Coping with Fears: Women's Personal Networks, Migration, and HIV/AIDS in Mozambique

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Abstract

Understanding social networks as a determinant of health behavior has been a major preoccupation of sociological research. Research also points to men's labor migration as a barrier to HIV/AIDS prevention. Yet little research has considered the structure of personal networks and the content of communication about HIV/AIDS of women who stay behind in places of migration origin. Using data from a 2006 survey of 1,680 women and their dyadic interactions in southern Mozambique, we examine the composition, informal HIV/AIDS communication and preventive behavior of migrants' and non-migrants' wives. Results show that migrants' wives were more likely to have fellow migrants' wives as close network members, they were also more likely to engage in HIV/AIDS communication and to discuss prevention but they were no more likely to talk about AIDS with migrants' wives than with non-migrants' wives. Probing the content of communication and HIV prevention behavior, we detect that network members' prevention behavior was similar to that ego's, although this did not differ by migration status. We interpret our findings in the context of the literature on social networks and health.

Coping with HIV Fears: Peer Networks of Migrants' Wives in Mozambique

INTRODUCTION

In the last three decades, sociologists have increasingly devoted attention to elucidating the impact of social networks on health. This follows a fundamental sociological principle that social structure affects and is affected by the well-being of individuals. This literature connects social networks to health through mechanisms such as social support, social engagement, social influence and access to resources, among other factors (Berkman and Glass 2000; Smith and Christakis 2008). Parallel to this literature is a burgeoning set of epidemiological and sociological studies that have identified labor migration, which separates couples, as an important factor fueling the African HIV/AIDS epidemic. Although the specific pathways through which migration impacts HIV/AIDS remain disputed, studies typically suggest that people who are more mobile or frequently change residence are at a higher risk of HIV infection and other sexually transmitted diseases (STDs) than people in more stable living conditions (Anarfi 1993; Decosas and Adrien 1997; Hunt 1989; Lurie et al. 2003). This is especially so in the context of Southern Africa where the roots of labor migration to South Africa from neighboring countries such as Mozambique run deep and the scale of this migration continues to grow (Crush et al. 2010).

However, work on migration and HIV/AIDS has largely ignored research on egocentric network studies (personal networks) that have documented how informal social ties and interactions within personal networks offer guidance and support for individual assessment of risks and exposure to HIV infection, thus serving as key resources for behavior change to avoid or reduce these risks (Agadjanian and Menjívar 2008; Helleringer and Kohler 2005; Kaler 2004;

Kohler, Behrman and Watkins 2007; Smith and Watkins 2005). Moreover, work on migration and HIV/AIDS has focused on migrants' vulnerability in places of migration destination and only a few studies have examined the vulnerability of migrants' partners in the areas from which migrants come (Coffee, Lurie and Garnett 2007; Landale and Oropesa 2001; Lurie 2000; Lurie et al. 2003; 2006).

More importantly, most sociological studies on social networks and health in general and personal networks and HIV/AIDS in particular, have paid little attention to network structure (Smith and Christakis 2008), and have instead focused more on the content and specific resources that are being transmitted within the network (Aneshensel 1992; House, Landis and Umberson 1988; Berkman and Glass 2000; Kawachi and Berkman 2001). This in spite of provisions for both in the social network literature (Marsden 1990; Wasserman and Faust 1994). Linking the structure of personal networks to resources transmitted within these networks may help elucidate how mechanisms of social networks influence the association between men's labor migration and the risk of contracting HIV by their rural partners.

Thus this study combines two bodies of literature-that on social networks and health and that on migration and HIV/AIDS- to investigate how women in rural Mozambique engage their personal networks to cope with worries of HIV infection, with a special focus on the differences between wives of migrants and wives of non-migrants. We begin by exploring current findings on the impact of social networks on health in general, before considering personal social networks and HIV/AIDS. We then elaborate upon a conceptual framework that incorporates homophily and selection within personal networks, HIV/AIDS communication and the practice of prevention and testing for HIV. Next, we outline key findings from our analysis and conclude

with a discussion of our findings and its implications for the literature on social networks and health and on migration and HIV/AIDS.

BACKGROUND

Conceptual and empirical studies from various disciplines have repeatedly shown evidence that those who have access to meaningful and reciprocal social ties have a health advantage than socially isolated individuals (Berkman and Kawachi 2000; House et al. 1988). This follows analyses of egocentric (local) networks (hereafter personal networks) and global networks. Personal networks are made up of direct ties to focal individuals in a population (egos) and global networks comprise both direct and indirect ties that include entire communities or workplaces (Smith and Christakis 2008). Both are required for understanding the impact of social networks on health. For example, personal network characteristics such as the size or density of a social network determine access to network resources like social support and social influence. On the other hand, one's position in a global network determines access to information, exposure to diseases (such as STDs) and other health behaviors. However, personal network studies are far more common in the literature due to less stringent data demands.

Most of the work connecting social networks to health has traditionally focused on social support (perceived and received, emotional and instrumental) that individuals derive from their social networks (Pescosolido 2001; Turner and Marino 1994; Thoits 1995). Others have focused on social influence and norms of social control that encourage or deter risky behavior (Marsden and Friedkin 1994; Murabito et al. 2001) and a few other studies have demonstrated that access to resources (such as information, financial resources and jobs) promote healthy behaviors (Berkman and Glass 2000). Yet some research has shown that social networks can facilitate risky

health behavior such as contracting STDs (Bearman, Moody and Stovel 2004) and the risk of obesity (Christakis and Fowler 2007) among other health outcomes.

There have been calls within the literature for conceptual and operational distinctions between and the integration of social support (quantity and quality of social relationships) and social network analysis of health (elaboration of structural aspects of social relationships) (Berkman and Glass 2000; House et al. 1988; Smith and Christakis 2008), but despite these calls most of the studies on the role of social networks and health have primarily focused on social support with greater emphasis on the quality and quantity of social relationships. For example, studies of the role of social support on mortality have shown that married couples enjoy a mortality advantage than unmarried individuals due to higher levels of social support (Hu and Goldman 1990; Thoits 1995; Turner and Marino 1994). This relationship has been shown to be independent of the selection of healthy people into marriage (Zick and Smith 1991). Conversely, widowhood has been associated with a short term rise in mortality following the loss of a spouse, especially for men (Elwert and Christakis 2006). Other evidence of hospitalization and care giving to an ill spouse and its association with increased risk of mortality or poor health to the other spouse has also been documented (Christakis and Allison 2006; Christakis and Iwashyna 2003), as there is sufficient evidence of the impact of various nonspousal interpersonal ties (peer effects on smoking or alcohol use) on health (Chen, White and Pandina 2001; Kaplan et al 2001). Thus the health of one member of the dyad or a social network, can affect the health of another. Overall, studies of social support and health largely do not explore the structural aspects of social networks and how resources are transmitted or constrained within these networks.

However, a few studies on social support and health have adapted a network approach in the context of specific health conditions such as psychological distress (Haines, Beggs and

Hurlbert 2002), disability (Pescosolido 2001) and STDs (Helleringer and Kohler 2007). For example, Haines et al. 2002 examined the direct and indirect effects of network structure on perceived adequacy of social support and psychological distress and found that network structure is important in improving our understanding of the determinants of social support and psychological distress than suggested by previous studies (Turner and Marino 1994). In a similar and more recent study, the authors find that gender moderates both the direct and indirect effects of perceived adequacy of social support and depressive symptoms (Haines, Beggs and Hurlbert 2008). On the whole, studies on social support and health in general and psychological distress in particular come to similar main conclusions-- that stronger social relationships and social support are associated with better health outcomes either directly or indirectly through stress reduction behavior (Aneshensel 1992; House, Landis and Umberson 1988; Kawachi and Berkman 2001) and that perceived adequacy of support is more important than received support (Haines et al. 2008; Thoits 1995; Turner and Marino 1994). In addition, research based on global networks has emerged in recent times that explores the underlying mechanisms of the spread of STDs and possible measures to contain the spread (Bearman, Moody and Stovel 2004; Helleringer and Kohler 2007). Not only do these studies underscore the importance of network structure in studies of health but they highlight the usefulness of global network data in understanding exposure to STDs such as HIV.

Inspired by this broad sociological literature on social support and health, research on HIV/AIDS prevention has addressed the impact of personal networks as constituted by individuals (egos) and their social interactions with others (alters) on sexual behavior change. For example, studies have demonstrated that information about the epidemic in a community, the infection status of potential sexual partners and the availability and effectiveness of prevention

options are often shared among members of personal networks (Behrman, Kohler and Watkins 2007; Buhler and Kohler 2002). Similarly, it has been shown that socially shared individual subjective risk perceptions and worries about contracting HIV/AIDS are important predictors of sexual behavior change (Agadjanian 2002; Agadjanian and Menjívar 2008; Behrman et al. 2003, Smith and Watkins 2005). Central to this body of literature are the findings that women and men perceive potential risks of infection and stigma differently and that sharing of information about prevention strategies is gendered (Agadjanian 2002; Smith and Watkins 2005; Anderson and Doyal 2004). In Malawi for example, while women often worry and talk about their husbands as potential sources of infection and may resort to divorce as a prevention strategy, men tend to engage their communication with peers for a more careful selection of extramarital partners (Smith and Watkins 2005).

Research on social networks and HIV prevention has been anchored in two theoretical foundations in the social and epidemiological sciences—that on the diffusion of innovations (Rogers 2003) and that on health behavior change as outlined in theories such as the "Health Believe Model," the "AIDS Risk Reduction Model" or the "Theory of Reasoned Action" (Catania, Kegeles and Coates 1990; Roesenstock, Strecher and Becker 1994; also see UNAIDS 1999 for an overview of these models). The diffusion of innovation perspective has been applied to changes in demographic behavior and in particular to the adoption of fertility regulation and the spread of low fertility norms in developing countries (Casterline 2001; Kohler 2001; Montgomery and Casterline 1996), perceptions of mortality change (Montgomery 2000), migration (Massey et al. 1994) and sexual initiation (Rogers and Rowe 1993). Health behavior change theories, on the other hand, have been applied to disease prevention and health behavior in both developing and developed settings (Catania et al. 1990; Kalichman 1997; Kaler 2004).

However, theories of health behavior change have been subjected to criticism for adopting a narrow individual psychosocial and cognitive perspective to explain HIV-related behavior rather than provide a platform for incorporating the socio-cultural context within which HIV/AIDS prevention strategies can be understood and implemented (UNAIDS 1999; Sweat and Denison 1995). This has been especially so in studies on sub-Saharan Africa, where formal HIV/AIDS prevention strategies seem inconsistent with prevailing cultural norms of sexual relations, marriage and family formation (Buhler and Kohler 2003; Caldwell 2000; Kohler et al. 2007).

Our study thus brings social context into the analysis of individual health by using multi-level random effect models from dyadic interactions in personal networks to examine the influence of men's labor migration on how migrants' partners in rural Mozambique engage their personal networks to cope with risks of HIV infection. Specifically, we compare the composition and selection of personal networks, the likelihood and content of informal communication on HIV and prevention and testing behavior among women married to migrants and those married to non-migrants.

Conceptual Framework

In conceptualizing the association between men's labor migration and migrants' wives use of personal networks to cope with the risk of HIV infection, we draw on social network literature which emphases how social networks are formed and the potential role of homophily and selection in that process. This literature assumes that personal network members are not chosen at random but systematically through homophily (the tendency for individuals to form ties similar themselves) (McPherson, Smith-Lovin and Brashears 2006; McPherson, Smith-Lovin and Cook 2001; McPherson, Popielarz and Drobnic 1992; McPherson and Smith-Lovin 1987; Popielarz 1999). Thus homophilous personal networks are made up of relationship pairs

that share similar characteristics and behaviors. When individuals are similar in personal characteristics, such as sex, race, and education, they normally hold similar interests, world-views and behaviors, which underscore the formation of expressive ties based on interpersonal attraction (Ibarra 1992; McPherson and Smith-Lovin 1987; Marsden 1988). Similarly, selection based on specific traits can contribute to the creation and dissolution of network ties or to the formation of network ties with certain features (Smith and Christakis 2008).

The concept of homophily has been applied to a wide variety of contexts including the work place, residential communities, political networks, romantic partners and among confidant networks (those who simply "discuss important matters with each other"). Homophily also plays an important role in the interaction patterns of men and women; thus Ibarra (1992) found that while women interacted mainly with fellow women for social support and friendships and with men for instrumental access, men were more likely to have strong gender homophilous ties across multiple networks. Similarly, long standing research on peer influence among adolescents has demonstrated that teenagers associate with others who share their behaviors and characteristics (such as smoking or sexual behavior) or actively recruit into their networks others with similar behaviors (Cohen 1977; Kandel 1978). Lastly, McPharson et al 2001, investigated several sociological phenomena such as social capital, social movements and social networks using homophily as a central organizing principle. Thus homophily has been found to be important in the study of different types of interpersonal ties.

In the social network and health literature, homohilous ties have shown an association with higher levels of social support and lower levels of psychological distress (Haines and Hurlbert 1992; Haines, Beggs and Hurlbert 2002; 2008). In particular, ties based on kinship have been linked to better health because they entail relationships that bind people together

(through mutual obligations and reciprocity) (Haines et al. 2008; Umberson et al. 1996). Research has also shown the importance of selectivity in the relationship between social networks and health. For example, Strauss and Pollack 2003, found that selectivity based or health status or health related traits (such as age and income) maybe influencing one's position within a personal network. Analyzing cross sectional data, the authors detected a propensity of obese adolescents to form smaller networks and occupy less central positions within these networks. Recent analysis of longitudinal data lends support to these findings (Haas, Schaefer and Kornienko 2011). Thus homophily and selectivity are crucial to the consideration of the effects of social networks on health due to the possibility that networks maybe endogenous with health (Smith and Christakis 2008).

Applying insights from network literature to the social networks of migrants' wives who stay behind in places of migration origin, we argue that personal networks will not only offer an avenue to express worries and cope with heightened fears associated with labor migration and the risks of HIV infection but the structure of personal networks and particularly homophily within these networks will be important for both HIV/AIDS-related communication and prevention and testing behavior to avoid HIV. Based on this broad assumption, we conceptualize and test specific hypotheses on how migrants' wives engage their personal networks as a way of coping with worries of HIV infection.

First, while men's labor migration entails benefits for left-behind women's material status and autonomy (e.g. Yabiku, Agadjanian and Sevoyan 2010), it is also said to generate psychological strain among women (Agadjanian, Arnaldo, and Cau, forthcoming; Boehm 2008; Roy and Nangia 2005). In settings such as rural southern Mozambique, where labor migration is common and is usually accompanied by notions of increased risk of HIV infection brought from

South Africa, migrants' wives may seek out other women in similar circumstances and with similar characteristics as close network members. Second, due to perceived vulnerability of migrants' wives to HIV infection, membership in personal networks and conversations among network members about HIV/AIDS will provide them an avenue to seek social support, share opinions, assess risks of HIV infection and explore possible options for prevention. Conversely, non-migrants' wives may not feel as vulnerable to HIV infection; hence their communication within these networks may deal less with HIV/AIDS than that of migrants' wives. Third, because close friends and relatives often form confidant networks which are supportive and encouraging of health-promotion behaviors, conversations about HIV/AIDS may be selective on spouse migration status. Lastly, we expect the content of migrants' wives HIV/AIDS communication to center around issues of preventing HIV, this follows from our conceptualization that labor migration is associated with perceptions of an increased risk of HIV infection from a migrant spouse.

In the second part of our conceptualization, we focus on prevention and testing for HIV among migrants' and non-migrants' wives. Broadly, we draw from diffusion of innovation theory which when applied to HIV/AIDS risk reduction explains how individual risk behavior is influenced by social norms and widely held prevention beliefs within personal networks (Kelly 1995). Thus personal network studies, particularly on sexual and reproductive behavior, have found similarities between the behavior and characteristics of network members and that of egos. For example, Valente et al. (1997), found an association between the specific methods of contraception used by egos and those used by their social network members. Similarly, Clark (2010) concluded that men's extra-marital sexual behavior is associated not only with that of their best friends but also with their subsequent extra-marital sexual partnerships. Thus broadly

speaking, we expect network member's reported HIV prevention and testing behavior to be associated with ego's behavior. However, we hasten to add that we are unable to test the direction of this relationship given the limitations of our data. Appling this conceptualization to migration, we expect migrants' wives prevention and testing behavior to be selective on both the migration status of their spouse and on the migration status of the partners of their network members as well as their network members own prevention and testing behavior. Thus our full conceptual framework yields the following specific hypotheses:

- **H1**: Migrants' wives are more likely to have fellow migrants' wives as close network members than are non-migrants' wives, net of other characteristics.
- **H2**: Migrants' wives are more likely to engage in communication about HIV/AIDS with members of their personal network than are non-migrants' wives, net of other characteristics of respondents and of their network members.
- **H3**: Migrants' wives are more likely to converse about HIV/AIDS with network members who are also migrants' wives than with network members who are not migrants' wives, net of other characteristics.
- **H4**: Migrants' wives are more likely to discuss HIV prevention in their conversations with network members compared to non-migrants' wives, net of other characteristics.
- **H5**: Migrants' wives are more likely to use HIV prevention and testing if network members are also migrants' wives and have used prevention and tested for HIV, net of other characteristics.
- **H6**: Network members' reported use of forms of HIV prevention and testing will be associated with ego's use, net of other characteristics.

Study Setting

Data for this study come from a survey conducted in Mozambique, a country in southeast Africa with a population of some 23 million. Like its southern African neighbors, Mozambique is located in the continent's "AIDS belt". The national prevalence rate among adults aged 15-49 increased from 8.2% in 1998 to 16.2% in 2004 (Ministry of Health 2005), putting that country at the 10th highest HIV prevalence in the world. Recent estimates are lower, 11.5 percent (Ministry of Health, 2010: 160) but still very high by international standards. In the southern Gaza province, where data for this study were collected, HIV prevalence in 2009 was estimated at 25 percent (Ministry of Health, 2010). The Republic of South Africa has long served as the pivot of the labor migration system in the southern African region drawing migrants from neighboring countries to its mining sector (Adepoju 2003; Crush et al. 2010). Labor migration from rural areas of southern Mozambique to the mines and other destinations in South Africa have been an important feature of the economy of that country since the colonial and post colonial era (Crush, Jeeves and Yudelman 1991; First 1983). Mozambique has also witnessed a steady increase in internal migration to its urban centers especially during the period of the civil war (the end of 1970s-1992), pushing more rural residents into migration.

More recently, socioeconomic imbalances amplified by structural adjustment policies, strains on the economy from environmental shocks (such as floods and droughts), erratic and low agricultural yield, scarce non-agricultural jobs and rising cost of living have all contributed to an increase in both internal and international migration (de Vletter 2007).

Reflecting the described labor migration regime and high HIV prevalence, has been the heightened notion in southern Mozambique that HIV/AIDS is a disease brought from South Africa by labor migrants (Agadjanian, Arnaldo and Cau forthcoming). This is seen in increased

pessimism from rural partners about their risk of infection arising from the perceived sexual behaviors of their spouses in places of migration destination. Recent research provides support for this pessimism as migrant miners were found to have reported actual risk taking behavior such as having multiple sexual partners and low condom use on the mine and at home with their rural partners (Crush et al. 2010). Migrant's wives risk of infection is further complicated by their inability to insist on condom use as this could be interpreted as questioning their partner's fidelity. Thus given the risk taking behavior of migrant men and dynamics of gender inequality, rural women in migrant-sending areas such as southern Mozambique are at real risk of HIV infection.

As the threat of HIV/AIDS becomes real and ubiquitous in everyday life, even among the general population, people engage in conversations about their risks of infection and the risks of infection of their partners, relatives and friends and much of this communication is inevitably about how migration may shape these risks.

METHODS

Data

The data used in this study were collected in 2006. A probability sample was drawn among women aged 18-40 residing in 56 villages of four districts of Gaza province in southern Mozambique. In each district, 14 villages were selected with probability proportional to size. In each selected village, all households with at least one married woman were canvassed and recorded into two lists: those with at least one woman married to a migrant and those without such women. These two lists were used as sampling frames; from each list, 15 households were randomly selected. In each selected household a woman was interviewed (in households classified as migrant, a woman married to a migrant was interviewed). This procedure yielded a

total sample of 1680 women (420 per district, 30 per village). The sample was thus more or less evenly split between women married to migrants and women married to non-migrants.

The survey instrument was administered in Tsonga (Changana), the main language of the area, or in Portuguese, Mozambique's official language, and covered respondents' sociodemographic characteristics, pregnancy history, husband's migration history (starting in 2000, the year of the particularly devastating floods in southern Mozambique), and household material status as well as information on HIV/AIDS awareness, prevention and gender attitudes. A separate module of the survey questionnaire was devoted to ego's relationship and interaction with personal network members. Ego was asked to name at least three people with whom she had most interaction and greatest trust (apart from her spouse and children). Detailed information was then gathered from egos who named at least one personal network member. They were asked about each network member's sociodemographic characteristics and HIV/AIDS-related and other health conversations they might have had with their network member in the recent past. The analysis in this study is limited to those with at least one personal network member and nearly all network members were women (96%). We utilize responses to these questions to construct predictors, controls and outcomes for this study.

Measures

Dependent Variables

The dependent variable for the test of our first hypothesis is whether or not a network member is a spouse of a labor migrant. This variable was derived from responses to the question asking ego if the spouse or partner of their close network members worked in the community, outside the community or does not work at all. This variable is coded as a dichotomous indicator

of whether or not network member's spouse worked outside the community (i.e., was a labor migrant) vs. otherwise.

The dependent variable for the test of our second hypothesis was constructed from responses to the question "Was AIDS ever mentioned in your conversations with [network member], even if briefly?" This question emphasized that even a brief mentioning of AIDS should be reported and recorded. Even though the question did not specify a time period for conversations, we assume that such conversations, if reported, occurred in the recent past. This outcome is also operationalized as a dichotomy. The third hypothesis was also based on this outcome.

The dependent outcome for our fourth hypothesis is limited to women who mentioned AIDS in their conversations with their network members. These women were asked to describe the content of their most recent conversation about AIDS. Responses to this question included: known AIDS cases, prevention of HIV, HIV testing and treatment of AIDS, and other themes. Each response category was coded dichotomously and tested separately.

The last set of dependent outcomes for the fifth and sixth hypotheses were constructed by asking respondents what they were doing in order to protect themselves from contracting HIV and the number of times they had been tested for the disease. Reponses included: doing nothing, using condoms, fidelity to husband, abstinence from sex, avoiding contact with blood or injections and practicing some other forms of prevention. Due to fewer respondents in some categories (e.g., using condoms) we coded this outcome into a dichotomous measure where 1 represented any form or combination of forms of HIV prevention and 0 if otherwise. Similarly, testing for HIV was dichotomously coded with 1 representing respondents who have tested for HIV at least once and 0 if otherwise.

Independent Variables

The main independent variable is husband's labor migration status. This was a dichotomous indicator and was coded 1 if the respondent's spouse was a labor migrant at the time of the survey and 0 if otherwise. A second independent variable of interest was whether the personal network member was married to a migrant or not (also used as a dependent variable to test hypothesis one as described above).

Two sets of other key predictors were used; the social network member's reported method of prevention of HIV and having an HIV test. Egos were asked whether they knew what methods of prevention their network members used to protect from HIV. The response options for this question were identical to those for the question asked of egos themselves (uses condoms, faithful to husband, abstain from sex, other and does nothing) and the variable was coded dichotomously—1 if network member used any form or combination of forms of prevention and 0 if otherwise. Lastly, egos were asked if they knew their network members had done an HIV test. This was also coded dichotomously with 1 indicating that the network member had done a test at least once and 0 if otherwise.

Control Variables

The variables used as statistical controls can be classified into two main groups. The first group represents standard socio-economic variables that may have influenced the probability of ego engaging in HIV/AIDS-related conversations. These variables are ego's age, number of living children (both defined continuously), education (in three categories; 0-4 years of school, 5-7 years of school and 8 or more years of school), employment (works for income or not), marital status (monogamous or polygynous union) and religious affiliation (in three groups, reflecting the religious composition of the study area: mainline churches, Evangelical and

Pentecostal- churches, and none), and household material possessions (defined as a 4-level scale: 1. no radio, bycicle, motocycle, or car; 2. radio, but no bicycle, motorcycle, or car; 3. bicycle but no motorcycle or car; 4. motorcycle or car). We also included the type of roof of respondent's primary dwelling place (thatched vs. zinc, lusolite or block roof) and whether the respondent's household owns cattle. In addition, we include an indicator of respondent's recent communication with her husband about HIV (i.e. whether or not HIV/AIDS was mentioned in recent conversations with husband).

The second group of statistical controls describes the characteristics of network members that may influence the content and likelihood of HIV/AIDS-related communication. These variables include age (defined relative to respondent's age: older, younger or about the same age), marital status (currently in union or not), relationship to network partner (kin or non-kin), religion of network member (also defined relative to respondent: same religion or different religion). A variable measuring the willingness of network members to loan money to the respondent in case of urgent need was also included as a control variable. The frequency distributions of all variables included in the analysis are listed in Table 1.

Analysis

Statistical Model

We use logistic regression to fit models for our dependent outcomes since they were all coded as dichotomous measures. We examine the composition of social networks and informal HIV/AIDS conversations between ego and reported social network members. The dyad ego-network member is thus the unit of analysis. If only one network member is reported, only one case is contributed to the model, whereas a case in which three partners are named contributes three cases. Respondents who did not name any network members (less than 1%) were excluded

from the analysis. While this approach allows us to use data more effectively by examining the entire set of dyadic interactions, it also creates a problem of within-respondent clustering of communication, as communication partners of the same ego may share some unobserved characteristics. We thus employ a random intercept model that allows the intercept to vary randomly by respondent (using respondent ID) to account for the possible correlation between the set of network partners of the same respondent (Barber et al. 2000).

Similarly, the sampling design is clustered which may result in biased estimates due to the non-independence of women in the same village. To tackle this source of potential bias, we introduce a second random intercept to account for clustering of respondents within villages. We fit these multi-level random intercept models using the Glimmix procedure in SAS 9.2. Although measures have been taken to reduce bias in the estimates, we must note that the cross-sectional nature of our data does not allow us to ascertain causality.

RESULTS

Descriptive Analysis

We begin the presentation of results with characteristics of networks members and AIDS related outcomes by migration status. Table 2 indicates that a majority of the network members of migrants' wives, 55%, were married to migrants, compared to 42% of non-migrants' wives. Personal network members were mainly made up of non-kin ties (neighbors, co-workers and friends) as opposed to family and relatives. This did not differ by migration status. More than 50% of network members were older than the ego, and half were of the same religion. Similarly, a high proportion of network members (86%) were reported to be likely to loan ego money if necessary. On AIDS related outcomes, migrants' wives were more likely to have conversed about HIV/AIDS with their personal network members (69%) than non-migrants' wives (69%

vs. 62%). There were only slight and not statistically significant differences in the use of forms of HIV prevention and testing by spouse's migration status. All the network characteristics and AIDS related outcomes apart from having network members who were married to migrants and having AIDS related communications and were not statistically significant by spouse's labor migration status.

Table 2 about here

Table 3, displays the distribution of specific themes of HIV/AIDS-related communication among women who had conversed about HIV/AIDS by husband's migration status. Following the options in the questionnaire four main themes of conversations emerged: (1) *AIDS cases (both known and suspected)*; (2) *Need for Prevention of AIDS* (3) *Testing for HIV and treatment of AIDS and* (4) *Other themes*. As seen from the table, conversations about prevention dominated AIDS-related communication, followed by discussions of suspected or known cases of HIV/AIDS. Migrants' wives were more likely to report higher proportions of any of the three specific AIDS-related themes. For example, 92% of migrants' wives reported discussions of prevention of AIDS in their conversations compared to 88 % of non-migrants' wives. Similarly, migrants' wives reported slightly higher proportions of conversations about AIDS related cases (64%) than non-migrants' wives (60%).

Table 3 about here

Multivariate Analysis

We start the presentation of multivariate findings with the test of the first hypothesis whether migrants' wives are more likely to have migrants' wives among their close network members, net of other factors. Table 4 presents results of multi-level random intercept models of this test. Model 1 (baseline) includes only the main predictor of interest, husband's labor

migration status. The model indicates that migrants' wives are more likely to have network members who are also married to migrants. When we include socioeconomic characteristics of respondents in Model 2, we observe that the magnitude of the effect of male labor migration status reduces slightly but remains statistically significant. The odds among migrants' wives of reporting network members who were also migrants' wives were 1.5 times those among non-migrants' wives. This finding is consistent with the bivariate analysis presented in Table 2. This provides support for our first hypothesis.

Table 4 about here

In Table 5, we test the second hypothesis of the study by comparing the likelihood of HIV/AIDS communication in personal networks of wives of migrants and non-migrants while controlling for ego's and network members' characteristics. The baseline model (Model 1) includes only the main predictor of interest, husband's labor migration status. In this model, migrants' wives were more likely to have talked about HIV/AIDS with their network members than non-migrants' wives. This effect is strong and statistically significant. The odds of HIV/AIDS conversations in social network of migrants' wives were 1.63 times that of non-migrants' wives.

When we add controls to account for sociodemographic characteristics of ego and those of their social network members (Model 2), the effect of labor migration status increases in magnitude and remain statistically significant. The odds of HIV/AIDS conversations in social network of migrants' wives are now nearly twice that of non-migrants' wives.

Our second key predictor whether network members were married to labor migrants was significantly associated with HIV/AIDS conversations. This effect reinforces not only our first hypotheses but offers further support for our second hypothesis that migrants' wives are more

likely to converse about HIV/AIDS than non-migrants' wives net of the sociodemographic characteristics of ego and personal network members.

To test the third hypothesis, we include an interaction term to examine whether migrants' wives are more likely than non-migrants' wives to converse about HIV/AIDS with their fellow migrants' wives. However, the interaction effects of the migration status of ego and network members' husbands were not statistically significant (results not shown). This implies that even though migrants' wives and their personal network members who also married to migrants are more likely to converse about HIV/AIDS with their personal networks, they are no more likely to seek out migrants' wives for such conversations than non-migrants' wives. Hypothesis three is therefore not supported.

Table 5 about here

We now turn to the test the fourth hypotheses. In this hypothesis, we test if on conversations about AIDS, theme preference differed significantly by migration status. Although at the bivariate level we saw a statistically significant difference by husband's migration status in reporting conversations about known AIDS cases, this difference became non-significant in the multivariate test. Similarly, the multivariate tests did not detect any significant differences in discussions on HIV testing and treatment of HIV/AIDS. The only statistically significant variations by migration status were in conversations that revolved around prevention. Table 6 (full model only) presents results of this test. As seen in the table, migrants' wives were significantly more likely to have mentioned HIV prevention in their AIDS-related communication than were non-migrants' wives: the odds of migrants' wives mentioning prevention in AIDS conversations were twice those of non-migrants' wives. These results lend support to our fourth hypothesis that migrants' wives are more likely to discuss prevention of

AIDS than non-migrants' wives. Interestingly, the effect of network member married to a migrant was negative but not significant.

Table 6 about here

The last set of logistic regression models that we fit test our fifth and sixth hypotheses namely; that migrants' wives will be more likely to use prevention and be tested for HIV if their network members are also migrants' wives and have used prevention HIV testing and that broadly, network members reported use of HIV prevention and testing will be associated with ego's use. Our fifth hypotheses was tested by including interaction terms to ascertain if there is an association between the migration status of network members and her use of prevention and testing for HIV and ego's use of prevention and testing, we could however, not detect any statistically significant associations between network member's migration status and use of prevention and testing and ego's use. Nor did we find any significant association between the labor migration status of ego and her use of prevention and testing. Thus contrary to our conceptualization, migrants' wives were no more likely than non-migrants' wives to use prevention if their network members are migrant's wives and use prevention nor were they more likely to have been tested for HIV if their network members have also been tested. Thus hypothesis five was not supported.

Table 7 about here

However, as regards our sixth and last hypotheses, we found that accounting for individual and network characteristics, egos whose network members report any form of prevention (i.e., used condoms, or were faithful to their spouses or abstained from sex) were more likely to also use at least one of these forms of prevention. The odds of ego using any form of prevention if her network members also uses were nearly 5 times compared to those whose

network members did not use prevention. Similarly, egos who reported their social network members have already tested for HIV/AIDS were more likely to have been tested for HIV. The odds of having been tested were 7.5 times those whose network members have not had a test for HIV. Both of these differences are statistically significant at $p<.05$. However, these results must be interpreted with caution as our data preclude testing for the direction of this association and more so because our data is based on ego's reports of network members prevention behavior and not the actual fact of prevention or testing. Thus it cannot be concluded whether network members influence respondents or respondents' influence network members.

DISCUSSION

Understanding social network structure is essential to understanding the pathways and mechanisms through which social networks impact health and this has been a major preoccupation of social scientists for the last three decades. However, the literature on personal networks and HIV/AIDS and specifically on migration and HIV/AIDS have paid little attention to how the structure of personal networks might determine or constrain network members' behavior and attitudes by shaping the flow of resources within the network. This study is designed to fill this gap by developing and testing specific hypotheses on how homophily and selection within personal networks and informal communication on HIV/AIDS as well as HIV prevention and testing behavior of rural partners of labor migrants and non-migrants act as a means of coping with worries about HIV/AIDS in southern Mozambique.

We find that net of sociodemographic characteristics of egos and network members, migrants' wives were more likely to have fellow migrants' wives as close network members, they were also more likely to engage in HIV/AIDS conversations than non-migrants' wives but they were no more likely to talk about HIV/AIDS with other migrants' wives than with non-

migrants' wives. We also detect that net of other factors, migrants' wives were more likely to have discussed prevention in their most recent AIDS conversations than were non-migrants' wives. Finally, we did not find any significant differences by the migration status of network members' spouse and network member's HIV prevention behavior on one hand and ego's prevention behavior on the other. However, we found that net of sociodemographic characteristics, network members' use of HIV prevention and testing is associated with ego's use.

These findings should be interpreted in light of the literature on social networks and health in general and on personal networks and HIV/AIDS in particular. First, our finding that migrants' wives were more likely to have fellow migrants' wives as close network members indicates that the choice of network members is homophily-driven. This confirms previous literature that finds that homophily and selection are influential in the role social networks play in health. Studies on health outcomes (such as psychological distress, smoking and alcohol use) have demonstrated that homophily based on demographic characteristics (such as age, race/ethnicity, sex, and education) and genetic related traits (such as appearance, intelligence and personality) are crucial in the formation of friendship ties (Marsden 1987; Rushton and Bons 2005) which in turn influence health.

Second, in finding that network members HIV prevention and testing behavior is similar to that ego's, we provides further evidence of the role of homophily in health behavior. This finding is also well aligned with the literature on social networks and health (Haines et al. 2008 and Turner and Marino 1994) and on personal networks and reproductive and sexual behavior (Valente et al. 1997; Clark 2010). Both groups of literature assert the importance of perceived

behavior or social support received from members of personal networks even if these perceptions are inaccurate.

Third, by finding statistically significant associations between labor migration and conversations about HIV/AIDS and specifically the discussion of HIV prevention within these conversations, we offer evidence in support of the growing literature that highlight the importance of social ties and interconnectedness in dealing with risk perceptions and worries about contracting HIV/AIDS (Behrman et al 2003; Buhler and Kohler 2003; Kaler 2004; Helleringer and Kohler 2005; Smith and Watkins 2005). HIV/AIDS discussions within informal networks are selective on ego and network member's husband's labor migration status. Within these networks, members share information, assess their risk of infection and gain social support to prevent HIV. Given that evidence from previous research demonstrated that interpersonal health communication is predictive of preventive behavior such as condom use (van der Straten 1995; Rickman 1994), our findings are particularly valuable to programs and policies geared towards combating the HIV/AIDS epidemic.

However, our conceptual framework produces some important qualifications that dispute previous findings. First, our finding that migrants' wives were no more likely to talk about HIV/AIDS with other migrants' wives than with non-migrants' wives brings into sharp focus the influential role played by homophily and selection beyond social network formation, especially as it pertains to HIV/AIDS conversations. This finding appears inconsistent with previous literature on social networks and health. For example, in studying the direct and indirect effects of network structure on perceived adequacy of social support and psychological distress, Haines et al. 2002 concluded that individuals embedded in homophilous networks (based on degree of closeness) report higher levels of perceived adequacy of social support and lower levels of

psychological distress. However, our findings on homophily based on migration does not imply that AIDS communications were more likely among network members who were also married to migrants and consequently, we may not conclude that egos derive social support through conversations with other migrants' wives. Thus although labor migration may predispose egos to talk about AIDS, they seek social support in a more diverse personal network. This seeming inconsistency receives further boost by the our findings that prevention and testing behavior is not impacted by the selectivity of network members based on migration status nor by the prevention and testing behavior of network members who are also married to labor migrants. Thus we may infer from this finding that regardless of men's labor migration, women's personal networks in sub-Saharan Africa may offer an avenue to exchange information and evaluate specific methods of prevention against HIV/AIDS, a process found influential in behavior change to avoid infection. We suspect that in a generalized HIV/AIDS pandemic, such as prevails in Southern Mozambique, many in the community speculate about their risks and HIV status and that of their friends and relatives. Thus discussions about HIV/AIDS and prevention strategies may be widespread in personal networks and migrants' wives who are perceived as more vulnerable to infection may share sensitive information about AIDS and their personal vulnerabilities in a network of trusted friends and confidants made up of both migrant and non-migrant's wives. Thus AIDS conversational networks in sub-Saharan Africa may be less homophilous than previous literature suggests. However, further research is needed before reaching definite conclusions.

In addition, our study makes a valuable contribution to the literature as it highlights the potential interaction between exchange of information on HIV and the influence of network member's prevention and testing behavior on ego's behavior. Although we must add that our

results offer only partial support for social influence as the association between ego's and network member's prevention and testing behavior may be due to selection and rather than influence.

Lastly, our findings present some important, if not direct, policy implications. HIV/AIDS intervention programs should heed the importance of personal networks in preventing HIV/AIDS. As local and international agencies and governments devote resources and efforts to setting up prevention programs and access to testing and treatment facilities, targeting rural partners of migrants with accurate and relevant information and channeling this information through their personal networks could prove effective in reducing the risks of HIV/AIDS among the general population and its specific subgroups such as migrants' wives.

In closing, the limitations of our study must be acknowledged and caution in the interpretation of the findings urged. First, although we constructed our conceptual framework based on the perceived vulnerability of migrants' partners to HIV/AIDS, we do not have specific quantifiable information on the circumstances surrounding informal HIV/AIDS communication. Indeed members were named based on close and trusted people with whom the ego interacted in general and not necessarily about HIV/AIDS. Second, the cross-sectional nature of our data limits causal inferences and does not enable us to exclude unobserved characteristics of respondents that may influence the selection of social networks members. Selectivity of social network members is important to this study as it may provide an alternative explanation that social network members were selected with respect to characteristics that will make them more or less likely to talk about AIDS. However, the name generator of our social network list and our findings on the lack of homophily-on-AIDS outcomes (conversations and prevention), gives us reason to believe that these associations are not simply due to selectivity. Similarly, it may be

unlikely that women choose as social network members those who use the same method of HIV prevention. What we conjecture, as in previous studies on contraceptive use (Valente et al. 1997) and in studies that control for unobserved factors (Clark 2010; Helleringer and Kohler 2005; Behrman et al. 2003), is that methods of prevention are likely discussed and evaluated in personal networks for their effectiveness prior to adoption. Lastly, we acknowledge as a limitation, the inability of our data to establish the causal direction of the association between network members and egos' prevention and testing behavior as part of this association may be due to selection and not influence.

These limitations notwithstanding, our study makes a valuable contribution to the debate about the role of personal network structure and resources transmitted within networks on health in general and the ways in which rural partners of migrants cope with increased risks of HIV/AIDS infection in particular.

REFERENCES

Adepoju, Aderanti. 2003. "Continuity and Changing Configurations of Migration to and from the Republic of South Africa" International Migration 41(1): 3-28.

Agadjanian, Victor. 2002. "Informal Social Networks and Epidemic Prevention in a Third World Context: Cholera and HIV/AIDS Compared." Pp. 201-221 In Advances in Medical Sociology, Volume 8, Social Networks and Health, edited by J.A Levy and B.A Pescosolido, Greenwich, CT: JAI-Elsevier Science

Agadjanian, Victor, and Cecilia Menjívar. 2008. "Talking about the 'Epidemic of the Millennium': Religion, Informal Communication, and HIV/AIDS in Sub-Saharan Africa" *Social Problems* 55 (3): 301-321

Agadjanian, V., Carlos Arnaldo, and Boaventura Cau. "Health Costs of Wealth Gains: Labor Migration and Perceptions of HIV/AIDS Risks in Mozambique" *Social Forces* (forthcoming).

Anarfi, John K. 1993. "Sexuality, Migration and AIDS in Ghana- A Socio-behavioral Study" *Health Transition Review* 3 (supplementary issue) 1-22.

Anderson, Jane, and L. Doyal. 2004. "Women from Africa Living with HIV in London: A Descriptive Study." *AIDS Care* 16(1):95-105.

Aneshensel, Carol S. 1992. "Social Stress: Theory and Research" *Annual Review of Sociology* 18:15- 38.

Barber, Jennifer S., Susan A. Murphy, William G. Axinn, Jerry Maples. 2000. "Discrete-Time Multi-level Hazard Analysis" *Sociological Methodology* 30: 201-235.

Bearman, Peter S., James Moody and Katherine Stovel. 2004. “Chains of Affection: The Structure of Adolescent Romantic and Sexual Networks.” *American Journal of Sociology* 110(1):44-91.

Behrman, Jere, Hans-Peter Kohler, and Susan C. Watkins. 2007. "Social Networks, HIV/AIDS and Risk Perceptions" *Demography* 44(1) 1-33.

Berkman, Lisa F. and Thomas Glass. 2000. “Social Integration, Social Networks, Social Support, and Health.” Pp. 137-173 in *Social Epidemiology*, edited by L.F. Berkman and I. Kawachi. Oxford: Oxford University Press.

Berkman, Lisa F. and Ichiro Kawachi, eds. 2000. *Social Epidemiology.* Oxford: Oxford University Press.

Boehm, Deborah A. 2008. ““Now I am a Man *and* a Woman!”: Gendered Moves and Migrations in a Transnational Mexican Community” *Latin American Perspectives* 35:16-30.

Brummer, Daan. 2002. “Labor Migration and HIV/AIDS in Southern Africa” International Organization of Migration Regional Office for Southern Africa. Available online http://www.sarpn.org.za/documents/d0000572/P534_Labour_Migration_HIV.pdf. Accessed March 2011.

Buhler, Christoph, and Hans-Peter Kohler. 2002. “Talking About AIDS: The Influence of Communication Networks on Individual Risk Perceptions of HIV/AIDS Infection and Favored Protective Behaviors in South Nyanza District, Kenya”. *Demographic Research* S1 (13): 397-438.

Caldwell, John C. 2000. “Rethinking the African AIDS Epidemic.” *Population and Development Review* 26(1): 117-35.

Casterline, John B. 2001. "*Introduction*" Pp. 1-38. in *Diffusion Process and Fertility Transition: Selected Perspectives,* edited by J. Casterline. Washington, DC: National Academy Press.

Catania, Joseph. A., Susan M. Kegeles and Thomas J. Coates. 1990. "Towards an Understanding of Risk Behavior: An AIDS Risk Reduction Model (ARRM)". *Health Education Behavior* 17: 53-72.

Chen, Ping-Hsin., Helene R. White, and Robert J. Pandina. 2001. "Predictors of Smoking Cessation from Adolescence into Young Adulthood." *Addictive Behaviors* 25:517-529.

Christakis, Nicholas A., and James H. Fowler. 2007. "The spread of Obesity in a Large Social Network Over 32 Years" *New England Journal Medicine* 357(4):370-379.

Christakis, Nicholas A., and Paul D. Allison. 2006. "Mortality after the hospitalization of Spouse." *New England Journal Medicine* 354(7):719-730.

Christakis, Nicholas A., and Theodore J. Iwashyna. 2003. "The Health Impact of Health Care on Families: a Matched Cohort Study of Hospice Use by Descendents and Mortality Outcomes in Surviving Widowed Spouses." *Social Science and Medicine* 57(3):465-475.

Clark, Shelley. 2010. "Extra-Marital Sexual Partnerships and Male Friendships in Rural Malawi" *Demographic Research* 22(1):1-28.

Coleman, James S. 1990. *Foundations of Social Theory*. Cambridge: Harvard University Press.

Coffee, Megan., Mark N. Lurie, and Geoff P. Garnett. 2007. "Modeling the Impact of Migration on the HIV Epidemic in South Africa" *AIDS* 21:343-350.

Cohen, Jere M. 1977. "Sources of Peer Group Homogeneity" *Sociology of Education* 50:227-241

Crush, Jonathan, A. Jeeves, and Yudelman, D. 1991. *South Africa's Labor Empire: A History of Black Migrancy to the Gold Mines*. Boulder, CO Westview.

Crush, Jonathan, Ines Raimundo, Hamilton Simelane and Boaventura Cau. 2010. "Migration-Induced HIV and AIDS in Rural Mozambique and Swaziland." Southern African Migration Programme.

De Vletter, Fion. 2007. "Migration and Development in Mozambique: Poverty, Inequality and Survival." *Development Southern Africa* 24(1):137-53

Decosas, J. and Adrien A. 1997. Migration and HIV. In: *AIDS*, Vol. 11, (Suppl A), S77-S84.

Elwert, Felix and Nicholas A. Christakis. 2006. "Widowhood and Race." *American Sociological Review* 71(1):16-41.

Erickson, Bonnie. 2003. "Social Networks: The Value of Variety." *Contexts* 2:25-31.

First, R. 1983. *Black Gold: the Mozambican Miner, Proletarian and Peasant*. New York: St. Martin's Press.

Haas, Steven A., David R. Schaefer and Olga Kornienko. 2010. "Health and the Structure of Adolescent Social Networks." *Journal of Health and Social Behavior* 51:424-439.

Haines, Valerie A., John J. Beggs, and Jeanne S. Hurlbert. 2008."Contextualizing Health Outcomes: Do Effects of networks Structure Differ for Women and Men?" *Sex Roles* 59: 164-175.

Haines, Valerie A., John J. Beggs, and Jeanne S. Hurlbert. 2008. "Exploring the Structural Context of the Support process: Social Networks, Social Statuses, Social Support, and Psychological Distress. Advances in medical Sociology 8:269-292.

Haines, Valarie A. and Jeane Hurlbert. 1992. "Network Range and Health" *Journal of Health and Social Behavior* 33:254-266.

Helleringer, Stephane, and Hans-Peter Kohler. 2005. "Social Networks, Perception of Risk, and Changing Attitudes Towards HIV/AIDS: New Evidence from a Longitudinal Study Using Fixed-Effects Analysis" *Population Studies* 59(3): 265-282.

Helleringer, Stephane, and Hans-Peter Kohler. 2007. "Sexual Network Structure and the Spread of HIV in Africa: Evidence from Likoma island, Malawi. *AIDS* 21:2323-2332.

House, J.S. Landis K. R., and Debra Umberson. 1988. "Social relationships and Health" *Science* 241: 540-545.

Hu, Yuanreng., and Noreen Goldman. 1990. "Mortality Differentials by Marital: An International Comparison." *Demography* 27:233-250.

Hunt, Charles W. 1989. "Migrant Labor and Sexually Transmitted Disease: AIDS in Africa." *Journal of Health and Social Behavior* 30:353-373.

Ibarra, Herminia. 1992. "Homophily and Differential Returns: Sex Differences in Network Structure and Access in an Advertising Firm" *Administrative Science Quarterly* 37:422-447.

Kaler, Amy. 2004. "AIDS-talk in Everyday Life: The Presence of HIV/AIDS in Men's Informal Conversation in Southern Malawi" *Social Science and Medicine* 59: 285-297.

Kandel D.B., 1978. "Homophily, Selection and Socialization in Adolescent Friendships." *American Journal of Sociology* 84:427-436.

Kawachi, Ichiro, and Lisa F. Berkman. 2001. "Social Ties and Mental Health" *Journal of Urban Health* 78(3): 458-457.

Kelly, J., 1995. Changing HIV Risk Behavior: Practical Strategies. New York, NY: The Guilford Press.

Kohler, Hans-Peter, Jere R. Behrman, and Susan C. Watkins. 2007. "Social Networks, HIV/AIDS and Risk Perceptions" *Demography* 44(1): 1-33.

Kohler, Hans-Peter. 2001. *Fertility and Social Interactions: An Economic Perspective*. Oxford: Oxford University Press.

Landale, Nancy S., and R.S Oropesa. 2001. "Migration, Social Support and Perinatal Health: An Origin-Destination Analysis of Puerto Rican Women" *Journal of Health and Social Behavior* 42: 166-183.

Lin, Nan, 2001. *Social Capital: A Theory of Social Structure and Action*. Cambridge, UK: Cambridge University Press.

Lurie, Mark N. 2006. "The Epidemiology of Migration and HIV/AIDS in South Africa" *Journal of Ethnic and Migration Studies* 32: (4): 649-666.

Lurie, Mark N. 2000. "Migration and AIDS in Southern Africa: a review" *South African Journal of Science,* Vol. 96, No. 6, pp. 343-347.

Lurie, Mark. N., Brian G. Williams, Khangelani Zuma, David Mkaya-Mwamburi, Geoff P. Garnett, Michael D. Sweat, Joel Gittelsohn, and Salim S. Abdool Karim. 2003. "The Impact of Migration on HIV-1 Transmission in South Africa: A Study of Migrant and Nonimmigrant Men and their Partners" *Sexually Transmitted Diseases* 30(2):149-156.

Marsden, Peter V. 1988. "Homogeneity in Confiding Relations." *Social Networks* 10:57-76.

Marsden, Peter V. 1987. "Core Discussion Networks of American." *American Sociological Review* 52:122-313.

Marsden, Peter V. and Friedkin 1994. "Network Studies of Social Influence" Pp. 3-25 in Advances in Social Network Analysis: Research in the Social and Behavioral Sciences, edited by S. Wasserman and J. Galaskiewicz. Thousand Oaks, CA:Sage.

Massey S. Douglas, Joaquin Arango, Graeme Hugo, Ali Kouaouci, Adela Pellegrino and J. Edward Taylor. 1994. "An Evaluation of International Migration Theory: The North American Case" *Population and Development Review* 20(4) 699-751.

McPherson, Miller J., Lynn Smith-Lovin, and James M. Cook. 2001. "Birds of a Feather: Homophily in Social Networks." *Annual Review of Sociology* 27:415-444.

McPherson, Miller J., Pamela A. Popielarz, and Sonja Drobnic. 1992**. "**Social Networks and Organizational Dynamics." American Sociological Review 57(2):153-170.

McPherson, Miller J., Lynn Smith-Lovin. 1987. "Homophily in Voluntary Organization: Status Distance and the Composition of Face-to-Face Groups" *American Sociological Review* 52:370-379.

McPherson, Miller J., Lynn Smith-Lovin, Mathew E. Brashears. 2006. "Social Isolation in America: Changes in Core Discussion Networks Over Two Decades." *American Sociological Review* 71(3):353-375.

Ministry of Health of Mozambique. 2005. Relatório sobre a Revisão dos dados de vigilância epidemiologica do HIV – Ronda 2004. Maputo: Ministry of Health.

Ministry of Health. 2010. *Inquérito nacional de prevalência, riscos comportamentais e informação sobre o HIV e SIDA (INSIDA), 2009. Relatório final* Maputo, Mozambique: Ministry of Health.

Montgomery, Mark R., and John B. Casterline. 1996. "Social Networks and Diffusion of Fertility Control." Policy Research Division, Working Paper No. 119. New York: The Population Council.

Montgomery, Mark R. 2000. "Perceiving Mortality Decline" *Population and Development Review* 26(4): 795-819.

Murabito M. Joanne, Jane C. Evans, Martin G. Larson, Bernard E. Kreger, Greta L. Splansky, Karen M. Freund, Mark A. Moskowitz, and Peter W. F. Wilson. 2001. "Family Breast Cancer History and Mammography: Framingham Offspring Study" *American Journal of Epidemiology* 154(10): 916-923.

Pescosolido, Bernice A. 2001. "The Role of Social Networks in the Lives of Persons with Disabilities." Pp. 468–89 in *Handbook of Disability Studies*, edited by G. L. Albrecht, K. D. Seelman, and M. Bury.Thousand Oaks, CA: Sage Publications.

Popielarz Pamela A. 1999a. (In)voluntary Association: A Multilevel Analysis of Gender Segregation in Voluntary Organizations. *Gender Soc.* 13:234–50.

Putnam, Robert D. 2000. *Bowling Alone: The Collapse and Revival of American Community*. New York: Simon & Schuster.

Rickman, Richard L., Mark Lodico, Ralph J. Diclemente, Robert Morris, Charles Baker, Susan Huscroft. 1994. "Sexual Communication is Associated with Condom use by Sexually Active Incarcerated Adolescents" *Journal of Adolescent Health* 15(5): 383-388.

Rogers, Everett M. 2003. *Diffusion of Innovations.* Free Press. New York

Rodgers Joseph L., David C. Rowe. 1993. "Social Contagion and Adolescent Sexual Behavior: A Developmental EMOSA Model." Psychological Review 100(3): 479-510.

Rosenstock, Irwin M., Victor J. Strecher, and Marshall H. Becker. 1994. "The Health Belief Model and HIV Risk Behavior Change." Pp. 5-24 in *Preventing AIDS: Theories and Methods of Behavioral Interventions,* edited by R.J. DiClemente and J.L. Peterson. New York: Plenum Press.

Roy, A. and P. Nangia. 2005. “Impact of Male Out-Migration on Health Status of Left behind Wives: A Study of Bihar, India.” Paper Presented at the 2005 Meeting of the International Union for the Scientific Study of Population, 18-23 July

Rushton, Philippe J., and Trudy A. Bons. 2005. “Mate Choice and Friendship in Twins: Evidence for Genetic Similarity.” Psychological Science 16: 555-559.

Setel, P. 1999. *A Plague of Paradoxes: AIDS, Culture and Demography in Northern Tanzania*. Chicago: University of Chicago Press.

Smith, Kirsten P., and Susan C. Watkins. 2005. "Perceptions of Risk and Strategies for Prevention: Responses to HIV/AIDS in Rural Malawi" *Social Science and Medicine* 60(3):649-60.

Smith, Kirsten P., and Nicholas A. Christakis. 2008. “Social Networks and Health” *Annual Review of Sociology* 34:405-429.

Sweat, M. and Denison J. 1995. “Reducing HIV Incidence in Developing Countries with Structural and Environmental Interventions” AIDS 9 (suppl. A):S251-S257.

Thoits, Peggy A., 2011. “Mechanisms Linking Social Ties to Physical and Mental Health” *Journal of Health and Social Behavior* 52: 145-161.

Thoits, Peggy A., 1995. “Stress, Coping and Social Support Processes: Where are we? What Next?” *Journal of Health and Social Behavior (*Extra Issue) 53-79.

Tobler, Waldo. 1995. Migration: Raventein, Thornthwaite, and Beyond.” *Urban Geography* 16(4): 327-342.

Turner, Jay R., and Marino Franco. 1994. “Social Support and Social Structure: A descriptive Epidemiology. *Journal of Health and Social Behavior* 35:193-212.

UNAIDS report on the global AIDS epidemic 2010. Available online: http://www.unaids.org/en/media/unaids/contentassets/documents/unaidspublication/2010/20101123_globalreport_en.pdf (accessed April 2011).

UNAIDS. 1999. Sexual Behavior Change for HIV: Where Have Theories Taken Us? Geneva: United Nations. Available online *www.who.int/**hiv**/strategic/surveillance/en/**unaids**_99_27.pdf*

Umberson, Debra, Robert Crosnoe, and Corinne Reczek. 2010. "Social Relationships and Health Behavior across the Life Course" *Annual Review of Sociology* 36:139-157.

Umberson, Debra, Meichu D. Chen, James S. House, Kristine S. Hopkins and Ellen Slaten. 1996. "The Effect of Social Relationships on Psychological Well-Being: Are Men and Women Really so Different?" American Sociological Review 61:837-857.

Valente, Thomas W., Susan C. Watkins, Miriam N. Jato, Ariane Van Der Straten, and Louis-Philippe M. Tsitsol. 1997. "Social Network Associations with Contraceptive use Among Cameroonian Women in Voluntary Associations." *Social Science and Medicine* 45 (5):677-687.

van der Straten, Ariane; Rachel King, Olga Grinstead, Antoine Serufilira, Susan Allen. 1995. "Couple communication, sexual coercion and HIV risk reduction in Kigali, Rwanda" *AIDS* 9(8): 935-944

Wasserman, Stanley and Katherine Faust. 1994. *Social Network Analysis: Methods and Applications.* Cambridge, UK: Cambridge University Press.

Yabiku, Scott T., Victor Agadjanian, and Arusyak Sevoyan. 2010. "Husbands Labor Migration and Wives Autonomy, Mozambique 2000-2006." *Population Studies* 64(3): 293-206.

Zick CD., and KR Smith. 1991. "Marital Transitions, Poverty, and Gender Differences in

Mortality." *Journal of Marriage and Family* 53: 327-336.

TABLES

Table 1. Descriptive Statistics of all Variables in Analysis

Variables	Percent (unless noted otherwise)
Dependent Variables	
Network member is married to migrant	
Yes	47.98
No	52.02
Ever talked about AIDS with network member	
Yes	65.13
No	34.87
Talked about AIDS cases in AIDS conversations with network members[a]	
Yes	61.59
No	38.41
Talked about AIDS prevention in AIDS conversations with network members[a]	
Yes	90.07
No	9.93
Talked about testing of HIV and treatment of AIDS with networks members[a]	
Yes	21.62
No	78.38
Ego's use of methods of HIV prevention	
Uses any method of prevention	80.1
Does not use any method of prevention/don't know	19.9
Ego has tested for HIV	
Yes	17.34
No	82.66
Independent Variables	
Husband’s labor migration status	
Migrant's wife	41.12
Non-migrant's wife	58.88
Social network member's use of methods of HIV prevention	
Uses any method of prevention	33.06
Does not use any method of prevention	66.94
Social network member has tested for HIV	
Yes	6.01
No or don't know	93.99
Control Variables	

Ego's characteristics	
Mean age	27.1
Number of living children	2.2
Education	
No school	26.7
1-4 years of school	45.33
5 or more years of school	27.97
Employment	
Yes	21.45
No	78.55
Type of marriage	
Polygynous	21.06
Monogamous	78.94
Co-residence with parents-in-laws	
Co-resides with at least one parent-in-law	38.44
No co-resident parent-in-law	61.56
Household material possession	
HH has no radio, bicycle, or motocycle/car	33.55
HH has radio but no bicycle, or motocycle/car	32.54
HH has bicycle but no motocycle/car	25.27
HH has motocycle/car	8.64
Roof material of main dwelling	
Thatch	39.39
Zinc sheet, tile, cement	60.61
Cattle ownership	
Household owns cattle	31.17
Household owns no cattle	68.83
Religious affiliation	
None	13.89
Mainline church	27.41
Zionist/other Pentecostal	58.7
Communication with husband regarding HIV/AIDS	
Talked to husband about HIV/AIDS	58.4
Did not talk to husband about HIV/AIDS	41.6
Network member's characteristics	
Relation	
Kin or inlaw	37.12
Non-kin or in-law	62.88
Age (Relative to Ego)	
Older than ego	51.37
Same as ego	18.95
Younger than ego	29.68

Religion (Relative to Ego)	
Same as ego	48.95
Other/No religion/Don't know	51.05
Network Member will loan ego money if in need	
Yes	85.96
No/Don't know	14.04
Network member works outside the household	
Yes	12.47
No/Don't know	87.53

Notes: Number of observations for ego-1678; number of network dyads-3246; number of dyads that had HIV/AIDS conversations-2114

Table 2. Network Characteristics by Husband's Labor Migration Status

	Husband's Labor Migration Status	
Characteristic	Migrant	Not a migrant
Ever talked about AIDS with network partner**		
Yes	69.35	62.07
No	30.65	37.93
Network partner is married to migrant**		
Yes	55.3	42.42
No	44.7	57.58
Network member's use of HIV prevention		
Member uses at least one method of prevention	34.17	32.2
Member does not use any method of prevention	65.83	67.8
Network member had an AIDS test		
Yes	6.76	5.47
No	93.24	94.53
Relation		
Kin or inlaw	37.99	36.31
Non-kin or in-law	62.01	63.69
Relative age		
Older than ego	52.45	50.41
Same as ego	19.16	18.86
Younger than ego	28.39	30.73
Religion		
Same as ego's	50.5	47.84
Other/No religion or don't know	49.5	52.16
Network partner will loan ego money if in need		
Yes	86.91	85.18
No or don't know	13.09	14.82
Network partner works outside the household		
Yes	12.95	12.16
No or don't know	87.05	87.84
Total	1848	1390

** p<.01

Table 3. Themes of HIV/AIDS Related Conversations in Social Networks

	Husband's Migration Status	
Themes	Migrant	Not a migrant
Need for Prevention	92.22*	88.23*
Known or Suspected AIDS Cases	64.21*	59.55*
Testing and Treatment of AIDS	23.65*	19.97*
Other themes	4.99	4.81

Notes: More than one theme per partner is possible, percentages do not add up to 100

*p<.05

Table 4: Husband's Labor Migration and Wife's Likelihood of Having a Migrants' Wife as Social Network Members : Multi-Level Random Effects Models, Odds Ratios

	Model 1	Model 2
Labor migration		
Migrant's wife	1.67**	1.50**
[Non-migrant's wife]	1	1
Ego's characteristics		
Age (in years)		0.98*
Number of living children		0.98
[No education]		1
1-4 years of school		1.08
5 or more years of school		1.26†
Curently working		0.83†
[Not working]		1
In polygynous union		0.86
[In monogamous union]		1
Resides with parents in-law		1.03
[Does not reside with parents in-law]		1
Household material possession index		1.09†
Thatched roof		0.86†
[Zinc, lusolite or block roof]		1
Household own cattle		1.04
[Does not own cattle]		1
Mainline church		1.09
Zoinist/Pentecostal		0.95
[No religion]		1
Had Talked to husband about AIDS		1.17†
[Has not talked to husband about AIDS]		
**p<0.01; * p<.05; †p<.10		

Table 5: Husband's Labor Migration Status and Wife's Likelihood of HIV/AIDS Related Conversations, Multilevel Random Effects Models, Odds Ratios

	Model 1	Model 2
Labor migration status		
Migrant's wife	1.63**	1.99**
[Non-migrant's wife]		1
Ego's characteristics		
Age (in years)		1.04*
Number of living children		1.15
[No education]		1
1-4 years of school		1.45†
5 or more years of school		2.67**
Currently working		2.17**
[Not working]		1
In Polygamous union		1.26**
[In Monogamous union]		1
Resides with parents in-law		1.06
[Does not reside with parents in-law]		1
Household material possession index		1.01
Thatched roof		0.96
[Zinc, lusolite or block roof]		1
Household own cattle		1.09
[Does not own cattle]		1
Mainstream church		1.31
Zoinist/Pentecostal		1.59†
[No religion]		1
Had talked to husband about AIDS		12.18**
[Has not talked to husband about AIDS]		
Network member's Characteristics		1
Kin		0.89**
[Non-kin]		1
Older than ego		1.04
Younger than ego		1.11
[Same as ego]		1
Same religion as ego's		1.01
[Different religion from ego's]		1
Network member would loan money		1.27
[Network member would not loan money]		1
Network member is married to migrant		1.43**
[Network member is not married to migrant]		1
Network member works		1.24
[Network member does not work]		1

**p<0.01; * p<.05; †p<.10

Tables 6: Husband's Labor Migration and Wife's Likelihood of Discussing HIV Prevention in HIV/AIDS Related Conversations, Multilevel Random Effects Models, Odds Ratios	
	Model 1 (Full)
Labor migration status	
Migrant's wife	2.05**
[Non-migrant's wife]	1
Ego's characteristics	
Age (in years)	0.97
Number of living children	1.17*
[No education]	1
1-4 years of school	0.69
5 or more years of school	0.65
Currently working	1.01
[Not working]	
In polygynous union	2.03*
[In monogamous union]	1
Resides with parents in-law	1.04
[Does not reside with parents in-law]	1
Household material possession index	0.97
Thatched roof	0.87
[Zinc, lusolite or block roof]	1
Household owns cattle	0.78
[Does not own cattle]	1
Mainsline church	1.35
Zionist/Pentecostal	1.12
[No religion]	1
Had talked to husband about AIDS	2.40*
[Has not talked to husband about AIDS]	
Network Partners Characteristics	
Kin	1.01
[Non-kin]	1
Older than ego	0.88
Younger than ego	0.75
[Same age as ego]	1
Same religion as ego's	1.30
[Different religion from ego]	1
Network member would loan money	1.53
[Network member would not loan money]	1
Network member is married to migrant	0.73
[Network member is not married to migrant]	1
Network member works	0.94
[Network member does not work]	1
**p<0.01; * p<.05; †p<.10	

Table 7: Husband's Labor Migration, Network Member's Use Prevention and Test for HIV and Wives' Use. Multilevel Random Effects Models, Odds Ratios

	Ego's Uses AIDS Prevention	Ego has Tested for HIV
Labor migration status		
Migrant's wife	1.20	1.03
[Non-migrant's wife]	1	1
Social network member use of prevention		
Network member uses any prevention	4.91**	-
[Network member does not use any prevention]	1	-
Social network member HIV Testing		
Network member has tested for HIV		7.44**
[Network member has not tested for HIV]		1
Ego's characteristics		
Age (in years)	1.01	0.956*
Number of living children	1.00	1.17*
[No education]	1	1
1-4 years of school	1.55*	0.84
5 or more years of school	2.03**	1.43
Currently working	1.59*	0.74
[Not working]	1	1
In polygynous union	0.73	1.13
[In mongmous union]	1	1
Resides with parents in-law	0.93	1.02
[Does not reside with parents in-law]	1	1
Household's material possession index	1.02	1.22
Thatched roof	1.59*	1.28
[Zinc, lusolite or block roof]	1	1
Household owns cattle	0.57*	0.68*
[Does not own cattle]	1	1
Mainline church	1.07	1.01
Zionist/Pentecostal	0.96	1.07
[No religion]	1	1
Had talked to husband about AIDS	2.58**	2.20*
[Has not talked to husband about AIDS]	1	1
Network Members Characteristics		
Kin	0.60**	0.77
[Non-kin]	1	1
Older than ego	1.01	0.95
Younger than ego	1.25	1.02

[Same age as ego]	1	1
Same religion as ego's	1.32	1.24
[Different religion from ego's]	1	1
Network member would loan money	1.11	1.36
[Network member would not loan money]	1	1
Network member is married to migrant	0.82	0.79
[Network member is not married to migrant]	1	1
Network member works	1.11	1.13
[Network member does not work]	1	1

**p<0.01; * p<.05; †p<.10