Do Social Interactions Affect Individual HIV/AIDS Attitudes and Prevention Strategies in Rural Malawi ?

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Abstract

AIDS awareness alone is a necessary but insufficient condition for individual change in risk behaviors. Instead, it appears that social networks and social participation may be important forces encouraging positive attitudes towards condoms use. In this paper, I analyze network and social participation data gathered from a 2001 household survey in rural Malawi using multivariate models that control for individual socio-economic characteristics and exposure to AIDS prevention information.

I find that attendance in local community events, and structure of AIDS conversation networks influence AIDS attitudes and behaviors. Social isolation has the most negative effects, especially for women, on the outcomes examined. Social participation in multiple social gatherings, on the other hand, appears to increase the approval and use of condoms, especially for men.

Introduction

With over 10 million of people and about 15% of the adult general population HIV positive in 2001 (UNAIDS, UNICEF and WHO 2003), Malawi is representative of many other sub-Saharan African countries experiencing some of the most severe HIV/AIDS epidemics in the world. Adults aged 15 to 49 are most likely to engage in high-risk behavior for HIV infection, and represent about 44 percent of the total population. For them, AIDS has become the number one cause of death and accounts for more than half of all hospital admissions (JICA and Malawi MHP 1999). Deaths and funerals have become so common in rural Malawi that adults in reproductive age knew on average about four acquaintances who died from AIDS within the last year, 90% of the people attended at least 5 funerals and half of them went to over 15 funerals in the last year. In this country, like in many others, the disease is spreading faster than ever before: the estimated number of people living with HIV/AIDS in Malawi was estimated at 850,000 at the end of 2001, and about 80,000 adults and children were estimated to have died from the epidemic in 2001 (UNAIDS et al. 2003). The AIDS epidemic in Africa is unique because of the high rate of heterosexual transmission, the high percentage of women and children among people infected, and the speed of progression.

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Most of the Malawi adult population is married, and most are currently not infected. In the absence of an effective vaccine, behavioral change is the only way to slow a further spread. Since HIV is transmitted only through blood and other bodily fluids, and the primary mode of transmission is unprotected sexual contact, the individual risk of exposure to HIV can be reduced by limiting the number of sexual partners, avoiding casual sex, using condoms and maintaining mutually faithful relationships.

Since the onset of the epidemic, the Government of Malawi implemented a number of policies, institutional and operational strategies to mitigate the spread of HIV/AIDS. The main strategy in HIV/AIDS control has relied primarily on "Information, Education, Communication" or "IEC" campaigns at the national level. Community outreach has also been undertaken through NGOs under donor funding, but most of these efforts have been limited in geographical coverage, and the epidemic continues to progress throughout the country.

The challenge in Malawi is not so much to increase awareness about AIDS but rather to modify sexual behavior. In urban as well as in rural areas, almost all men and women (i.e., more than 98%) have heard of AIDS in 2000 and knowledge about prevention strategies have increased (e.g., 55 percent of women and 71 percent of men know condom use prevent HIV transmission, and at least two-third of the people in 2000 knew about sexual abstinence and delaying age at first sex as protective strategies against AIDS (Malawi NSO. and ORC Macro. 2001)).

However, attitudes and practices have not changed at the same pace: use of condoms remains low (29 percent of women and 39 percent of men use condoms with non-cohabiting partner, and only 3 percent of women and 6 percent of men use them with cohabiting partners), and the reduction of the number of sexual partners remains limited (about 18 percent of married men and less than 1 percent of married women reported having one or more extramarital partner in the last year in 2000).

Watkins and her collaborators have found that rural Malawians have become increasingly informed and aware of the AIDS epidemic, and some have changed their behavior or risk perception (Smith 2001; Watkins and Schatz 2001). But models of behavior change suggest that individuals need more than knowledge to translate awareness into action (Aggleton et al. 1994). At least three elements in these models appear essential in getting individuals to translate their knowledge of risk into successful reduction of their risk behaviors: (1) information, (2) motivation, and (3) behavioral skills in a supportive and reinforcing environment. One of the key finding from many studies is that individual knowledge is necessary, but is often insufficient to lead to personal behavior changes. Enough individual motivation (genuine or induced through normative peer pressure, for instance) must exist for the person to change his/her behavior or to adopt some protective method.

In Malawi, 84% of the people live in rural areas and are concentrated in small and relatively densely settled villages that provide a communal life and a context within which information are shared that may influence decisions that individuals, couples, or households make about farming, labor and trading, migration, health care, reproduction and HIV/AIDS. In such context, most individuals have some limited exposure to HIV prevention campaigns and health workers, and therefore most of their knowledge and attitudes is shaped by informal conversations with friends, relatives and neighbors.

As seen in the case of the diffusion of family planning, social interactions with peers, key individuals and groups can play some influential role in motivating individual behavior change, and introducing and spreading new ideas, behaviors, norms and values in communities. But social

interactions have also been hypothesized to serve as mechanisms for reducing uncertainty by providing social learning opportunities to individuals to evaluate information. Individuals, for instance, are not only exposed to different HIV/AIDS prevention messages spread by the media, health workers, religious groups and NGOs promoting abstinence, condom use and fidelity, but they also share local stories with friends, acquaintances and relatives. In this context, men and women often struggle deciding which protective strategy is most effective for them and social interactions can help them in dealing with this wide variety of individual experiences and sometimes contradictory information.

Therefore, understanding the mechanisms and factors at play in rural communities is critical for better preventive interventions, more effective support and policies, and better allocation of scare resources. In this paper, I use the Malawi Diffusion and Ideational Change (MDIC) survey to investigate the extent to which various measures of social interactions matter for individual AIDS-related attitudes and behavior change in the context of rural Malawi.

I find, for instance, that Malawians more socially isolated or who least participate in social activities are more likely to lack exposure to potentially more protective attitudes and behaviors through social learning and social influence. Some effects of the AIDS conversational network and social participation are often stronger than traditionally measured individual characteristics like education and wealth. Social participation, a variable looked at for the first time in this study, appears, especially for men, to be particularly important for approval and use of condoms.

After presenting my measures of social interactions, I present the dataset along with the set of AIDS-related dependent variables; the set of social interaction variables under investigation and the individual and community characteristics used as control variables. I then introduce the estimation models used to measure the statistical significance and size of the effects of the different measures of social interactions on different AIDS-related outcomes. This is followed by a presentation and discussion of the effects of the different summary measures of social interactions along with their components.

Analytical framework

The concept of social interactions is broad and encompasses various psycho-social dimensions at the individual level as well as macro-structural dimensions at the societal level. As conceptualized by Bongaarts and Watkins (1996:657-662) and based on the data available, social interactions are limited in this research to: (1) **informal and formal personal relations**, and (2) **participation in social events**, through which information and ideas about AIDS related issues may be exchanged, evaluated and acted upon, within the constraints of the local context, and the social approval or disapproval of peers and influential community members (Webster, Freeman and Aufdemberg 2001). The impersonal influence of the mass-media, and other broad cultural influences to which individuals are also exposed to, are not the main focus of this research, but efforts are made to control for them as much as possible.

AIDS conversation network

Personal relations are examined in this paper from the individual perspective in form of the conversation partners with whom there have been formal or informal discussions on specific topics such as AIDS. Each respondent's personal environment used to discuss AIDS can be summarized by some structural characteristics (e.g., size, density and strength of ties between alters and with ego) and some compositional characteristics (e.g., ties multiplexity, homophily between alters and

ego characteristics, and alters homogeneity). In this section, I explain how I use these characteristics to rank individuals according to their relative level of sociability (thru a summary social network index I create), and to categorize them into four groups of social integration (e.g., from isolated to highly integrated).

Based on the existing research on ego-centric social network measures (Schensul 1999; Scott 2000; Wasserman and Faust 1994), I did with data from rural Malawi a factorial analysis of 17 different AIDS social network measures summarizing the structural and compositional characteristics of the respondent's AIDS conversation network (details not shown but available from author). I found that strong emotional and kinship ties with the respondent (e.g., confidants and very close friends or relatives), gender homophily (i.e., the extent the conversation partners are of the same sex as the respondent), emotional closeness (i.e., strength of ties) and the close-knit structure (i.e., density and ties homogeneity) among AIDS network partners, as well as the size of the AIDS conversation network and the geographic proximity of the conversation partners are the six most important dimensions structuring these conversation networks (i.e., these characteristics explain close to half of the variance).

Interestingly, the patterns found both in 1998 and 2001 and for each sex are quasi-identical, suggesting that these findings appear relatively robust to gender and short time variations. Additionally, these patterns seem to apply to the broader personal environment composed of the conversation partners for family planning as well as those for AIDS. These patterns also appear robust to the number of AIDS conversation partners and a similar analysis done for the respondents with two or more AIDS conversation partners indicates that whether or not respondents with only one AIDS conversation partner are included in the analysis does not change the results. These findings are somewhat comparable to those made by Campbell and Marsden (1986) and Huang and Tausig (1990) for the US population. Both groups of authors used a similar factor analysis to study a set of network measures related to size, density and diversity respectively for a community in Northern California in 1977-78 and for the general US population (1985 US General Social Survey).

As seen so far, these conversation networks can be characterized along different dimensions, but one of them in particular is whether the respondents are socially isolated or interacting a lot with those in their local area. For this purpose, I created an AIDS Social Network Index modeled after the one developed by Berkman and Syme (1979) to summarize the level of interpersonal interaction the respondents experiences through his/her AIDS conversational networks and to determine whether the respondents are socially isolated or embedded in a tight social group.

Berkman-Syme's social network index is based on four different measures of social ties (McDowell and Newell 1996:134-137; Schoenbach et al. 1986:578, 580-581): (1) marital status (married vs. unmarried), (2) sociability (number of close friends and relatives and frequency of contacts), (3) religious group affiliation/attendance (yes vs. no), and (4) membership/participation in other social or community organizations (yes vs. no). The overall index is a weighted sum of these index components where intimate contacts (items 1 and 2) are weighted more than religious and community participation. The index has 12 levels and is used to categorize people in four levels of social integration (low, medium low, medium high, and high). The lowest category includes people "who did not belong to a church or other type of group and *either* had, at most, from three to five close friends or relatives or were unmarried and not in the highest category of social contacts with close friends and relatives." (Schoenbach et al. 1986:580)

In contrast to Berkman-Syme, I decided not to include in the index confounding variables like marital status and religious affiliation because they are also used as control variables in the multivariate analysis, and they can also determine some of these social interactions. As for voluntary group membership, no data is available from the survey I am using. This index instead focuses on sociability and includes only the structural and functional characteristics of the respondent conversational network used to discuss AIDS[2].

The index I created follows Glass et al.'s approach (1997:1510) and treats the respondent's conversation network as a linear combination of the six factor scores identified by gender. The factors scores are by construction uncorrelated and normalized, and I computed this index as the weighted average of the six factor scores where the relative weight of each factor corresponds to its contribution in the overall variance explained (by the six first factors). As expected the index is most correlated to the variables that are best explained by the first six factors, and each factor is most correlated to the variables that contributes to it ($0.69 = r^2 = 0.99$). Therefore, the index offers overall a good summary of the strength of ties, density and of some of the homogeneity aspects characterizing these AIDS conversation networks ($0.30 = r^2 = 0.75$) but does not capture as well their size ($r^2 \sim 0.10$).

The AIDS social network index is useful not only for ranking individuals according to their relative level of sociability, but it can also be used to categorize respondents into three or **four groups of social integration**: Suarez et al. (2000:49) use, for instance, equidistant cut points for assigning individuals in low, medium or high groups. In the present case, the most isolated individuals (i.e., about 2.9% of the women and 1.5% of the men who have no AIDS conversation partners and for whom most network measures don't apply) must be kept in a distinct group. The remaining of the population (i.e., those with at least one AIDS conversation partner) is normally distributed, and can be divided in three groups where the level of social integration is either low (? s below the mean social network index), medium (within ±? s around the mean social network index) or high (? s above the mean social network index).

Working with an overall index and distinct groups can be useful to reveal underlying patterns not directly visible using raw variables. Berkman et al. (1979:188) found that the three variables they used in their "index of contacts with friend and relatives" (i.e., number of close friends, number of close relatives, and monthly frequency of contacts) were not important predictors of mortality when they were considered individually, but "when combined, they are associated with significant increases in [mortality] risk." In our case, it seems particularly relevant to examine groups of individuals with specific combinations of network size, density, strength of ties and compositional homogeneity. Individuals in the lowest group in several of these dimensions are likely to be also more socially isolated, while individuals with other combinations are likely to be exposed to a more socially integrated group of contacts.

Using our social network index to classify individuals in four groups of social integration ranging from isolated to highly integrated, we can see in Table 2a how individuals are distributed as expected across a gradient for the components making the index (i.e., density, strength of ties, homogeneity and to a much lesser extent network size). The variations by groups of social integration are highly statistically significant nearly for all the components (to the exception of the network size). Interestingly, to the exception that men have overall some larger and denser AIDS social networks, the patterns and the frequencies observed are very similar for both sexes.

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2. Since these are conversational networks rather than support networks, no data are available on the frequency of contact, duration or reciprocity of the ties.

For the purpose, we can ignore here the isolated individuals since most social network measures do not apply to them, and instead we can focus on the three main groups of social integration. While combining the six key dimensions of these AIDS conversation networks into a single index reduces the information available, we can still distinguish some strong contrast between groups for the key variables composing it. For instance, women in the low group of social integration have on average a low density of ties between conversation partners (38.1%) with only 4.6% of them having some strong ties with each others, and a woman has on average only one strong tie with her conversation partners (Table 2a). This situation varies upward gradually across groups of integration and, for those in the higher group, nearly everyone knows each other (density of ties is on average 96.2%) with close to one third of the conversation partners having some strong ties with each others, and more than three-fourth of them have some strong relationships with the respondent.

In term of compositional homogeneity, we can see through the components of this index that women in higher group of social integration predominantly spoke with relatives (82.6% of the cases) while those in the low group of social integration spoke more often with non-relatives (8.6% of the cases). A similar pattern also exists in respect to geographic proximity, especially with people living in the same village: the most socially integrated women spoke on average to 78.8% of the same village while those less socially integrated spoke on average to 25.2% of the people from their village. Some similar but weaker patterns also exist for other measures of homophily and homogeneity like the gender and the closeness of the conversation partners. Similar patterns, with only minor variations, also exist for men.

Participation in social events

While social network measures are useful to capture to some extent the role played by direct conversations about AIDS, we can also gain an idea of the individuals' social exposure to more diffuse information by their attendance in the different types of social events occurring locally. Social participation in local events is measured in this paper by the number of times in the last year and in the last month an individual went to a funeral, a drama performance in general or about family planning or AIDS in particular, a wedding, a prayer meeting, a political meeting, or a beer place ("bottled beer" or "Chibuku")[3]. In this section, I explain how I created an index of social participation to summarize the attendance to these different types of local events, and also how I use it to classify individuals by groups of social participation (e.g., "low", "medium" or "high").

Measures of social participation such as those are important to capture some of the broader and more diffuse social environment individuals are part off. These are for the most part local events attended voluntarily, informally and without formal membership or affiliation. The variety and frequency of the different events attended, the context and the duration of these face-to-face contacts, and the diversity of the people meet during these events, all contribute to make the participation in these social events more than mere random and meaningless encounters.

Research on social participation in general is recent and embedded within the study of social capital, group participation and public health. Several authors, for instance, have shown the role of social participation and social capital in shaping health-related behaviors in different Western communities (Baum et al. 2000; Broman 1993; Lindstrom, Hanson and Ostergren 2001).

3. These six social participation items were not included in the questionnaire used in 1998, and thus this analysis is possible only for the 2001 survey.

Lindstrom et al. (2003; 2000; 2002), in particular, have shown some important differences between low/high social participation and smoking behaviors in a Swedish community. In the context of rural Africa, while some authors have examined the role played by social affiliation and group membership (Alesina and La Ferrara 2000; Boulay and Valente 1999; La Ferrara 2002; Paz Soldan 2003; Valente et al. 1997), only a few of them have examined the role played by attending specific social events like funerals on some demographic outcomes (Behrman, Kohler and Watkins 2002a; Smith 2002). This research aims at filling this gap in knowledge, and examines for the first time some of the roles played on different AIDS-related outcomes by the participation to these social events as a whole and by type of events.

Table 2b shows summary statistics for events attended in the last 12 months (panel a) and in the last month (panel b) prior to the survey in summer 2001. Out of the six types of event people were asked about, funerals were most frequently attended. Not only everyone (99%) went at least once in the last 12 months, but almost as many (96%) also went to at least one in the last month. In fact, both men and women are attending a staggering number of funerals: on average women attended 17, and men about 19 in the last 12 months. Despite some individual variations, 90% of the individuals attended at least 5 or 6 funerals, and half of the people went to 15-17 funerals in the last year; 10% of the individuals even went to 30-33 burials. On average, men attended a few more funerals than women. Funerals are so much part of the daily life that in the month prior to the interview (conducted between June and August 2001), 90% of the people interviewed reported attending at least two funerals, and 10% of the women and men went to 8 and 10 funerals respectively (the average of funerals attended last month was about 4 and 5).

Other frequently attended local social events are prayer meetings: more than half of the people went to at least one prayer meeting last month, and three out of four went to at least one last year. Among those who attended at least once in the last 12 months, women went on average about 8 times while men went about 10 times.

As expected, weddings are relatively rare events in the communities: only about half of the people attended one of them in the last year, and only 15% of the women and 19% of the men went to a wedding in the month prior to the survey. Political meetings and drama performances are social events even more occasional.

While some events like funerals, weddings and prayer meetings appear to be rather gender neutral (both women and men attend these events at roughly the same frequency), some others are more frequently attended by men than by women, e.g., political meetings and drama performances, and men more often go to bars.

Because some type of events are rare (e.g., weddings) while some are more frequent (e.g., funerals), and the attendance depending of the type of events can be normative or voluntarily, I operationalized the latent concept of social participation by examining the relative effect of participating in multiple types of social events. While analyzing the participation in each type of event can be valuable by itself, the individual propensity to attend each type of event as well as multiple ones (rather than only the most common ones) can be used as a summary measure of social participation.

In this case, knowing about the absolute frequency of participation is less informative than knowing whether some individuals attend few or many events compared to other people. For this purpose, I experimented with various ways to capture this underlying concept through various

summary measures[4], but the best approach to deal with outliers and the strongly skewed distributions of the number of times respondents went to each type of event has been to rely on the percentile distributions[5] of the individuals by sex, and by type of event attended last year and last month. The individual score for each type of event in this case is the average percentile for the events attended last year and last month. I then used these percentile distributions to partition (by sex) all the individuals in three groups of social participation using a modified version of Baum et al. (2000:420) definition: **low participators** are defined as "any person who scored in the bottom third of all six participation indices". Similarly **high participators** are defined here as those scoring in the upper third of at least four of the six indices (to allow for the fact that only a relative small fraction of people go to bars or drama performances). Finally, those in neither of these two groups are assigned to an intermediate ("medium") group used as reference category.

Table 2b provides the average number of events attended by individuals grouped according to their overall social participation. For men and women, and for both recently attended events (i.e., last month) as well as those attended in the last 12 months, the average number of events attended increases as expected by group of social participation for all types of social events. All the variations are statistically significant at 1% level indicating that the groupings summarize reasonably well the participation in each type of event.

Data

Sample

This research draws on the information collected as part of the Malawi Diffusion and Ideational Change (MDIC) project[6] conducted by Susan C. Watkins (University of Pennsylvania, USA) and Eliya M. Zulu (African Population and Health Research Center, Kenya) in partnership with the University of Malawi (Center for Social Research). This project provides access to a paired longitudinal household survey and a set of semi-structured interviews; discussions and diaries that were collected during the summers of 1998 and 2001 in three rural locations (Balaka, Mchinji, and Rumphi Districts) for a representative sample of about 125 villages in rural Malawi.

The survey focuses on the influence of informal conversations with social network partners (up to four) in respect to family planning and AIDS knowledge, attitude and practice; and provides a rich set of variables about the respondent's ties to other people. Such ego-centered dataset enables the study of social environment surrounding individuals and households and offers a better understanding of the social interactions influencing AIDS risk perception and sexual behaviors.

In 1998 about 1,800 ever-married women of reproductive age (i.e., less than 50) and their currently married partners (over 1500), divided equally across the three regions, were randomly surveyed at the village level about their socio-economic status, marital and fertility history, partnerships and autonomy status, as well as knowledge, attitude and practices with respect to family planning and HIV/AIDS for the respondent and his/her best friend(s).

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4. e.g, cumulative indices standardized or not, principal components and factor analysis after normalizing the distributions, social participation index with the individual score corresponding to the mean percentile distributions for the different social events (results not shown).

5. Note that when two (or more) percentiles are the same (i.e., ties), they are given the lower category number. Thus, all the individuals who do not participate to a certain type of event, for instance, are assigned a score equal to one while those attending the event are assigned higher scores corresponding to their percentiles in the population.

6. For further information about the project and data, see: http://www.ssc.upenn.edu/Social_Networks/

In addition to the information collected at the individual level for women and men, some village level data were also collected from key informants. Topics surveyed include access to basic infrastructure and services (water, electricity, closest facilities for trade, communication, health and education) as well as rural development activities, agriculture and land-use patterns, and religious groups presence.

Two main reasons make this dataset particularly appropriate for our purpose: first, it is one of the few social studies on AIDS available in sub-Saharan Africa representative of the general population in rural areas (Watkins and Schatz 2001); secondly, it is one of the few large scale socio-demographic survey that has been collecting data on individual AIDS conversation networks as well as participation to various local social events.

Selection of observations

This paper focuses on a new set of questions only collected in 2001 about individual attendance in local social events, and thus is limited to individuals interviewed in that year. While respondents were asked in both waves about their AIDS conversation partners, it is only in 2001 that they were asked about the number of times they went to different types of local social events in the last year and in the last month (prior to the survey).

Out of the original sampled population, 1539 ever-married women were successfully interviewed in 1998 and 1570 in 2001, including 1212 of them interviewed in both waves (attrition rate of 21.2%). In the case of men, 1066 were successfully interviewed in 1998 and 979 in 2001, including 743 of them interviewed in both waves (attrition 30.3%). In addition to the original 1998 respondents, 358 women and 237 men were interviewed in 2001. Some of them were individuals originally sampled in 1998 who could not be interviewed while others were new spouses (186 new wives and 28 new husbands).

In each wave, up to three attempts were made to interview respondents. The main reason for lost at follow-up was the respondent was temporarily away or moved permanently over the three years period (about two-third of the cases). In addition, marital instability (divorce, separation, remarriage) caused another 8.5% of the 1998 respondents to leave the surveyed area. Finally, 13.4% of the female respondents and 10.8% of the male respondents died between 1998 and 2001, and verbal autopsies indicate that about 75% of these deaths might be related to AIDS-causes (Doctor and Weinreb 2003).

The sample used in this paper is further restricted to the set of respondents with no missing data on any of the variables used in the multivariate models. In order to allow comparisons between outcomes and model specifications, listwise deletion was applied to remove cases with missing data for all the variables included in all the models (Long 1997:67). Most of the variables have less than 2% of missing data (including the outcomes). The variables with the most missing data or "don't know" answers are the following control variables: whether the household is polygamous (missing for 9% of the women and 3.4% of the men), the number of acquaintances suspected to have died from AIDS in the last 12 months (unknown by 4.8% of the women and 3.1% of the men), whether the respondent can get AIDS if sex with someone whole looks perfectly healthy (unknown by 4.1% of the women and 1.2% of the men), whether any large public health activities were done in the village within the last three years (missing for 4.1% of the women and 3.2% of the men).

To avoid dropping respondents with missing or unknown information for these variables, these control variables have been treated as polytomous categorical variables with missing or unknown as one of the category. The effect of the listwise deletion on all the other variables with

missing data is to reduce the original sample by 7.8% for women (n=1448 instead of 1570) and 6.3% for men (n=917 instead of 979). As seen in Table 1, the distribution of the sub-sample of respondents remains overall very close to the original sample despite a few statistically significant differences for some of the control variables (e.g., some of the women dropped from the analysis are more socially isolated, they live more often in polygamous unions, and suspect more often their husband to have some extramarital relationships).

Treatment of outliers

Some of the reported count data (e.g., number of local social events attended last year and last month, uncensored number of conversation partners for AIDS, number of acquaintances who died of AIDS) are strongly skewed with the majority of respondents clustered in the lower ranges of the distributions and small numbers reporting very large values. While cases with extreme values are very few (i.e., the upper 0.5% of the distributions), these outliers can distort some of the statistical analyses and descriptive statistics. Therefore, I decided to truncate these cases at the 99.5^{th} percentile to reduce the influence of outlying values. The decision to use the 99.5^{th} percentile was justified to preserve as much as possible the genuine distributions while correcting extreme values by more plausible responses. The truncation was done by sex and it affected less than 10 individuals in each case (e.g., 0.5% of each sample).

Variables

Dependent variables

To assess the effect of the various measures of social interactions under investigation, I focus my attention on four variables considered to play some important role for HIV prevention, and already examined by several authors in different settings (Behrman, Kohler and Watkins 2002b; Bühler and Kohler 2002; Smith 2002). These are: (1) worry of getting AIDS, (2) attitudes toward avoiding extramarital sexual behavior, (3) approval of condom use outside marriage, and (4) ever-use some condoms.

The worry of getting AIDS ("How worried are you that you might catch AIDS?") is used here as a proxy to measure the respondents' perceived risk of becoming infected with HIV/AIDS. According to conceptual models of individual behavior change, the greater the individual risk perception the likelier an individual is to adopt a protective strategy and/or to avoid high-risk behaviors. In short, risk perception can be a precursor to change. But because individuals tend to underreport their own risks, a measure of worry of getting AIDS has been used by several authors (Behrman et al. 2002b:16; Smith 2002:5). The worry measure is a scale composed of three categories: "not worried at all" (0), "worried a little" (1), "worried a lot" (2) and "don't know" coded as missing. For the purpose of this analysis, I have recoded these responses into a dichotomous measure simply indicating whether the respondent is worried (a little or a lot) or is not at all. Overall, as seen in Table 1 (panel c), 70.8% of the women and 58.4% of the men were worried of getting AIDS in 2001.

The next two measures are attitudinal and relate to the favored methods of avoiding HIV/AIDS infection (Bühler and Kohler 2002; Smith 2002; Watkins and Schatz 2001; Zulu and Chepngeno 2002). All respondents were asked to spontaneously give (i.e., without any prompting) one or more answers to the following question: "What do you think are the best ways to protect yourself from getting AIDS?". Among the possible answers, I focus my analysis, like Bühler and Kohler (2002:11), on the prevention strategies widely advocated as being the most effective:

namely avoiding extramarital sexual behavior and condom use outside marriage. Each of these variables is a dichotomous measure composed of one or several items.

Out of the best ways to protect oneself from getting AIDS, avoiding extramarital sexual behavior is equal to 1 for all respondents favoring matrimonial fidelity (i..e., "avoiding sexual relations with any partners except spouse") as well as for those favoring avoiding risky sexual behaviors (i.e., with any of the following: "Prostitutes/Bargirls", "Many partners", "People from town", "Other people you think might be infected"), and 0 otherwise. In 2001, the majority of individuals (i.e., 75.6% of women and 74.7% of men) reported avoiding extramarital sexual behavior as their favored protective strategy.

Favoring condom use outside marriage equals 1 if the respondent favor using condoms with any of the following: "*All* other partners except spouse", "Prostitutes/Bargirls", "People from town", "Other people you think might be infected"; and 0 otherwise. In 2001, only 39.3% of the men and 27.9% of the women cited one of these protective strategies as their favored method of avoiding HIV/AIDS (Table 1, panel c). While the acceptability of condom use outside marriage remains rather low in rural Malawi, it is worth noting that these percentages doubled for both sexes within the last three years prior to the survey (respectively from 19.4% for men and 14.6% for women in 1998).

While knowledge and attitudes are important elements contributing to behavior change, knowing whether the respondent (or her husband) ever-used some condoms is valuable to assess the impact of HIV prevention programmes, and the extent individuals have been translating their reported attitudes into practices. To increase the robustness and completeness of responses about condom use, I constructed like Smith's (2002:7) a dichotomous indicator from different questions indicating whether the respondent ever used condoms "with premarital lovers, with extramarital lovers, and as a form of contraception". In 2001, 31.8% of the men and 8.9% of the women reported in 2001 having ever used some condoms (Table1). This still remains rather low but indicates a substantial increase (from 19.5% and 2.9% respectively for men and women in 1998) probably both in reporting and in usage during this three years period.

Independent variables

The key independent variables in this analysis are two sets of measures of social interactions summarizing the respondent's AIDS conversation network and participation in social events. As explained earlier in the analytical framework section, I classified the respondents into *four groups of social integration* based on the structural and compositional characteristics of their AIDS conversation network. The social integration categories vary from isolated to low, medium and high (with the medium group used as reference). According to this definition, the more respondents are socially integrated the more the AIDS conversation partners not only know each other, but they also have some strong ties with each other as well as with the respondent. They also more often spoke with relatives, and with people living in the same village (or surrounding area). Similarly, I classified the respondents in *three groups of social participation* (e.g., "low", "medium" or "high") based on the extent they have been attending multiple social events compared to other people. The medium category is used as reference group.

In some alternative model specifications, I use the *components* of these measures of social interactions instead of their grouped summaries. In the case of the AIDS conversation network characteristics, the variables examined focus on: (1) the size of the conversation network thru (a) the censored number of AIDS conversation partners for which detailed data were collected (varying from 0 to 4), and (b) the uncensored size of the AIDS conversation network (i.e., the total

number of AIDS conversation partners[7]), (2) the density of ties between alters (i.e., the extent the conversation partners know each others) measured using the proportion of existing ties relative to those possible between alters (varying between 0 and 1), (3) the strength of ties between alters and ego thru (a) the average strength of ties with ego based on kinship and closeness[8] (varying between 0 and 1), and (b) the fraction of strong ties[9] with ego, as well as (4) the strength of ties between alters thru (c) the average closeness between conversation partners[10] (varying between 0 and 3), and (d) the fraction of strong ties between them. Finally, a set of variables examines the compositional homogeneity of the conversation network by focusing on (5) the homophily between alters and ego using (a) the fraction of alters of the same gender as ego, (b) the fraction of alters relative with ego, (c) the fraction of alters living in the same village as ego, (d) the fraction of alters living in the same county ("traditional authority") as ego, as well as (6) the alters homogeneity by examining (a) the closeness homogeneity between alters and (b) the gender homogeneity between alters (both measures varying between 0 and 1)[11].

Regarding the participation in local social events, I use the respondent's mean percentile (i.e., averaging the percentile rank for the number of times the respondent went last year and last month) for the following six types of events or places: (1) funerals, (2) drama performances, (3) weddings, (4) prayer meetings, (5) political meetings, (6) bars.

Specific individual, household and community characteristics that have been found to be important predictors of our outcomes in the literature are also controlled for in the multivariate models. This set of independent variables can be divided in three main groups: socio-demographic, protective factors, and risk factors. The distribution of the sample for some of these independent variables is provided in Table 1. Individual socio-demographic characteristics are controlled for using the following set of variables: age (continuous and squared), marital status (married or not), education (none, at least some primary or secondary), religion (Catholic, Protestant, Evangelical/Revivalist, Moslem, African Churches), ethnicity (Yao, Chewa, Lomwe, Tumbuka,

7. To adjust for the positive skewness of the distribution and for the fact that some respondents have no conversation partner, I used a started log transformation ($x' = \ln(x+1)$) to avoid log of zero which is undefined (Fox 1997:64-67; Mosteller and Tukey 1977:93-112).

8. The degree of emotional intensity (i.e., role relationship or degree of kinship) has been recoded into the following 6 ordered categories: (1) "No relations", (2) "acquaintances", (3) "friends", (4) "in-laws", (5) "kins", (6) "siblings". The degree of closeness is coded using the following scale: (1) "met once or twice", (2) "acquaintances", (3) "just friends", (4) "confidants". To take into account the multidimensional aspect of the tie strengths as conceptualized by Granovetter (1973:1361), I combine both tie characteristics by treating them as continuous variables and rescaling their multiplicative score. The joint product of the two scales varies between 1 and 24, and is rescaled between 0-1 using the maximum score (24). Marsden and Campbell (1984:498) have shown that these two dimensions provide the most robust measure of the unobserved tie strength concept.

9. Following Granovetter (1973:1361), ties identified by respondents as acquaintances or "just friends" are classified here as "weak" ties, and those between confidants as "strong" ties based on the closeness of the relationships. Adding kinship to the measure (e.g., for the ties with the respondent) allows defining the following set of ties as stronger ones: acquaintances who are siblings, friends who are in-laws/kins/siblings, and confidants who are friends/in-laws/kins/siblings and all other combinations are treated as weaker ties.

10. Closeness is measured on a scale between 0 (for "strangers") and 3 (for "confidants") with a score of 1 for "acquaintances", 2 for "just friends", and missing when the respondent does not know. This scale is treated as continuous, and the value for the different ties is summarized by the mean for each respondent

11. To measure homogeneity, I use the complement of the index of qualitative variation (i.e., 1-IQV) (Agresti and Agresti 1978:208; Bohrnstedt and Knoke 1988:75-98) which varies between 0 (greatest heterogeneity) and 1 (greatest homogeneity).

Ngoni, Senga, Other), region (north, Centre, and South), and wealth quintiles (from poorest to wealthiest) based on Filmer and Pritchett's (1999) approach[12].

Variables susceptible to play some "protective" role are organized in four groups. The first one is individual empowerment. Individual autonomy, in particular, is considered a pre-condition to develop life-skill strategies against HIV/AIDS. This issue is controlled for using the following set of variables: (1) whether the respondent does any work generating income (dichotomous), (2) whether the respondent has some control over reproduction (scale constructed only for women), (3) a set of five dummy variables about women's autonomy (e.g., whether the spouse would leave in case the partner neglects the household, is sexually unfaithful, might be infected with AIDS, use some family planning, etc.).

But individual knowledge and exposure to public health information are also important dimensions in models of behavior change. Knowledge about HIV/AIDS transmission (the second group of "protective" factors) is controlled for using two variables: (1) whether the respondents know that they can get AIDS if they have sex with someone who looks perfectly healthy (dichotomous), and (2) what are their chances to get AIDS from one-time sex with someone infected with AIDS (none/low, high, certain). The respondent's exposure to HIV/AIDS information through media and public health services (the third group of protective factors) is controlled through the following set of variables: (1) whether the respondent heard any AIDS messages at home from some community-based health worker (dichotomous), (2) the number of different sources of AIDS information the respondent was exposed to (from 0 to 3 for clinic/hospital, radio, and home-visit by health worker), and (3) whether there was any large public health initiatives in the village in the last three years (dichotomous). Finally, the potential influence of greater exposure to AIDS deaths on the respondents' attitudes and behaviors (the fourth "protective" factor) is also controlled for using the number of acquaintances they suspected to have died from AIDS in the last 12 months.

Several important individual risk factors are also controlled for. The first one is geographic mobility. More intense contacts with urban communities, trading centers and roads, have commonly been associated with higher HIV prevalence and risk factors (Barongo et al. 1992; Serwadda et al. 1995; Shabbir and Larson 1995; Wawer et al. 1991; World Bank 1999). Labor migrations and geographic mobility is controlled through the following set of dummy variables: (1) whether the respondents have ever been to the regional capital cities (never, only to own region's capital city, to neighboring region's capital city, to all three capital cities), (2) whether they have been out of the country, and (3) whether they ever stayed outside the district for more than one month.

Sexual behaviors form another set of risk factors which are much more difficult to measure. Collecting such information is notoriously difficult, and suffers from chronic misreporting. Sexual activity is indirectly measured using the number of children ever born as crude proxy. The survey also provides two standard measures of sexual behaviors: whether the respondent had some extramarital sex in the past year and whether the respondent (or her husband) ever used condoms. While the survey collected further details about the frequency and patterns of such behaviors, only dichotomous measures are used here to increase the robustness and completeness of the responses.

12. The quintiles are based on a wealth index computed by principal component analysis using household durables assets (i.e., consumer goods: ownership of a bicycle, bed with mattress, paraffin glass lamp, radio and whether it is working or not), as well as agricultural possessions (i.e., livestock such as number of cattle, goats, pigs and poultry owned by the household, land holding in acres), and living standard characteristics (i.e., house construction material, roof material, pit latrine, number of days the respondent eat some meat or fish last week).

The first one is simply based on the question "Have you yourself slept with anyone other than your husband/wife in the last 12 months." The second one has been presented earlier as one of the outcome of interest in this analysis, and is used as control in other multivariate models.

Beside individual risk factors, several spousal and household characteristics are also known to increase HIV/AIDS exposure and are control for through the following variables: (1) whether the union is polygamous (dichotomous), (2) the age difference between husband-wife (continuous), (3) whether the respondent suspects the spouse to have any extramarital relationships (dichotomous), (4) whether the spouse usually lives elsewhere (dichotomous).

Finally, a set of community characteristics is used to control for the proximity to urban centers (average distances in km to closest public facility and to closest town) and the level of development of the village (i.e., the village total population (log transformed), the fractions of households with pit latrine and with metal roof, and the village contraceptive prevalence rate (all methods)).

Research methods

In this paper, I use an econometric model proposed by Montgomery and Casterline (1996) to analyze the data cross-sectionally. The model has the form: $Y_{i,t}^* = X_{i,t}\beta_1 + Z_{i,t}\beta_2 + W_{i,t}\beta_3 + SI_{j,t}\beta_4 + u_{i,t}$ where:

- $Y_{i,t}^*$ = outcome variable of interest (e.g., condom use) for individual i at time t
- $X_{i,t}$ = vector of conventional demographic and socio-economic covariates predetermined at time t (e.g., age, marital status, education level, household wealth, religion, ethnic group, region, etc.) for individual i
- $Z_{i,t}$ = vector of protective covariates about individual empowerment, knowledge and exposure to AIDS prevention and counseling (e.g., chances to get AIDS, exposure to mass-media and public health campaigns, contacts with local health workers, etc.) for individual i at time t
- $W_{i,t}$ = vector of risk factor indicators (geographic mobility, sexual behaviors, spousal and households features, community characteristics) for individual i at time t
- $SI_{i,t}$ = vector of social interaction characteristics for individual i at time t which can be summarized by some summary indices of social participation and social integration or analyzed using their individual components
- $u_{i,t}$ = disturbance term for individual i at time t that incorporates a random error term $e_{i,t}$ (to take into account for instance the randomness in the availability or prices of condoms), and a vector of unmeasured fixed factors f_i affecting the motivation for individual i to adopt the outcome of interest (e.g., predetermined physiological and psychological individual characteristics, unobserved community characteristics, etc. that are likely to be correlated with covariates $SI_{i,t}$ or $X_{i,t}$, $Z_{i,t}$, $W_{i,t}$).

Logistic regressions are used to analyze the four dichotomous outcomes of interest. Robust estimates of standard errors are obtained using the Huber-White sandwich estimator of variance to adjust for the clustering of respondents in villages. Since sexual attitudes and practices can vary by gender, estimations are performed separately for men and women to obtain unbiased estimates (men and women interviewed are not independent observations, they are married or in consensual unions, and they share some common household characteristics).

As analytical strategy I estimate a series of models for each outcome. I first estimate a zero-order or bivariate model that includes only the summary measures of social integration (Table 3a) or social participation (Table 3b). The following sets of models are all multivariate ones controlling for the same set of individual, household and community covariates. In a first part (Tables 4), I present the results for these summary measures (panel a): first separately and then combined. The first model focuses on the social integration groups. The second model examines the social events participation groups. The third model includes both sets of measures and investigates whether any of the statistical effects noted in the previous models remain significant. In a second part (Tables 5), I follow the same approach but instead I include in the statistical models the variables used to create these summary measures. These alternative model specifications are useful to see how these summary measures perform compared to their individual components. All the coefficients presented are the odds-ratios.

Results

AIDS social network and social interactions

Bivariate Analysis. Table 3a presents for each sex the percentage distributions of the dependent variables according to the group of social integration. Overall, the level of social integration appears to have a statistically significant relationship (at 5% level) only for some outcomes, and essentially only for women. The main contrast appears to exist primarily between those lacking social integration and the rest.

A relatively clear gradient appears to exist for women: the more socially integrated they are the more worried they are of getting AIDS: only 50.0% of isolated women are worried while 74.7% of those most socially integrated are worried. Similarly, the more women are socially isolated and the less likely they are to have ever-used some condoms with their partners: none of the most isolated ones have ever used compare to more than 8% of them among the more socially integrated ones (i.e., medium and high groups).

For men, with respect to almost all outcomes no statistically significant differences appear to exist between social integration groups. Like for women, the main difference appears to be concentrated primarily in respect to worry about getting AIDS and having ever used some condoms. But unlike for women, greater social integration appears to be associated with slightly lower worry and condom use.

Multivariate Analysis. I find that these relationships noted at the bivariate level remain statistically significant even after controlling for individual socio-demographic differences as well as protective covariates and potential risk factors (Tables 4a and 4b - columns 1). They also remain as statistically significant even after taking into account social participation (columns 3).

The level of social integration – or rather the lack of it - appears to play a critical role predominantly for the most isolated women. For instance, women with low social integration (n=265) have 32% lower odds than those with medium social integration to worry about getting AIDS, and the most isolated women experience (n=42) even a 62% percent decrease in their odds of being worried – everything else being equal (Table 4a). Translated in predicted probabilities, this means that on average, respectively about 55% of the socially isolated women are worried compared to 69% of them in the low social integration groups and about 76% of them in the medium and high social integration groups (everything else being equal). Similarly, women with low social integration have 55% lower odds than those in the medium group of social integration to have ever used some condoms. Interestingly, differences in social integration do not appear to

have any statistically significant effect on women's attitude toward protective strategies (either toward matrimonial fidelity or condom use outside marriage).

As seen in Table 5a (column 1 – panel a), the characteristics of the AIDS conversation network having the most statistically significant relationships with these outcomes vary depending of the dependent variable. While the size of the conversation network and the extent to which conversation partners know each others (i.e., density of ties) do not appear to have any statistically significant effects at $p < 0.10$, the gender of the conversation partners and their geographic proximity seem to affect women's worry about AIDS: greater heterogeneity in particular appears to increase the odds of being worried. For instance, the greater the proportion of conversation partners of the same gender as the respondent, the smaller the proportion of respondents who are worried of getting AIDS (everything else being equal): the predicted probability of being worried is 70% if all partners are women while it is 91% if all of them would be men (an unlikely situation). Similar, the more the conversation partners come from the same surrounding area (rather than the village itself), the more likely the respondent is to be worried: if all of them are from outside the village, the predicted probability of being worried is 77% compared to 51% if all of them are from the village.

In respect to having ever-used some condoms, the strength of ties between the respondent and her conversation partners matters the most: the predicted probability of having ever-used some condoms is 17% for women with the maximum strength of ties compared to nearly 0% for those with the weakest ties. The effect of having all their conversations partners from their village makes only a marginal difference (4% of women having ever ever-used some condoms compared to 2% if none of the conversation partners are from the village).

Finally, attitudes toward matrimonial fidelity are encouraged by having some conversations partners who have some strong ties with each other, but a greater fraction of strong ties also leads to decreasing the odds of favoring matrimonial fidelity. Similarly, a greater fraction of strong ties between the respondents and their conversation partners decreases the likelihood for women to favor condom use outside marriage as protective strategy: the predicted probability varying between 18% if all the ties are strong to 34% if all of them are weak. This is partially confirmed as well through the closeness of the conversation partners: the more similar they are with each others, the lower the proportion of women favoring condom use (21% if all conversation partners have the same closeness compared to 29% if there are all different).

In the case of men, as noted earlier for the bivariate relationships, the level of social integration appears to have an opposite effect than for women: the most socially integrated men (n=216) have 40% lower odds to worry of getting AIDS compared to those in the medium group (n=495) of social integration while the most isolated ones (n=14) have 41% greater odds of being worried of getting AIDS (Table 4b - columns 1). The gradient, however, is not that clear since men in the low social integration group (n=192) have also 15% lower odds to worry of getting AIDS than those in the medium group. Holding everything else constant, on average, about 72% of the most socially isolated men are worried while these percentages vary from 62% to 53% for men in the low or high group of social integration (about 66% of the men are worried in the medium group).

As for having ever-used some condoms, low socially integrated men have 25% higher odds than those with medium social integration to have ever used some condoms while those in higher social integration groups have 9% lower odds. But the overall relationship is not statistically significant ($p > 0.40$) after controlling for the full set of covariates. It is also worth noting that, like for women, differences in social integration do not appear to have any statistically significant

effect on men's attitudes toward protective strategies (i.e., matrimonial fidelity or condom use outside marriage).

A closer look at the individual characteristics of the AIDS conversation network for men (Table 5b – column 1, panel a) indicates that like for women, the gender composition has an influence on the respondent's concern of getting AIDS. But in this case, the more homogeneous the conversation network, the greater the likelihood to be worried about AIDS: if all the conversation partners are men, the predicted probability for a man to worry about getting AIDS is 66% compared to 37% if all the conversation partners are women (rather unlikely). But greater gender homogeneity of the conversation partners also decreases men's odds to worry about getting AIDS: everything else being equal, 59% of the men are worry of getting AIDS if all the conversation partners are of the same gender compared to 84% of them if there is maximum gender heterogeneity.

In respect to having ever-used some condoms, one the characteristics of the AIDS conversation network that matters the most is the number of conversation partners, and in particular whether a man spoke about AIDS with at least two or more persons: while the odds of having ever-used some condoms increases by about 50% by conversation partner, the effect is not linear. Everything else being equal, the percentage of men who ever-used some condoms varies from: 7% for those without any AIDS conversation partner, to 10% for those who spoke to only one person, and respectively to 15% for those with two partners, 21% for those with three partners and 28% for those with four partners. While having a small core group of conversation partners appears to matter, having a much larger number of conversation partners has limited effects (i.e., the uncensored size of the conversation network is not statistically significant). It is also worth noting that condom user increase with greater heterogeneity of the conversation partners, especially in respect to kinship ties and gender composition. For instance, after controlling for other covariates, the percentage of condom users varies on average from 12% if the respondents spoke only with kins to 36% if they didn't speak to any kin. As for the gender composition, if all the conversation partners are from the same gender, the percentage of condom users is only 25% while it is 44% if there is maximum gender heterogeneity.

Regarding protective attitudes, several characteristics of the AIDS conversation network appear to matter significantly for men. A higher percentage of them, for instance, favor avoiding extramarital sexual behaviors if they have a high proportion of strong ties with their conversation partners (i.e., only 66% favor matrimonial fidelity if they only have no strong ties with any of their conversation partners compared to 86% if they only have strong ties with all of them). But while strong ties with the respondent matters, greater heterogeneity among conversation partners is also important: if all the conversation partners have some strong ties with each others, then only 50% of the respondents favor matrimonial fidelity compared to 82% of them if they all their conversations partners only have weak ties with each other. As for favoring condom use outside marriage as protective strategy, the most important characteristic that matter is the proportion of ties with kins. The percentage of men favoring this strategy varies, for instance, from 29% if none of the AIDS conversation partners are related with the respondents to 57% if they are all kins with them (holding everything else equal). But the average strength of ties also matters: the greater the closeness with the respondents and the less likely they favor this strategy. For instance, the percentage of men favoring condom use outside marriage varies from 15% to 62% whether the strength of ties with all the conversation partners is the strongest or weakest.

Social participation in local events

While the number of times each individual went at specific events or places varies, it is expected that the overall propensity to go more often to many of them might influence individual attitudes and behavior regarding AIDS. At least two processes might be at work here: (1) the nature and the high frequency of some of these events (e.g., funerals) might have some psychosocial effects on the individual, and (2) these gatherings offer an opportunity to exchange information between friends and relatives. One way to examine whether the attendance to these various social events overall matters is to look at the effects different levels of social participation have, and in particular whether low participators and high participators have some outcomes statistically significant different. The relative participation in specific events, furthermore, can tell us about the importance of the participation to particular events.

Bivariate Analysis. At first glance, as indicated by the bivariate relationships between the level of social participation and different AIDS-related outcomes (Table 3b), social participation appears to make some statistically significant differences at 5% level in a number of cases: for women, greater social participation is positively associated to being more worried of getting AIDS (i.e., 81.8% of high participators are compared to 68.6% of low participators) and to a greater chance of reporting ever use of condoms (i.e., 15.1% for high participators compared to 5.8% for low ones). But social participation does not appear to have any significant effect on favoring any particular protective strategy.

The overall effect of social participation for men appears somewhat different. In fact, a greater social participation seems to have a dual effect: on one hand, it substantially increases the chance of having ever used some condoms: 42% of high participators have ever used some while only 21.4% of low participators have. Similarly, greater social participation is also associated with favoring more condom use outside marriage as protective measure: 57.3% of high participators do compared to 32.2% of low ones. This appears to occur to the detriment of favoring matrimonial fidelity: while 79.0% of low participators favor avoiding extramarital sexual behaviors as one of their best protective strategy, this percentage decreases to 68.5% among high participators.

Multivariate Analysis. After controlling for various individual and community characteristics (Tables 4a and 4b – columns 2), only some of the strongest relationships noted at the bivariate level remain statistically significant overall while several others remain significant only for particular categories. Secondly, the effects of social participation appear larger and statistically more significant for men than for women. Thirdly, the differences between groups of social participation are non-linear with larger effects for the individuals participating more than the average than for those participating less. Finally, the effects are robust and remain even after controlling for groups of social integration (panel a columns 3 in Tables 4a and 4b).

In the case of women, social participation has only limited effects, too weak to remain statistically significant overall. While the overall directions of the relationships remain for the two outcomes with the stronger bivariate relationships (i.e., worry about getting AIDS and having ever-used some condoms), the effects are not linear: higher female participators, for instance, have higher odds to be worried (about 60% higher) than those in the medium group but almost no difference exists between the low and medium groups. In term of predicted probability, this means that about 81% of high participator women are worried compared to 73% among women in lower groups of social participation (everything else being equal). On the other hand, while high and medium participators have virtually the same odds in respect to having ever-used some condoms, those in the lowest group have 35% lower odds to ever have used some condoms. Finally, like for social integration, social participation appears to only have limited or no statistically significant

effect on women's attitude toward protective strategies. While no significant difference appears to exist for condom use outside marriage, women's attitude toward matrimonial fidelity vary: in both cases (controlling for everything else), on average low or high social participator women more frequently favor this strategy (respectively 80% and 79%) compared to those in the medium group of social participation (about 75%).

As for men, the three significant bivariate effects noted earlier remain even after controlling for individual characteristics. Everything being equal, on average the odds of favoring condom use outside marriage are 16% lower for low participators than for men in the medium group while they are 150% higher for high participators. In term of predicted probability, this means that on average about 31% of the low participators favor this strategy compared to 35% in the medium group and 56% among those in the high group. This pattern is not limited to the attitude toward condoms, it also applies to behavior: the odds to have ever-used some condoms are 37% lower for low participators than for men in the medium group, while they are 44% higher for high participators. In this case, this means that on average about 20% of the low participator men have ever-used some condoms compared to 28% in the medium group and 36% in the high participation group, holding everything else constant. As noted earlier, this pattern occurs to the detriment of matrimonial fidelity: high participators have 44% lower odds to favor this strategy than men in the medium group of participation while low participators have 35% higher odds to favor its as one of their protective strategy. This translates in term of predicted probability into 81% of low participator men favoring matrimonial fidelity compared to 68% among high participators.

The effects of participating to each of these social events on various AIDS-related outcomes can also be examined in a similar fashion to better understand some of the variations observed. Tables 5a and 5b present the results respectively for women and men.

For women, the lack of relationship between social participation and the outcomes investigated remains for most individual events. The only three events having some statistically significant effects are the funerals, weddings and drama performances, but the effects are relatively small. As seen in the last columns of Table 5a (panel a), the more a woman attends some funerals (compared to the rest of all the other women), the lower her odds to have ever-used some condoms (her odds decreasing by 1% for each percentile). The effect, however, is relative small: everything being equal, on average the predicted probability for women of having ever used some condom varies between 5% if she was in the lowest decile of women attending funerals and 2% if she was in the highest decile. Relatively low or high funeral attendance has also a limited effect (not statistically significant, $p>0.30$) on the percentage of women worried of getting AIDS which varies from 71% among those in the lowest decile to 77% for those in the highest decile.

Similarly, while a greater attendance in weddings increases women's odds to have ever-used some condoms (by about 1% per percentile), the predicted probability of having ever used some condoms only varies respectively between 2.8% and 6.0% for those in the lowest or highest deciles. Finally, greater attendance in drama performances has only limited effects for women, it slightly decreases their odds (by about 0.5%) to favor condom use outside marriage as their protective strategy ($p=0.05$). In term of predicted probability, the percentage of women favoring this strategy decreases from 25% among those in the lowest decile to 19% for those in the highest decile.

For men, the attendance in three types of social events is statistically more significant than the participation in other ones. These more significant events are the political meetings, drama performances, and going to bars which happen to be also the events more frequently attended by

men than women. A greater attendance in political meetings, for instance, increases men's odds to worry of getting AIDS (about 1% for each participation percentile). This means that, controlling for everything else, the percentage of worried men varies on average from about 60% for those attending the least political meetings (i.e., those in the lowest decile) to about 69% for those attending the most meetings (i.e., the highest decile). A similar but much smaller effect (not statistically significant) also exists in respect to favoring condom use outside marriage as protective strategy which varies from 36% to 40% whether men attend few or many political meetings. But such attendance does not make any difference regarding attitudes favoring matrimonial fidelity or having ever-used some condoms.

Drama performances have a somewhat different effect for men: on one hand a greater attendance decreases their odds (by about 1% for each participation percentile) to favor matrimonial fidelity as one of their protective strategy (the percentage of men citing matrimonial fidelity as one of their strategy varying from 70% to 78% between the lowest and highest deciles of participators). Similarly, the percentage of men worry of getting AIDS also decreases from 63% to 59% between these extreme groups of participants. On the other hand, a greater attendance is also associated to more positive attitudes towards condoms: the men's predicted probabilities vary between the lowest and the highest deciles respectively from 34% to 49% in favor of condom use outside marriage and from 24% to 40% for having ever-used some condoms. While not statistically significant, some similar patterns exist for men in respect to their attendance in prayer meetings.

While going to local bars is primarily to socialize with friends and acquaintances, only a fraction of the people do: only 30% of the men and 10% of the women reported to have been at least once last year[13]. Going to bars (or beer drinking places) increases significantly men's odds (by about 1% for each percentile) to favor condom use outside marriage and to have ever-used some condoms. Controlling for everything else, on average, the percentage of men varies between those going the least and those going the most (i.e., the lowest and highest deciles) from 35% to 45% of them favoring condom use outside marriage and from 26% to 33% of men having ever-used some condoms. A similar, but smaller, increase occurs in respect to worry about AIDS which increases from 61% to 65%, but this also takes place to the detriment of favoring matrimonial fidelity which decreases from 78% to 71%.

While funerals are so frequent, the attendance of a greater number of them has only limited to no statistical effects on any of the outcomes considered, even if a greater attendance makes a larger difference for men than for women: on average, the percentage of women worry of getting AIDS varies from 72% to 76% between those attending the least and those attending the most (i.e., the two extreme deciles) while among men the percentage varies from 58% to 67%. But a greater attendance of funerals for men is also associated to a lower percentage of them favoring matrimonial fidelity which decreases from 81% to 72% between the lowest and highest participators. But no such variation exists in respect to attitude and use of condoms.

13. Note that while it is possible that some respondents did not like to disclose their drinking habits, there is no evidence of systematic under-reporting.

Discussion

AIDS conversation network

As it has just been seen, participation in local social events can have substantial effects on some HIV protective attitudes and practices, and since the most statistically significant effects occur for the individuals participating the most, it was reasonable to expect that high social integration (i.e., through a large, cohesive but relatively close set of AIDS conversation partners) would also be associated with significant effects on individual HIV protective attitudes and practices. But unexpectedly, high social integration appears to produce very few statistically significant effects. It is instead social isolation (i.e., the lack or insufficient number of close conversation partners) that has negative effects on different outcomes.

In general, involvement in social relationships has been found to play an important role in preventive health behavior (Broman 1993), and people more socially engaged are expected to have more preventive behaviors than those socially more isolated. In Western countries and Japan, for instance, socially isolated individuals have been found to have two to four times higher risk of overall mortality compare to those with more ties to friends, relatives, and community (Eng et al. 2002:700).

In the case of women, the lack or insufficient number of close conversation partners translates in a lack of information (i.e., social learning) and/or exposure to strong ties from peers or close friends (i.e., social influence). A lack of social integration, for instance, is associated with lower odds of being worried about AIDS and to have ever-used some condoms. This could indicate that women's AIDS conversation networks provide greater exposure to information, and are critical for social learning. This seems partially confirmed for women's worry about getting AIDS which increases with the greater compositional heterogeneity in gender and geographic proximity: the less the conversation partners are also women or are from the same village as the respondent, the greater the percentage of women worried, but the more socially isolated individuals lack this broader social exposure.

In respect to condom use, having some very strong ties matters the most which might indicate a greater role played by social influence for this outcome. In this case, it is not so much the quantity of strong ties that matters, it's the existence of some very strong ones that is really important. Having at least one very close friend or relative provides not only some opportunity for social learning, but also some peer influence, potentially through greater trust and respect. A similar but much weaker pattern also appears to exist for attitudes towards favoring matrimonial fidelity or condom use outside marriage as protective strategies.

At the opposite, for men, a greater social integration is associated with lower percentage of men worried about getting AIDS or of having ever-used some condoms. A possible explanation for this situation could be that social influence play a greater role in men's AIDS conversation networks than for women. In this case, the more dense and homogeneous the conversation network is, the more normative the effects are (social influence). While greater male "dominance" of the conversation network increases men's likelihood to worry about AIDS, the more heterogeneous and the looser the ties with the respondent, and the likelier they are worried about AIDS and use condoms (social learning)].

A somewhat similar pattern seems to exist in respect to favoring matrimonial fidelity as protective strategy: while a higher proportion of strong ties with the respondent appears to play a positive role (i.e., peer influence favoring matrimonial fidelity), to have too many kin relationships or too many conversation partners knowing each other very well reduce the odds to favor

matrimonial fidelity. In this case, greater homogeneity between alters and kinship ties seems to play a normative role limiting the respondent's options or rather to influence men toward other protective strategies (i.e., condom use outside marriage in the case of kinship ties). Thus the conversation partners having the strongest effect on the respondent are the closest friends and acquaintances not kin with the respondent, and who do not know each other. Everything else being equal, on average, about 93% of the men who have two or more AIDS conversation partners favor matrimonial fidelity if they have these joined characteristics but only 52% do if all the conversation partners have some strong ties with each other and all have kinship ties with the respondent.

Social participation in local events

As expected, higher social participation has been found to be significantly associated with various HIV protective outcomes. But surprisingly, the relationship does not appear to be linear or to follow a gradient. While in a few cases individuals with the lowest social participation have lower or negative outcomes, most of the effects appear concentrated in the group experiencing the highest social participation. What appears to really matter is not the lack but the concentration of social participation. A possible explanation why social participation in local social events has such effect could be that higher social participation provides individuals with a greater quantity and diversity information that allows them to better assess their personal level of risk, as well as to evaluate what protective strategies might be best for them.

In the case of men, for instance, greater attendance in local events appears associated to a greater exposure to people and to conversations influencing not only their attitude toward condom use (i.e., as favored protective strategy outside marriage) but also their behavior (i.e., greater use of condom) to the detriment of favoring matrimonial fidelity as protective strategy. Even if it is reasonable to expect the participation in local social events to be responsible for some of these effects, some selection process is also likely occurring: the higher participators are also likely to be more sexually active and to be higher risk takers. But at this stage of this analysis, it is not possible to parse whether the differences noted between low and high social participators in respect to AIDS-related outcomes are due to different unobserved characteristics between these individuals (e.g., individuals more socials are self-selected and have different psychosocial traits making them more susceptible to have these outcomes) or whether social participation itself has a real causal effect affecting individual attitude and behaviors.

But, as seen in the case of funerals, attendance in frequently occurring events does not necessarily translate in significant differences in individual attitudes or behaviors. While several authors (Gregson et al. 1998; Lindan et al. 1991; Macintyre, Brown and Sosler 2001; Ntozi and Kirunga 1997) have found that personal experience of high level of mortality in the community (i.e. knowing people who have died of it, in particular friends or relatives) can be a significant predictor of positive change for individual sexual behaviors (e.g., initiation of condom use, restricting sexual relations to one partner, or reducing the number of sexual partners) in several Eastern and Southern African countries in the mid-1990s. In the case of rural Malawi in 2001, despite the large number of funerals attended by most individuals, greater funeral attendance increases only moderately individual's worry about getting AIDS. In fact, for both men and women, the number of acquaintances suspected to have died from AIDS in the last 12 months prior to the survey has no statistically significant relationship with any of the outcomes.

Without doubt, mortality in these communities is high (Doctor and Weinreb 2003), and funerals are common and well attended. For instance, during the survey field work in summer 2001, at numerous occasions interviews in different villages had to be rescheduled because of

funerals. Qualitative data (Watkins 1999-2003) also indicate that while most people don't openly speak about death or AIDS during the burial, they often talk afterward while walking back home with some friends or while attending some social gathering related to the funerals (cooking or eating some meals with surviving relatives). In this context, funerals are the occasion for different people to meet and to discuss not only various subjects (e.g., family planning in the case of the Luo in rural Kenya (Behrman et al. 2002a:716-717, 724)) but also about AIDS, the life of the deceased and his/her exposure to the disease and the consequences for the surviving relatives. Speaking about death and AIDS, especially in this context, is even more remarkable because of commonly shared beliefs that talking about these subjects can bring bad luck or easily be interpreted by others as wishing or being responsible (witchcraft) for the death or the illness of the person. While nearly everyone associates AIDS to sexual transmission, not everyone is sick or die of AIDS at the same time. This fact can always leave in people's mind room for interpretation why some people who might have similar life style got sick and died, while some other are still fine.

One of the possible explanations to reconcile the paradox that greater exposure to funerals has limited effect on individual attitudes and behaviors might simply be related to the cheer frequency of funerals making most people "blasé" about death and AIDS. In this case, many of these casual conversations remain superficial or have limited impact on the respondents own attitudes or behaviors.

It is worth noting, however, that the most substantial effects are associated not with the most frequent events, but rather with occasional events like political meetings and drama performances. Drama performances, for instance, are relatively rare in these rural communities[14] but people often go to neighboring villages for such shows when they take place. In 2001 about 26% of the women and 38% of the men had attended at least one of these shows in the last 12 months. The subjects covered in these shows are varied, but AIDS and family planning are often featured (this was the case in two-third of the villages surveyed where a show occurred).

Some of the differences in the participation in different types of social events are better understood by considering two dimensions characterizing them: first, whether there are of the private or public sphere, and second whether they are recurrent or occasional. Weddings and funerals, for instance, are by far among the most intimate events in people's life. They are also among the most regulated social events where norms and conventions dictate who should attend these events. Mutual respect, kinship rules and social hierarchy limit individual free will and personal preferences for attending, or not, such events. As a result of these socio-cultural constraints, these events are rather formal events lasting for several days and gathering relatively large groups of people often related by kinship ties. On the other hand, public meetings are often much more informal, last only for brief period of time, and are the occasion for a more diverse group of people to meet to discuss about religion, politics or some public health issue. Prayer meetings, for instance, are recurrent while political meetings and drama performances are occasional and much more connected to the national or local life. A possible explanation of the lower women's participation to these public events could be related to the local norms regulating gender roles, as well as their autonomy status within their household.

Political meetings, drama performances and weddings offer some other types of social events: not only they occur only few times during the year, but participation to them obeys to different characteristics. They offer the occasion for many people - including from surrounding

14. Only 15 of the 125 villages surveyed (13%) had one or more drama or theater troops that came to their village in the last year.

villages - to meet either briefly (e.g., political meetings, drama performances) or for a few days (e.g., weddings). While drama performances have been shown to offer some effective way to increase public awareness about HIV/AIDS and to promote protective strategies (Glik et al. 2002; Valente and Bharath 1999), political meetings to a large extent do not focus on such subject; yet, they do appear to have some positive effects on both men and women. We can hypothesize that it is likely to be the social interactions occurring during these meetings rather than the political discourses that might be responsible for much of these effects. It is worth noting, however, that only a fraction of the men (48%) and of the women (29%) attended such meetings last year. This could be because such meetings are not organized everywhere with the same frequency (i.e., variable depending on some community characteristics like local leadership, village location and size, etc.), as well as on individual participation characteristics (civic commitment, women status and autonomy, etc.).

Overall, these events are also the occasion for a diverse group of people to meet and share conflicting point of views, anecdotes and stories that can either increase men's doubt or confusion about AIDS or reduce their uncertainties, and help them to favor new protective strategies. We hypothesize, for instance, that the messages and social interactions occurring during recent meetings provide men with a source of social learning that decreases their fear about AIDS but also destigmatizes condom use.

Finally, while greater social participation can have some positive outcomes, not all social places have the same effects on individual attitudes and behaviors. This is particularly true for men who visit bars. Not only those going more often to bars have a higher tendency to favor condoms outside marriage as protective measure against AIDS, but they also have more often ever-used some condoms and they have a higher likelihood of reporting extramarital affairs (details not shown). Throughout the literature on HIV/AIDS in Africa, drinking places have been commonly associated with high-risk of HIV transmission (Gysels, Pool and Nnalusiba 2002; Kishindo 1996; Mgalla and Pool 1997; Pickering et al. 1997; Walden, Mwangulube and Makhumula-Nkhoma 1999; World Bank 1999). The strategic location of many of these places (along roads or in trading places), the greater contact with truck drivers, migrant workers, and bar girls; as well as the alcohol consumption, are often considered some of the major cofactors driving the epidemic from urban to rural areas.

Overall, this research indicates that, while the participation to specific types of social events appears to play some role for some AIDS-related outcomes, an overall measure of social participation as used in this paper is able to capture an important latent dimension that would otherwise be omitted. Not only more surveys should collect some information about attendance in local social events, but more researchers should consider analyzing these variables jointly rather than independently. As pointed out by Baum et al. (2000:420), differentiating groups of individuals according to their relative participation in multiple types of events yields great potentials for measurement of social capital in various contexts.

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Table 1. MDIC Survey Sample characteristics (rural Malawi, 2001)

Variables	Women (2001)		Men (2001)	
	Total	Sub-sample	Total	Sub-sample
Total number of cases (*n*)	1,570	1,448	979	917
a. Selected control variables				
Mean age (years)	34.2 (9.7)	34.2 (9.7)	40.1 (10.8)	40.1 (10.8)
Not Married	9.5%	8.8%**	2.8%	2.7%
Education				
- No schooling	33.4%	33.6%	17.7%	17.3%
- At least some primary education	60.0%	59.8%	68.3%	68.7%
- At least some secondary education	6.6%	6.6%	13.9%	14.0%
Religion				
- Catholic	17.3%	17.7%+	19.3%	19.3%
- Protestant	23.3%	23.0%	21.8%	22.5%*
- Revivalist	18.0%	18.3%	20.1%	20.1%
- Muslim	23.5%	23.3%	23.2%	22.6%
- African churches	17.8%	17.7%	15.6%	15.6%
Ethnicity				
- Yao	23.2%	23.0%	23.2%	22.6%+
- Chew a	30.1%	30.8%*	31.3%	31.3%
- Tumbuka	29.5%	28.7%*	26.1%	26.5%
- Others	17.2%	17.5%	19.3%	19.6%
Region				
- North	32.0%	31.3%+	29.5%	30.1%+
- Centre	33.7%	34.6%**	37.3%	37.6%
- South	34.3%	34.1%	33.2%	32.3%*
Geographic mobility				
- Has lived elsewhere 1+ months	9.8%	9.9%	17.7%	18.0%
- Ever been to all three regional capital cities	7.8%	7.7%	28.1%	27.7%
- Spouse usually lives elsewhere	11.8%	11.7%	4.0%	3.9%
Household characteristics				
- Polygamous household	36.0%‡	34.3%**	16.5%†	15.9%
- Self does work generating income	77.3%	77.1%	99.3%	99.2%**
- Has a metal roof	10.4%	9.9%	10.4%	10.3%
HIV/AIDS-related characteristics				
- Had extramarital sex in past year	2.6%	1.6%	9.8%	10.1%*
- Get AIDS if sex with someone who looks perfectly healthy	93.5%†	93.6%	94.3%	94.3%*
- Mean number of sources of HIV/AIDS information exposed to (0-3)	2.3 (0.6)	2.3 (0.6)	2.4 (0.6)	2.4 (0.6)
- Suspect spouse has extramarital relationships	27.3%	26.6%*	4.8%	4.3%*
- Mean number of acquaintances suspected to have died from AIDS in last 12 months	3.5† (3.6)	3.5 (3.6)	4.0† (4.0)	4.1 (4.0)
Community characteristics				
- Village average distance to closest town (km)	20.1	20.1	19.9	20.1
- Any large public health activities in the village in last 3 years	71.6%†	71.2%	72.3†	71.8%
b. Social interaction variables				
AIDS conversation network				
- Socially isolated	3.9%	2.9%**	1.7%	1.5%
- Low social integration	18.7%	18.3%	21.2%	20.9%+
- Medium social integration	55.0%	55.6%+	53.1%	54.0%*
- High social integration	22.5%	23.2%**	23.9%	23.6%
Participation in local social events				
- Low	46.7%	46.6%	28.5%	29.1%+
- Medium	44.6%	44.7%	55.9%	55.3%
- High	8.7%	8.7%	15.6%	15.6%
c. Dependent variables				
- Worry of getting AIDS	70.8%†	70.6%	58.4%	59.0%
- Favor avoiding extramarital sexual behaviors as protective strategy	75.6%	75.8%	74.7%	74.6%
- Favor condom use outside marriage as protective strategy	27.9%	27.3%+	39.3%	39.1%
- Ever used condoms	8.9%	8.6%	31.8%	31.6%

Source: 2001 interviews with ever-married women of reproductive age (i.e., between 15 and 49) and their husbands from the Malawi Diffusion and Ideational Change Project (MDICP).

Notes: All descriptive statistics are based on non-missing data. Standard deviations are shown in parentheses. Unless otherwise indicated, missing cases are less than 2% of the total number of cases. † Missing or "Don't Know" for 2-5% of cases; ‡ Missing or "Don't Know" for 5-10% of cases; § Missing or "Don't Know" for more than 10% of cases.
The difference between the sub-sample of respondents used in this analysis and those not included (due to missing data in one or multiple variables) is statistically significant at the following level: (+) significant at 10%; (*) significant at 5%; (**) significant at 1% (using a two sample t-test with unequal variances)

Table 2a. Summary Statistics: selected AIDS conversation network characteristics by groups of social integration[a] (rural Malawi, 2001)

	Women (2001)					Men (2001)				
Social integration groups[a]	Low	Medium	High	Total	Prob > F	Low	Medium	High	Total	Prob > F
Total number of cases (n)	265	805	336	1448[b]		192	495	216	917[b]	
(% by gender)	18.3[a]	55.6[a]	23.2[a]	100.0[b]		20.9[a]	54.0[a]	23.6[a]	100.0[b]	
1. Network size										
Mean uncensored size of AIDS conversation network	5.53 (5.6)	6.28 (5.13)	5.90 (4.21)	6.04 (5.03)	+	6.99 (7.38)	7.70 (7.37)	7.68 (6.7)	7.54 (7.22)	NS
Mean censored size of AIDS conversation network (0-4)	3.41 (0.96)	3.75 (0.64)	3.70 (0.65)	3.67 (0.73)	**	3.72 (0.65)	3.88 (0.38)	3.89 (0.36)	3.85 (0.45)	**
Proportion with more than four AIDS network partners	0.302 (0.46)	0.447 (0.498)	0.461 (0.499)	0.423 (0.494)		0.375 (0.485)	0.541 (0.499)	0.569 (0.496)	0.513 (0.500)	
2. Density of ties										
Mean density of ties between AIDS conversation partners (0-1)[c]	0.381 (0.389)	0.845 (0.273)	0.962 (0.159)	0.785 (0.343)	**	0.461 (0.375)	0.865 (0.227)	0.969 (0.124)	0.804 (0.309)	**
3. Strength of ties										
between alters and ego										
Mean tie strength with ego (0-1)	0.330 (0.137)	0.462 (0.095)	0.629 (0.106)	0.477 (0.145)	**	0.357 (0.112)	0.444 (0.091)	0.622 (0.102)	0.468 (0.135)	**
Mean fraction of strong ties with ego (0-1)	0.289 (0.339)	0.491 (0.279)	0.901 (0.169)	0.551 (0.342)	**	0.276 (0.302)	0.413 (0.261)	0.831 (0.203)	0.484 (0.327)	**
among alters										
Mean closeness between AIDS conversation partners (0-3)[c]	0.683 (0.714)	1.686 (0.563)	2.129 (0.45)	1.603 (0.745)	**	0.818 (0.658)	1.747 (0.497)	2.134 (0.452)	1.642 (0.696)	**
Mean fraction of strong ties between AIDS conversation partners (0-1)[c]	0.046 (0.145)	0.155 (0.198)	0.286 (0.265)	0.165 (0.222)	**	0.054 (0.127)	0.18 (0.2)	0.329 (0.287)	0.189 (0.231)	**
4. Homogeneity of the network										
Homophily between alters and ego										
Mean proportion of AIDS conversation partners of same gender as ego (0-1)	0.679 (0.371)	0.925 (0.178)	0.972 (0.100)	0.890 (0.239)	**	0.707 (0.319)	0.935 (0.171)	0.979 (0.128)	0.897 (0.227)	**
Mean proportion of AIDS conversation partners who are relatives with ego (0-1)	0.086 (0.175)	0.350 (0.297)	0.826 (0.233)	0.414 (0.364)	**	0.086 (0.160)	0.254 (0.260)	0.698 (0.306)	0.324 (0.336)	**
Mean proportion of AIDS conversation partners living in same village (0-1)	0.252 (0.311)	0.637 (0.344)	0.788 (0.303)	0.600 (0.374)	**	0.310 (0.331)	0.481 (0.369)	0.669 (0.337)	0.490 (0.373)	**
Mean proportion of AIDS conversation partners living in same area (0-1)	0.642 (0.396)	0.919 (0.187)	0.976 (0.097)	0.880 (0.256)	**	0.685 (0.351)	0.916 (0.181)	0.959 (0.152)	0.877 (0.245)	**
Alters homogeneity										
Mean proportion of AIDS conversation partners of same gender (0-1)[c]	0.510 (0.379)	0.535 (0.295)	0.582 (0.264)	0.542 (0.306)	**	0.493 (0.339)	0.484 (0.27)	0.578 (0.276)	0.508 (0.29)	**
Mean proportion of AIDS conversation partners of same closeness (0-1)[c]	0.691 (0.437)	0.918 (0.250)	0.949 (0.201)	0.882 (0.300)	**	0.67 (0.429)	0.939 (0.214)	0.997 (0.051)	0.895 (0.281)	**

Source: 2001 interviews with ever-married women of reproductive age (i.e., between 15 and 49) and their husbands from the Malawi Diffusion and Ideational Change Project (MDICP).

Notes: All descriptive statistics are based on non-missing data. Standards deviation are shown in parentheses.

a. Descriptive statistics computed only for respondents with one or more AIDS conversation partners. Respondents reporting no AIDS conversation partners (2.9% of the women (n=42) and 1.5% of the men (n=14)) are assigned to an isolated group (not included in this table) since all these network characteristics are not applicable for them.

b. Total and percentage include respondents reporting no AIDS conversation partners.

c. Measure computed only for respondents with at least 2 to 4 AIDS conversation partners. Respondents reporting only one AIDS conversation partners are assigned zero per default for these measures.

(NS) p-value not significant at 10% or less; (+) significant at p-value = 10%; (*) significant at p = 5%; (**) significant at p = 1%.

Table 2b. Summary Statistics: attendance in local social events by social participation groups (rural Malawi, 2001)

	Women (2001)					Men (2001)				
Social participation groups	Low	Medium	High	Total	Prob > F	Low	Medium	High	Total	Prob > F
Total number of cases (n)	675	647	126	1448		267	507	143	917	
(% by gender)	46.6	44.7	8.7	100.0		29.1	55.3	15.6	100.0	
a. Mean number of events attended last 12 months										
– Funerals	13.2	19.0	26.8	17.0	**	13.9	19.5	26.8	19	**
	(8.9)	(10.5)	(13)	(10.9)		(9.6)	(12.6)	(16.5)	(13.2)	
– Drama performances	0.3	1.2	3.4	1.0	**	0.3	2.1	5.4	2.1	**
	(1.2)	(2.8)	(4.0)	(2.5)		(1.9)	(4.7)	(6)	(4.6)	
– Weddings	0.4	1.2	2.5	0.9	**	0.2	1.1	2.4	1.1	**
	(1.2)	(1.4)	(1.9)	(1.5)		(0.6)	(1.3)	(1.8)	(1.4)	
– Prayer meetings	3.1	8.3	14.2	6.4	**	3.2	8.3	13.1	7.6	**
	(5.8)	(9.3)	(12.1)	(8.9)		(6.6)	(11.9)	(15.4)	(11.7)	
– Political meetings	0.4	1.0	2.7	0.9	**	0.6	1.8	4.6	1.9	**
	(1.5)	(2.1)	(4.0)	(2.2)		(1.5)	(3.5)	(5)	(3.6)	
– Bars	0.4	1.7	6.0	1.5	**	2.2	16.2	16.6	12.2	**
	(4.3)	(8.3)	(17.6)	(8.3)		(12.8)	(48.6)	(30.9)	(39.3)	
b. Mean number of events attended last 1 month										
– Funerals	3.0	4.7	6.9	4.1	**	3.1	5.2	7	4.9	**
	(2.6)	(3)	(3.7)	(3.1)		(2.6)	(3.5)	(4.3)	(3.6)	
– Drama performances	0.0	0.3	1.1	0.3	**	0.1	0.6	1.9	0.6	**
	(0.4)	(0.9)	(1.2)	(0.8)		(1.0)	(1.4)	(2.8)	(1.7)	
– Weddings	0.0	0.2	0.6	0.2	**	0.0	0.2	0.7	0.2	**
	(0.2)	(0.5)	(0.7)	(0.4)		(0.2)	(0.5)	(0.7)	(0.5)	
– Prayer meetings	0.5	1.4	2.7	1.1	**	0.5	1.4	2.5	1.3	**
	(1.1)	(1.4)	(2.1)	(1.5)		(1.1)	(1.6)	(2.3)	(1.8)	
– Political meetings	0.1	0.2	0.6	0.2	**	0.1	0.3	1.0	0.3	**
	(0.3)	(0.6)	(1.0)	(0.5)		(0.4)	(0.7)	(1.4)	(0.8)	
– Bars	0.1	0.3	1.6	0.3	**	0.5	2.7	4.0	2.3	**
	(1.2)	(1.7)	(3.9)	(1.8)		(2.7)	(6.6)	(7.0)	(5.9)	

Source: 2001 interviews with ever-married women of reproductive age (i.e., between 15 and 49) and their husbands from the Malawi Diffusion and Ideational Change Project (MDICP).

Notes: All descriptive statistics are based on non-missing data. Standards deviation are shown in parentheses.
(NS) p-value not significant at 10% or less; (+) significant at p-value = 10%; (*) significant at p = 5%; (**) significant at p = 1%.

Table 3a. Bivariate analysis of AIDS-related outcomes by social integration groups (rural Malawi)

Social integration group	Women (2001)					Men (2001)				
Outcome	Isolated	Low	Medium	High	Prob > F	Isolated	Low	Medium	High	Prob > F
Total number of cases (n)	42	265	805	336		14	192	495	216	
(% by gender)	2.9	18.3	55.6	23.2		1.5	20.9	54.0	23.6	
Personal risk assessment										
- Worry of getting AIDS (%)	50.0	62.6	72.7	74.7	**	71.4	60.4	60.8	52.8	NS
Favored protective strategy against AIDS										
- Avoid extramarital sexual behaviors (%)	66.7	73.2	77.1	75.6	NS	71.4	72.9	76.2	72.7	NS
- Condom use outside marriage (%)	26.2	28.7	25.8	29.8	NS	35.7	41.2	37.8	40.7	NS
Behavioral outcome										
- Ever used condoms (%)	0.0	4.5	10.3	8.6	**	0.0	34.9	31.9	30.1	+

Source: interviews with ever-married women of reproductive age (i.e., between 15 and 49) and their currently married partners from the Malawi Diffusion and Ideational Change Project (MDICP).

Notes: (NS) p-value not significant at 10% or less; (+) significant at p-value = 10%; (*) significant at p = 5%; (**) significant at p = 1%.

Table 3b. Bivariate analysis of AIDS-related outcomes by social participation groups (rural Malawi)

Social participation group	Women (2001)				Men (2001)			
Outcome	Low	Medium	High	Prob > F	Low	Medium	High	Prob > F
Total number of cases (n)	675	647	126		267	507	143	
(% by gender)	46.6	44.7	8.7		29.1	55.3	15.6	
Personal risk assessment								
- Worry of getting AIDS (%)	68.6	70.6	81.8	*	57.3	58.8	62.9	NS
Favored protective strategy against AIDS								
- Avoid extramarital sexual behaviors (%)	78.4	72.8	77.0	+	79.0	74.0	68.5	+
- Condom use outside marriage (%)	27.7	26.1	31.0	NS	32.2	37.7	57.3	**
Behavioral outcome								
- Ever used condoms (%)	5.8	10.2	15.1	**	21.4	34.1	42.0	**

Source: interviews with ever-married women of reproductive age (i.e., between 15 and 49) and their currently married partners from the Malawi Diffusion and Ideational Change Project (MDICP).

Notes: (NS) p-value not significant at 10% or less; (+) significant at p-value = 10%; (*) significant at p = 5%; (**) significant at p = 1%.

Table 4a. Multivariate analysis of AIDS-related outcomes based on social participation groups and social integration groups, Odds Ratios, Women (rural Malawi, 2001)

Outcomes	Worry of getting AIDS			Favor avoiding extramarital sexual behaviors			Favor condom use outside marriage			Ever used condoms		
Explanatory variables	(1)	(2)	(3)	(1)	(2)	(3)	(1)	(2)	(3)	(1)	(2)	(3)
a. Social Interaction variables (SI)												
Social Integration Group	**		**	NS		NS	NS		NS	+		+
- Isolated	**0.38****		**0.38***	0.72		0.70	1.39		1.35	**[a]**		**[a]**
- Low	**0.68****		**0.68****	**0.74+**		**0.72***	**1.33+**		1.30	**0.45***		**0.46+**
- (Medium)	**(-)**		**(-)**	(-)		(-)	(-)		(-)	**(-)**		**(-)**
- High	**0.98**		**0.99**	0.81		0.82	1.24		1.26	**0.72**		**0.70**
Social Events Participation Group		NS	NS		+	+		NS	NS		NS	NS
- Low		1.02	1.05		**1.36***	**1.37***		1.24	1.23		**0.65+**	0.68
- (Medium)		(-)	(-)		**(-)**	**(-)**		(-)	(-)		(-)	(-)
- High		**1.60+**	**1.60+**		**1.24**	**1.24**		0.92	0.92		1.05	1.06
Observations	1447	1447	1447	1442	1442	1442	1442	1442	1442	1392	1429	1392
Log likelihood	-768.4	-772.4	-766.9	-744.1	-743.8	-741.6	-768.2	-768.7	-766.9	-326.7	-329.7	-325.3
Pseudo R2	0.122	0.117	0.124	0.070	0.071	0.073	0.093	0.092	0.094	0.219	0.218	0.222

Table 4b. Multivariate analysis of AIDS-related outcomes based on social participation groups and social integration groups, Odds Ratios, Men (rural Malawi, 2001)

Outcomes	Worry of getting AIDS			Favor avoiding extramarital sexual behaviors			Favor condom use outside marriage			Ever used condoms		
Explanatory variables	(1)	(2)	(3)	(1)	(2)	(3)	(1)	(2)	(3)	(1)	(2)	(3)
a. Social Interaction variables (SI)												
Social Integration Group	*		*	NS		NS	NS		NS	NS		NS
- Isolated	**1.41**		**1.41**	0.93		0.96	2.16		2.35			
- Low	**0.85**		**0.86**	1.05		1.03	1.09		1.15	1.25		1.27
- (Medium)	**(-)**		**(-)**	(-)		(-)	(-)		(-)	(-)		(-)
- High	**0.60****		**0.60****	0.91		0.94	1.18		1.14	0.91		0.87
Social Events Participation Group		NS	NS		+	+		**	**		**	**
- Low		0.99	0.98		**1.35**	**1.34**		**0.84**	**0.86**		**0.63***	**0.60***
- (Medium)		(-)	(-)		**(-)**	**(-)**		**(-)**	**(-)**		**(-)**	**(-)**
- High		1.03	1.05		**0.66**	**0.66**		**2.50****	**2.55****		**1.44+**	**1.42**
Observations	915	915	915	909	909	909	915	915	915	915	901	901
Log likelihood	-541.1	-537.4	-537.3	-457.5	-460.6	-457.4	-525.7	-535.2	-524.7	-470.8	-469.6	-464.3
Pseudo R2	0.126	0.132	0.132	0.114	0.108	0.114	0.142	0.126	0.143	0.175	0.169	0.179

Source: 2001 interviews with ever-married women of reproductive age (i.e., between 15 and 49) and their husbands from the Malawi Diffusion and Ideational Change Project (MDICP).

Notes: Only the coefficients for the social interaction variables are reported; all the models control for the following set of covariates: (1) Individual socio-economic characteristics: age (and age squared), current marital status, education, wealth quintile, religion, ethnic group, region; (2) protective factors: (a) individual empowerment (self-generating income, women control over reproduction and gender autonomy), (b) knowledge about HIV/AIDS transmission (get AIDS if sex with someone who looks perfectly healthy, chances to get AIDS from one-time sex with someone infected with AIDS), (c) HIV/AIDS information exposure (heard AIDS messages from CBD/HAS, number of sources of AIDS information exposed to, large public health initiatives in the village in the last three years), (d) impact of death (Number of acquaintances suspected to have died from AIDS in last 12 months); (3) risk factors: (a) geographic mobility (ever been to regional capital cities, have been out of the country, stay away outside district for more than 1 month), (b) sexual behaviors (children ever born, extramarital sex in the past year, Ever used condoms), (c) spousal/HH characteristics (polygamous union, husband-wife age difference, spouse extramarital relationships, spouse usually lives elsewhere), (d) community characteristics (average distances to closest public facility, and to closest town, total population (log), fractions of households with pit latrine and metal roof, contraceptive prevalence rate (all methods)).

Reference categories in parentheses. Robust standard errors (adjusted for the clustering of respondents in villages) are used to calculate p-values. Overall significance of polytomous categorical variables indicated in first line of variable results. (NS) p-value not significant at 10% or less; (+) significant at p-value = 10%; (*) significant at p = 5%; (**) significant at p = 1%.

Table 5a. Multivariate analysis of AIDS-related outcomes based on participation to social events and characteristics of AIDS conversation networks, Odds Ratios, Women (rural Malawi, 2001)

Outcomes	Worry of getting AIDS			Favor avoiding extramarital sexual behaviors			Favor condom use outside marriage			Ever used condoms		
Explanatory variables	(1)	(2)	(3)	(1)	(2)	(3)	(1)	(2)	(3)	(1)	(2)	(3)
a. Social Interaction variables (SI)												
AIDS Conversation Network Characteristics												
Number of AIDS conversation partners (censored)	1.04		1.04	1.05		1.04	0.99		0.97	1.09		1.09
Size of the AIDS conversation network (log)	1.31		1.31	1.14		1.17	0.85		0.89	1.27		1.27
Density of network ties between alters	1.09		1.07	0.73		0.72	0.77		0.75	0.75		0.76
Average strength of ties wth ego	2.15		2.13	0.68		0.60	3.34		2.86	**33.78***		**30.20***
Fraction of strong ties with ego	1.24		1.23	1.36		1.39	**0.41***		**0.43***	0.51		0.60
Average closeness between alters	0.96		0.96	**1.44+**		**1.46+**	0.89		0.90	0.93		0.91
Fraction of strong ties between alters	1.03		1.03	**0.44+**		**0.45+**	1.56		1.63	2.46		2.34
Fraction of alters same gender as ego	**0.26***		**0.25***	0.80		0.78	0.86		0.86	0.81		0.89
Fraction of alters relative with ego	0.67		0.67	0.77		0.78	**1.75+**		**1.78+**	0.50		0.50
Fraction of alters living in the same village as ego	0.97		0.98	0.76		0.76	1.06		1.05	**1.97***		**2.05***
Fraction of alters living in the same TA as ego	**3.21****		**3.29****	1.22		1.27	1.11		1.18	1.50		1.31
Closeness homogeneity between alters	0.76		0.77	1.20		1.18	**0.66***		**0.63***	1.07		1.25
Gender homogeneity between alters	**1.90+**		**1.95+**	1.32		1.36	1.12		1.14	0.77		0.72
Social Events Participation												
Funerals (mean percentile)		1.00	1.00		1.00	1.00		1.00	1.00		**0.99***	**0.99***
Drama performances (mean percentile)		1.00	1.00		1.00	1.00		**1.00+**	**1.00+**		1.01	1.00
Weddings (mean percentile)		1.00	1.00		1.00	1.00		1.00	1.00		**1.01****	**1.01****
Prayer meetings (mean percentile)		1.00	1.00		1.00	1.00		1.00	1.00		1.01	1.01
Political meetings (mean percentile)		1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00
Bars (mean percentile)		1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00
Observations	1447	1447	1447	1442	1442	1442	1442	1442	1442	1429	1429	1429
Log likelihood	-757.5	-772.5	-755.9	-739.3	-743.6	-736.3	-762.3	-766.6	-759.1	-322.6	-323.0	-314.8
Pseudo R2	0.135	0.117	0.136	0.076	0.071	0.080	0.100	0.095	0.103	0.235	0.234	0.253

Source: 2001 interviews with ever-married women of reproductive age (i.e., between 15 and 49) and their husbands from the Malawi Diffusion and Ideational Change Project (MDICP).

Notes: Only the coefficients for the social interaction variables are reported; all the models control for the following set of covariates: (1) Individual socio-economic characteristics: age (and age squared), current marital status, education, wealth quintile, religion, ethnic group, region; (2) protective factors: (a) individual empowerment (self-generating income, women control over reproduction and gender autonomy), (b) knowledge about HIV/AIDS transmission (get AIDS if sex with someone who looks perfectly healthy, chances to get AIDS from one-time sex with someone infected with AIDS), (c) HIV/AIDS information exposure (heard AIDS messages from CBD/HAS, number of sources of AIDS information exposed to, large public health initiatives in the village in the last three years), (d) impact of death (number of acquaintances suspected to have died from AIDS in last 12 months); (3) risk factors: (a) geographic mobility (ever been to regional capital cities, have been out of the country, stay away outside district for more than 1 month), (b) sexual behaviors (children ever born, extramarital sex in the past year, ever used condoms [not included when used as dependent variable]), (c) spousal/HH characteristics (polygamous union, husband-wife age difference, spouse extramarital relationships, spouse usually lives elsewhere), (d) community characteristics (average distances to closest public facility, and to closest town, total population (log), fractions of households with pit latrine and metal roof, contraceptive prevalence rate (all methods)).

Reference categories in parentheses. Robust standard errors (adjusted for the clustering of respondents in villages) are used to calculate p-values.
(+) significant at p-value = 10%; (*) significant at p = 5%; (**) significant at p = 1%.

Table 5b. Multivariate analysis of AIDS-related outcomes based on social participation groups and social integration groups, Odds Ratios, Men (rural Malawi, 2001)

Outcomes	Worry of getting AIDS			Favor avoiding extramarital sexual behaviors			Favor condom use outside marriage			Ever used condoms		
Explanatory variables	(1)	(2)	(3)	(1)	(2)	(3)	(1)	(2)	(3)	(1)	(2)	(3)
a. Social Interaction variables (SI)												
AIDS Conversation Network Characteristics												
Number of AIDS conversation partners (censored)	0.97		0.95	0.91		0.90	1.01		1.02	**1.52***		**1.49***
Size of the AIDS conversation network (log)	0.97		0.97	1.08		1.11	0.98		0.94	0.88		0.86
Density of network ties between alters	0.57		0.53	0.73		0.74	0.97		0.91	0.85		0.79
Average strength of ties with ego	2.20		2.38	0.81		0.86	**0.10+**		**0.12+**	0.90		1.31
Fraction of strong ties with ego	0.76		0.71	**3.08+**		**2.77+**	0.88		0.95	2.23		2.28
Average closeness between alters	1.20		1.26	**1.65+**		**1.59+**	0.83		0.87	1.09		1.17
Fraction of strong ties between alters	0.94		0.80	**0.22***		**0.25***	2.10		1.73	1.70		1.33
Fraction of alters same gender as ego	**3.19***		**3.47***	1.02		0.91	1.06		1.15	3.09		3.65
Fraction of alters relative with ego	0.56		0.55	**0.35***		**0.36***	**3.35****		**3.21****	**0.24****		**0.23****
Fraction of alters living in the same village as ego	0.86		0.85	0.61		**0.60+**	1.21		1.24	0.71		0.74
Fraction of alters living in the same TA as ego	1.65		1.62	1.10		1.18	0.76		0.72	1.32		1.19
Closeness homogeneity between alters	1.27		1.33	0.69		0.72	0.86		0.83	1.26		1.21
Gender homogeneity between alters	**0.29****		**0.27****	1.07		1.09	1.23		1.16	**0.42+**		**0.39+**
Social Events Participation												
Funerals (mean percentile)		1.00	1.00		0.99	0.99		1.00	1.00		1.00	1.00
Drama performances (mean percentile)		1.00	1.00		**0.99+**	**0.99+**		**1.01****	**1.01****		**1.01****	**1.01****
Weddings (mean percentile)		1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00
Prayer meetings (mean percentile)		1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00
Political meetings (mean percentile)		**1.01+**	**1.01***		1.00	1.00		1.00	1.00		1.00	1.00
Bars (mean percentile)		1.00	1.00		1.00	1.00		**1.01***	**1.00***		**1.00+**	**1.00+**
Observations	915	915	915	909	909	909	915	915	915	915	915	915
Log likelihood	-531.8	-536.7	-526.5	-450.9	-454.3	-445.8	-529.5	-523.4	-517.3	-461.5	-464.1	-451.1
Pseudo R2	0.141	0.133	0.150	0.127	0.120	0.137	0.135	0.145	0.155	0.191	0.187	0.210

Source: 2001 interviews with ever-married women of reproductive age (i.e., between 15 and 49) and their husbands from the Malawi Diffusion and Ideational Change Project (MDICP).

Notes: Only the coefficients for the social interaction variables are reported; all the models control for the following set of covariates: (1) Individual socio-economic characteristics: age (and age squared), current marital status, education, wealth quintile, religion, ethnic group, region; (2) protective factors: (a) individual empowerment (self-generating income, women control over reproduction and gender autonomy), (b) knowledge about HIV/AIDS transmission (get AIDS if sex with someone who looks perfectly healthy, chances to get AIDS from one-time sex with someone infected with AIDS), (c) HIV/AIDS information exposure (heard AIDS messages from CBD/HAS, number of sources of AIDS information exposed to, large public health initiatives in the village in the last three years), (d) impact of death (Number of acquaintances suspected to have died from AIDS in last 12 months); (3) risk factors: (a) geographic mobility (ever been to regional capital cities, have been out of the country, stay away outside district for more than 1 month), (b) sexual behaviors (children ever born, extramarital sex in the past year, ever used condoms [not included when used as dependent variable]), (c) spousal/HH characteristics (polygamous union, husband-wife age difference, spouse extramarital relationships, spouse usually lives elsewhere), (d) community characteristics (average distances to closest public facility, and to closest town, total population (log), fractions of households with pit latrine and metal roof, contraceptive prevalence rate (all methods)).

Reference categories in parentheses. Robust standard errors (adjusted for the clustering of respondents in villages) are used to calculate p-values.
(+) significant at p-value = 10%; (*) significant at p = 5%; (**) significant at p = 1%.