditional qualitative sources and the survey data to corroborate the journal findings. The direct quotes we use below are from the journals, identified by a pseudonym for the journalist and the date.

### Methods

We used qualitative data to inform variable selection for the quantitative analysis. This is an unusual approach in the HIV/AIDS literature, which more often

focuses on factors argued by public health experts to matter. Yet as a UN analysis noted, “Prevention measures that are promoted globally are often at odds with what couples perceive as acceptable strategies to protect themselves within their own social and family environment” (United Nations, 2002, p. IX). Moreover, lay perceptions present a more complete picture of the factors that put people at risk: “[Lay people’s] basic conceptualization of risk is much richer than that of the experts and reflects legitimate concerns that are typically omitted from expert risk assessments” (Slovic, 1987,

p. 295). Studies of behavior change that focus exclusively on the two measures of most interest to the prevention community—condom use and fidelity or chastity—bias examinations of behavior change downward by ignoring other potentially effective ways of limiting the epidemic. Consequently, we used the qualitative data to learn what other strategies rural Malawians are considering. We then used quantitative analysis to find support for the notion that rural Malawians are indeed responding to the epidemic, and in ways that are reasonable given their perceived sources of risk.

After selecting variables from our survey data that correspond to factors of risk and prevention identified in the qualitative data, we conducted bivariate cross-sectional and longitudinal tests of association between worry and these factors (results not shown); most of the statistically significant variables were related to marriage or social interaction.<sup>3</sup> We proceeded to multivariate analysis using (1) the variables that were significant for either sex in the longitudinal analysis and (2) control variables that take into account characteristics such as age that are not of concern here but could also affect the degree of worry. Because the dependent variable, worry, is an ordered categorical variable (“a lot”, “some”, “not at all”) we used ordered logit regressions, which model the likelihood of being in a higher versus a lower category of being in a higher versus a lower category of worry. Thus, worry in 2003 was regressed on (1) a pair of indicators of change in each independent variable (one indicating an increase in the value of the variable over time, the other indicating a decrease), (2) the value of the independent variable in 1998, and (3) worry in 1998 (analyzed as a nominal variable). To adjust for clustering in the sample, we calculated robust standard errors, which are reflected in the reported *p*-values.

In two additional models, we investigated further whether change in marital status has a significant effect on worry and vice versa. Specifically, we used multinomial logistic regression to determine whether levels of worry in 1998 predict subsequent changes in marital status (Table 4) and ordered logistic regression to test whether changes in marital status predict changes in worry about AIDS (Table 5). Multinomial logistic regression, which is used to analyze nominal dependent variables, predicts the likelihood of being in a particular category versus being in a reference category (which for our purposes is “experiencing no change in marital status”).

<sup>3</sup> Many variables expected to be associated with worry were not. Variables not significant in any analysis include the number of funerals attended in the last month and attributing thinness followed by death to AIDS. Variables significant in cross-section but not in the longitudinal models include whether the husband usually stays in his wife’s village and knowing that healthy-looking people can have AIDS.

## Results

### *Qualitative results*

Our first finding is that extensive discussion of HIV/AIDS takes place in respondents’ social networks, often stimulated by such events as attending a funeral or (for men) seeing an attractive woman. Together, rural Malawians identify and evaluate potential ways of contracting HIV, sources of personal risk, and acceptable strategies for avoiding infection. They also share their worries with each other, as when one woman collecting water tells another that she is worried because her husband has infected her with gonorrhoea, which could also mean AIDS (Alice 01XX03).

In these discussions, men are assumed to be inherently promiscuous. Women are presented as ideally faithful, although it is acknowledged that in practice they may not be. Perhaps accordingly, men typically worry most about their extramarital partners as a potential source of infection, whereas women worry most about their husbands. If the marriage is polygynous, women may also worry about their husbands’ other wives. Worry is heightened because respondents vastly overestimate the transmissibility of HIV, typically insisting, both in the qualitative data and in the survey (Table 1), that having sex once with an infected person is certain or highly likely to result in infection.

The qualitative data also show that village residents are extremely aware of the sexual behavior of others, especially their own spouses. For example, women notice when their husbands come home late, attributing the tardiness to drinking or sexual encounters or, commonly, to both. Moreover, in a village it is difficult to keep extramarital partnerships a secret. Men and women confide their own affairs to friends, and they hear about their spouses’ infidelity from observant neighbors. That respondents are able to observe their spouses’ behavior and that they receive information about it from others supports our contention that they are in a good position to assess reasonably accurately the extent to which their spouses put them at risk of infection.

In addition to providing a mechanism for identifying sources of risk, social networks also serve as a context for collectively formulating strategies to avoid infection. Some of these are consistent with programmatic advice. For example, some men proclaim that they have become completely faithful because of their concern about AIDS, often specifically attributed to seeing someone die of AIDS. Other strategies, however, are local adaptations or innovative formulations. For example, consistent with their belief that their husbands pose the greatest threat, a common strategy among women is to try to persuade a husband to be faithful by talking with him about the consequences for their children should

they both die. Less common is for an aggrieved wife to track down and verbally or physically attack the other woman.

Men's strategies of prevention revolve primarily around extramarital partnerships, consistent with their perception that these partners pose the greatest threat. The most common strategies are adaptations of programmatic advice: a reduced number of partners and, particularly, more careful selection of partners. To illustrate, one man talking with others at the village center said:

I don't feel afraid, since...I select only those good looking, healthy and plump married women, rather than the single women who go for many sexual partners because they are single. But married women respect themselves and they don't go for many as single and school girls can do. (Simon 032202)

In addition to choosing women based on appearance, marital status, or age, men turn to their social networks to learn about the sexual biographies, and thus riskiness, of prospective partners.

An unexpected strategy of prevention that is increasingly under discussion in respondents' networks is divorce. While divorce itself is not new to rural Malawi (Reniers, 2003; Kaler, 2001), it appears that attitudes toward divorce specifically in response to AIDS are changing. In early accounts divorce was not considered a sensible solution to the threat of AIDS; the widely and emphatically expressed view was that there is no point in divorcing a spouse suspected of having AIDS because if one spouse is infected, the other surely is, too. In contrast, more recently divorce is spoken of as the only certain way to avoid infection from an unfaithful spouse. The argument for divorcing a spouse sure to "bring AIDS into the family" is often made authoritatively and publicly, as in the following report of a court case in which a woman sought a divorce because she found condoms in her husband's pocket, regarded as evidence of infidelity. In granting the divorce, the chief proclaims to the defendant and onlookers that

In short, the woman is right! Because she is protecting herself and your children's future, she does not want to live with AIDS because of your behavior. And therefore I can't, me as a chief, tolerate that and I say a woman is free, and right-minded and has a good thinking, [the] women gathered here can take courage [from] this...rather than being quiet and never fighting for the survival of healthy living as your friend here did. (Simon 022602)

### *Quantitative results*

Table 1 shows high levels of worry about AIDS in 1998, but a decline over time, findings consistent with

data from other countries in sub-Saharan Africa (Gregson, Zhuwau, Anderson, & Chandiwana, 1998; United Nations, 2002). Both in our sample and elsewhere, men worry less about AIDS than do women, possibly because they feel they have been more successful in altering their own behavior than women feel they have been in altering that of their husbands. In support of this explanation, in our data the decline over time is larger for men than for women in both absolute and relative terms. Nonetheless, much of the decline is moderate, shifts from one level of worry to the next lower one.

A substantial proportion of respondents report that they are "not at all worried" about infection with HIV. While it might appear fatalistic not to be worried in a context where virtually everyone personally knows someone who they believe died of AIDS, some respondents, based on their knowledge of their own and their spouse's behavior, are justified in believing they are not at risk of infection (Zulu & Chepngeno, 2003; Watkins, 2003). Although the number of people respondents report chatting with about AIDS did not decline over time, the extent to which those people were worried did, regardless of the indicator we use to measure it.

In this sample of ever-married women and their husbands, the proportions married declined only slightly between waves (Table 2).<sup>4</sup> However, cross-sectional comparisons of the percent married in each wave underestimate marital change. To illustrate, a woman married in 1998 who divorced in 1999 and remarried in 2000 would appear to have experienced no marital change when analyzed cross-sectionally, when in fact she experienced two changes. Retrospective marital histories collected in 2001 and cross-checked against 1998 data show that 14.2% of women and 17.6% of men experienced at least one marital dissolution or creation between waves. The finding of nearly universal marriage despite frequent divorce is consistent with the qualitative finding that rural Malawians are not opting out of marriage per se, but rather increasingly accepting divorce as a strategy for dealing with a spouse that puts one at risk.

Table 2 also shows that, consistent with the qualitative findings, compared to other ways of contracting HIV, the sexual transmission of HIV worries respondents most. Although a substantial minority says that their main concern is non-sexual transmission (e.g., needles) there is almost no mention of these transmission modes in the qualitative data. Thus, the growing proportion reporting that they worry most about non-sexual modes is probably due to the nature of the survey

<sup>4</sup>Because the qualitative data characterizes separation in rural Malawi as a transitory state typically ending in reconciliation, we combined separated and married individuals.

question, which forced respondents no longer worried about sexual transmission to cite a non-sexual source. Interpreted in this manner, the change suggests an increase over time in protective behavior, consistent with the qualitative findings.

The qualitative evidence indicates why women worry most about their husbands: because it is commonly assumed that men are inherently promiscuous, and many women have evidence that their husbands are unfaithful. Table 2 supports this supposition, with the majority of women reporting either that they know or suspect that their husband has been unfaithful, or that they cannot or do not know whether he has been unfaithful. The comparable figures for men are much lower, although part of the difference may result from men underreporting their suspicions because men are expected to divorce adulterous wives. Although there was little aggregate change between waves in respondents' beliefs about the fidelity of their spouses, the lack of aggregate change masks a striking amount of change at the individual level.

The evidence in the qualitative data that divorce is increasingly viewed as a strategy for preventing infection is supported by the survey data. For example, the proportion of women (men were not asked) who agreed that a wife is justified in divorcing a husband suspected of having HIV/AIDS increased from 16% to 28% between 1998 and 2001; in bivariate analyses this variable was significantly and positively associated in both years with how much a respondent worried about AIDS. There was also an increase in the proportion agreeing that it is justified to divorce an unfaithful husband, although this variable was not associated with worry. Agreement that divorce is justified in response to beating or failure to provide financial support did not change between waves, suggesting that this apparent liberalization of attitudes toward divorce is not general, but rather specific to AIDS.

The qualitative data show an increase over time in the acceptability of condom use with extramarital partners, although use in marriage to prevent infection still shows little sign of acceptance. The survey contained an assortment of questions regarding experience with condoms. While for the aforementioned reasons we worry about the validity of this data, we do find it remarkable that every single measure increased—typically doubling—between 1998 and 2001. For example, all of the following proportions increased: women reporting condom use (current or ever) for family planning; men and women reporting that their network partners and best friends have used condoms; and men and women reporting that condoms are the best strategy for them personally to avoid infection. Restricting the analysis to those who reported having had extramarital partners, the proportion that used condoms with those partners ever and recently also increased. Survey

respondents often over-report “desirable” behaviors. However, that these behaviors were more widely reported in 2001 than in 1998—and by both women and men—indicates that, at the very least, the social pressure to report condom use increased or became more influential over the 3-year period. That respondents who admitted to infidelity (a distinctly “undesirable” behavior) also reported large increases in condom use provides additional support for the notion that condom use is increasing.

Based on the qualitative results, we expected variables associated with marriage and social interactions to significantly predict change in worry. Table 3 shows multivariate regressions of change in worry on change in specific sources of concern.<sup>5</sup> The first model is a baseline model with control variables, whereas the second model also incorporates network-partner influence. Consistent with the qualitative finding that women worry most about their husbands, whereas men worry most about their extramarital partners, we found that, for women only, variables associated with marriage are strongly associated with change in worry. Moreover, these relationships are robust to the addition of measures of social interaction. Specifically, we find that compared to unmarried women, women married in the first wave became more worried over time. Women who were single in the first wave but married in the second were more than twice as likely as other women to become more worried, although the relationship is only marginally significant. On the other hand, for both men and women, becoming single more than doubled the likelihood of becoming less worried; however, the relationship for men is only marginally significant and becomes insignificant when we control for network-partner influence.

The analysis also shows the importance of wives' suspicions in determining how much they worry about HIV/AIDS. Women who suspected their husbands of infidelity in 1998 were more than twice as likely to become more worried over time, and becoming more suspicious between waves increased the likelihood of becoming more worried by approximately 70%. The variables for spousal infidelity are not significant in the men's models, nor are relationships always even in the expected direction. In an additional model (not shown), we tested whether transitioning into or out of a polygynous union was significantly associated with change in worry. For men, it was not, but for women, it was: restricting the analysis to respondents married or separated in both waves and controlling for the other variables in the baseline model, women in polygynous marriages in 1998 were 80% more likely than women in monogamous marriages to become more worried by

<sup>5</sup>The technical interpretation is “worry in the second wave, controlling for worry in the first wave”.



Table 3

Multivariate ordered logit regression of change in worry on change in marital relationship and social interactions, 1998 and 2001, women and men, odds ratios

	Women		Men	
	Baseline	Network partners <sup>†</sup>	Baseline	Network partners <sup>†</sup>
<b>Marital relationship</b>				
Married or separated <sup>a</sup>	1.85*	1.62 <sup>†</sup>	1.43	1.01
<i>Yes → no</i>	0.41**	0.43**	0.43 <sup>†</sup>	0.49
<i>No → yes</i>	2.02	2.59 <sup>†</sup>	Dropped due to collinearity	
Opinion of fidelity of spouse <sup>a</sup> (reference category “probably faithful”)				
Knows/suspects unfaithful	2.08**	2.16**	0.81	0.95
Cannot/do not know spouse’s behavior	1.14	1.16	1.02	1.18
<i>Became &gt; suspicious</i>	1.67**	1.74**	1.08	1.02
<i>Became &lt; suspicious</i>	0.80	0.78	1.04	0.94
Divorced justified if think husband has AIDS <sup>a</sup>				
<i>Agrees → disagrees</i>	1.41	1.51	<i>n/a</i>	<i>n/a</i>
<i>Disagrees → agrees</i>	0.68	0.65		
	1.52*	1.42 <sup>†</sup>		
<b>Social interactions</b>				
# Talked with about AIDS <sup>a</sup>	1.02	1.02	0.97 <sup>†</sup>	0.99
<i>Increased</i>	1.27	1.26	0.93	0.81
<i>Decreased</i>	0.97	0.99	1.04	0.77
Average level of network partner worry <sup>a,b</sup>				
<i>Increased</i>		2.10**		2.82**
<i>Decreased</i>		1.11		1.97*
		0.19**		0.22**
Observations	878	878	675	675
Pseudo- $R^2$	0.043	0.094	0.067	0.131

Note: Variables in italics signify change in values from one wave to the next. Age, region, wealth, and education in 1998 controlled for in all models, as is level of worry in 1998.

<sup>†</sup> Significant at 10%; \*significant at 5%; \*\*significant at 1%.

<sup>a</sup> Corresponds to value in 1998.

<sup>b</sup> Values range from 1 (all partners “not worried”) to 3 (all partners “very worried”).

2001. If a woman’s husband took a second wife between waves, she was more than three times as likely as other women to become more worried about HIV/AIDS. In contrast, if she changed from being in a polygynous marriage to being in a monogamous one, she was twice as likely to become less worried.

The second set of important predictors of change in worry is measures of social interaction. Here it is not so much the general measures (the number talked with about AIDS, the number known who died of AIDS<sup>6</sup>) that matter, although it may be that since respondents were asked to recall and sum past interactions, the variables are measured with considerable noise. What do

matter are the levels of worry in respondents’ conversational networks. Specifically, we see that the more a respondent’s network partners worried in 1998, the more likely the respondent was to become more worried by 2001. Moreover, if they became less worried over time, the respondent became less worried. For men, if they became more worried over time, the respondent became more worried. (Interestingly, men are slightly more influenced by their network partners than are women.) The importance of network influence in determining respondent worry is evident in the dramatic increase in the model  $R^2$ ’s as we go from the first to the second model. Using other measures of network-partner worry (having at least one network partner worried or the number of partners that are worried about AIDS) yielded similar results (not shown).

One strategy of prevention featured locally (especially among women) but not in program recommendations is divorce, which we investigate in Tables 4 and 5. For

<sup>6</sup> In a separate model (not shown), we tested whether change in the number of acquaintances suspected to have died of AIDS was significantly related to change in worry, controlling for the variables in the baseline multivariate model. Interestingly, for both genders, it was not.

Table 4  
Worry in 1998 predicting future change in marital status: multinomial logits, women and men, odds ratios

Women	Marriage	Separation	Divorce	Widowhood
Worry about AIDS in 1998 (reference category “very worried”)				
Not at all worried	0.97	1.18	0.53 <sup>†</sup>	0.30 <sup>†</sup>
Moderately worried	0.61	2.59	0.54 <sup>†</sup>	0.92
Age	0.99	1.05 <sup>†</sup>	0.97*	1.05**
Observations	1171			
Pseudo- <i>R</i> <sup>2</sup>	0.021			
Men	Marriage <sup>a</sup>	Separation <sup>b</sup>	Divorce	Widowhood
Worry about AIDS in 1998 (reference category “very worried”)				
Not at all worried	0.66		0.82	1.49
Moderately worried	0.81		0.80	1.06
Age	0.97 <sup>†</sup>		0.99	0.99
Observations	808			
Pseudo- <i>R</i> <sup>2</sup>	0.006			

Note: Reference category for dependent variable is “no change”. If the respondent underwent more than one change in marital status between waves, the change analyzed was the first to occur. Separated persons who reconciled were coded “no change”. In other analyses (results not shown), we analyzed each change in marital status separately, restricting analysis to only those respondents at risk for the transition under investigation (e.g., divorce model restricted to married or separated persons). Results did not differ from the results presented here.

<sup>†</sup> Significant at 10%; \*significant at 5%; \*\*significant at 1%.

<sup>a</sup> Due to polygyny, married men’s first marital change could be marriage.

<sup>b</sup> Men who separated were dropped from the analysis due to there being too few cases (3) to analyze.

women only, being worried about AIDS in the first wave increased the likelihood of subsequently divorcing, and divorcing between the waves brought about a reduction in worry. These results are consistent with the qualitative finding that women in particular use divorce as a strategy to avoid infection, and that the marital relationship is more central to women’s constructions of their risk than it is to men’s. Table 4 also shows that, relative to women who were not worried about AIDS in 1998, women who were very worried were more than three times more likely to subsequently be widowed. These women may have known well that they had reason to be worried: verbal autopsies conducted in 2001 show that two-thirds of the husbands of women who were widowed between the waves exhibited symptoms associated with AIDS (Doctor, 2002).

Overall, the results presented in Tables 3–5 support the view that worry about AIDS is associated for women, but not men, with characteristics of the conjugal union. Specifically, a strong association exists between worry and suspicions that a husband is unfaithful, polygyny, and being married generally. For both women and men, worry about AIDS is also associated with measures of social interaction, namely the extent to which network partners themselves worry about AIDS.

Table 5  
Change in marital status predicting change in worry: ordered logits, 1998 and 2001, women and men, odds ratios

	Women	Men <sup>a</sup>
Change in marital status (reference category “no change”)		
Marriage	1.38	1.16
Separation	0.97	n/a
Divorce	0.41**	0.87
Widowhood	0.77	0.98
Married or separated in 1998	1.31	0.74
Age	0.99	1.01
Observations	1171	810
Pseudo- <i>R</i> <sup>2</sup>	0.019	0.023

Note: Level of worry in 1998 controlled for. If the respondent underwent more than one change in marital status between waves, the change analyzed was the last to occur. Separated persons who reconciled were coded “no change”.

\*\*\*Significant at 10%; \*significant at 5%; \*\*significant at 1%.

<sup>a</sup> Men who separated were dropped from the analysis due to there being too few cases (1) to analyze.

## Discussion

The ultimate assessment of aggregate-level behavioral change in response to AIDS is change in HIV incidence.

Given that in many developing world settings (Malawi included) such data do not exist, most researchers look instead at reported behaviors. Because reports of sexual behavior are unreliable, we examined behavioral change indirectly by analyzing the association between change in perceived risk, measured by worry about infection, and change in sources of concern commonly discussed within local social networks. Worry about AIDS among rural Malawians declined between 1998 and 2001. This decline cannot plausibly be attributed to unobserved heterogeneity since the same people were interviewed in both waves, nor to an age effect, as what little association exists between worry and age is positive. One could argue that the decline is due to random error or shifting relative risks, or is attributable to the initial shock and concern that resulted from observing the effects of the epidemic diminishing among respondents. While these processes may have contributed, that the decline is systematically related to change in factors that qualitative accounts indicate influence worry suggests that they are not the entire story. Rather, we regard the decline as indirect but persuasive evidence that the AIDS-related behavior of rural Malawians is changing.

We found that rural Malawians are knowledgeable about risk factors and well positioned to assess reasonably accurately their personal risk of infection by virtue of knowing their own behavior and directly observing, or hearing gossip about, the behavior of their spouses. We also found that Malawians frequently engage in discussions about preventing AIDS. Qualitative data show that in these conversations, gendered routes of infection are identified, and sensible prevention strategies developed and assessed. Quantitative and qualitative data consistently demonstrate that women worry most about infection from their husbands. Consequently, their primary prevention strategies center around marriage: persuading their husbands to be careful, and, increasingly, divorce. Men worry most about their extramarital partners and focus on partner reduction and informed partner selection to reduce their risk of infection.

The two most striking results of this analysis are the strong associations between change in worry and change in both marital status (especially for women) and network-partner worry. Women perceive that depending on a spouse's behavior may be risky, motivating them to avoid infection by divorcing a spouse suspected of infidelity. Conversations in local social networks about AIDS and the extent to which others worry are important in changing perceptions of risk. By transmitting knowledge and influence, networks affect how people think and feel about the epidemic and potential sources of infection. They provide opportunities to learn about the behavior of a spouse or potential partner and a mechanism for formulating locally acceptable strategies of prevention. Although many of these strategies are

not promoted by donor organizations or the Malawian government, given the low transmission probabilities of HIV, they may be effective in the aggregate, if not for individuals. Indeed, while we lack the data necessary to directly test their effectiveness, microsimulations do show a considerably higher probability of infection within marriage than between divorce and remarriage (Bracher, Santow, & Watkins, 2003).

Our study has limitations, including the possibility that network endogeneity biases our network findings. Although social network analyses are subject to problems of selectivity and unobserved heterogeneity, an analysis that used fixed effects and instrumental variables to control for these possibilities found that network influence on worry about AIDS is robust to these controls (Kohler, Behrman, & Watkins, 2002). A second limitation is restrictions placed on the sample such as excluding respondents interviewed in one wave only. Despite this limitation, we believe that our results are generalizable. Not only was the sample not subject to these restrictions similar in its basic characteristics and levels of worry about AIDS, but studies of other populations in sub-Saharan Africa have documented similar levels of worry about AIDS and relationships between characteristics and worry: the married worry more than the single (Kengeya-Kayondo et al., 1999; Lindan et al., 1991), women worry more than men (United Nations, 2002), and whereas women worry most about their spouses, men worry most about their extramarital partners (Kengeya-Kayondo, et al., 1999; Bunnell, 1996; Lindan, et al., 1991). Lastly, although little empirical research exists on the determinants of change in risk perception, we consider it highly unlikely that our respondents are unique in their attempts to prevent infection, in the extent to which they discuss HIV/AIDS with others, or in the significant role played by social interactions in shaping their responses to the epidemic.

Our results indicate collective efforts at prevention in rural Malawi. Village culture is changing as husbands and wives grapple in their social networks with the threat of HIV/AIDS. Some of our respondents may have given up struggling, but fatalism and resignation do not characterize the orientation of most. In Malawi and elsewhere, localized prevention efforts may slow the spread of HIV/AIDS.

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