Social Networks, Extra-Marital Partnerships, and Suspicion Among Married Couples in Rural Malawi*

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ABSTRACT

Extra-marital sexual partnerships (EMSPs) are believed to play a critical role in transmitting HIV in many countries in sub-Saharan Africa, including Malawi. Yet, the personal and social factors associated with EMSPs remain poorly understood, partly because this issue poses notoriously difficult problems for empirical research. This study attempts to overcome some of these limitations by employing a longitudinal data set to investigate the correlates of both husbands' self-reports about EMSPs and wives' suspicions about such partnerships. While this paper examines the effects of individual and marital union characteristics on EMSPs, it pays particular attention to the role of social networks both in fostering or discouraging extra-marital sex and in disseminating information to spouses about such behaviors. Three clear findings emerge from these analyses: that the selection of additional wives is closely linked to extra-marital sex, that socializing with men who have non-marital partnerships increases the likelihood that married men have EMSPs, and that both of these factors raise wives' suspicion that their husbands have EMSPs. In general, however, wives exhibit only modest accuracy in determining whether their spouse has other sexual partners. A better understanding of the practice and perception of EMSPs can help guide policies to more effectively respond to this major mode of HIV transmission.

INTRODUCTION

The spread of the AIDS crisis into the general population of married couples in much of sub-Saharan Africa has shone an increasingly intense spotlight on extra-marital sexual partnerships (EMSPs). In nearly all afflicted countries, extra-marital intercourse (EMI) has been identified as one of the primary sexual behaviors fueling the epidemic. One of the most consistent findings in the epidemiological literature is that having multiple, particularly concurrent, sexual partnerships substantially increases the risk of acquiring HIV (Halperin and Epstein 2004; Morris and Kretzschmar 1997, 2000). In response, public health officials as well as some government leaders have instituted "be faithful" and "zero-grazing" policies, which encourage individuals to have only one sexual partner. Some researches and policy makers have attributed considerable success to such programs, particularly in Uganda (USAID 2002).

Among demographers and sociologists interest in the determinants of EMI predates the HIV/AIDS epidemic and the topic received sporadic attention as it relates to total fertility, non-marital fertility, family cohesion and dissolution, and the transmission of other STIs. These studies tend to focus on the individual characteristics of those who have EMSPs, such as their occupation, wealth, educational level, and migrant status. Migrant labors, for example, are believed to have more EMSPs due to their residence

away from their wives and families (Boerma et al. 2002; Caldwell, Caldwell and Quiggin 1989; Chirwa 1997; Hirsch et al. 2002; Hunt 1993; Wolffers et al. 2002). Others have found greater wealth to be positively associated with more EMSPs, partly because richer men can afford payments and gifts in exchange for sexual favors. After controlling for income, men are more likely to have multiple partnerships in their late twenties and early thirties. The effects of educational attainment on EMI has been found to be positive in some studies and negative in others (Ahlburg, Jensen and Perez 1997; Isiugo-Abanihe 1994; O'Connor 2001). Interestingly, the effect of religion on having EMSPs appears to be context specific with few differences by religious affiliation within a given region, although Muslims where found to be significantly less likely than Catholics or Traditionalists in Nigeria to have EMSPs (Isiugo-Abanihe 1994). How one's level of religiosity affects the probability of having EMI has not been examined, but may prove a better predictor of EMI.

Previous studies have also examined some aspects of the marital union such as whether it is polygamous or monogamous and whether the couple practices post-partum abstinence after the birth of a child. The effect of polygamy on EMI is complex. Isiugo-Abanihe (1994) finds that in Nigeria men in polygamous unions are more likely to have ever had EMSPs, but are less likely to have had EMSPs in the last week. Paying closer attention to the distinction between first and higher order wives may help explain part of this difference (Timaeus and Reynar 1998). In polygamous societies, the process of taking additional wives appears to increase the overall probability of *ever* having EMSPs as men may have sex with prospective new brides before they marry; but having more than one wife may decrease the probability of recently EMSPs as polygamous men may seek fewer non-marital partners during their wives' menses, pregnancy, or the post-partum abstinence period (Isiugo-Abanihe 1994; Orubuloye, Caldwell and Caldwell 1991). The practice of post-partum abstinence is widely believed to encourage the formation of EMSPs (Ali and Cleland 2001; Awusabo-Asare and Anarfi 1997; Cleland, Ali and Capo-Chichi 1999; Glynn et al. 2001; Orubuloye et al. 1991). Although practiced throughout sub-Saharan Africa, this custom exhibits considerable variation by region and by ethnic group, with average abstinence spells lasting from one month to two years after the birth of a child (Zulu 2001). At least one study has also found an increased risk of male extra-marital relations during pregnancy as well (Onah et al. 2002), while another found that greater spousal closeness reduced men's and women's proclivity to have non-marital partners (Isiugo-Abanihe 1994). Many dimensions of the marital union, such as the degree of homogamy between spouses with respect to age and educational level, and the quality of communication between spouses have not been investigated, but arguably could have an important effect on the probability that a husband or wife seeks a non-marital sexual partner.

While these studies have identified some of the main individual and marital union correlates of EMI, they face at least four common limitations. First, research on EMI is notoriously fraught with respondent misreporting producing substantial errors-in-measurement. Several research projects have found that both males and females often initially deny sexual relations with secondary partners, only to reveal them later if trust with the interviewer is established (Tawfik and Watkins 2003). Given that the revelation

of extra-marital relationships can have potentially large and harmful consequences for respondents and their families, respondents have a strong incentive to lie about clandestine sexual relations. Even if extra-marital relationships are openly acknowledged between spouses, many respondents may not wish to share such personal and private information with an interviewer (usually a stranger). Such critiques about privacy and confidentiality could be made of all reporting on fertility and sexual behaviors, but seem especially salient with respect to EMI (Fenton et al. 2001). While some scholars have argued that concerns about misreporting of sexual data may be exaggerated and in cultural settings where men's EMSPs are widely accepted, bias in reporting may be less than anticipated (VanLandingham et al. 1994), deep-seated distrust of self-reported data on EMSPs has likely stymied research on this topic.

Another limitation of these previous studies is their lack of attention to the social processes which may either foster or retard an individual's propensity to have EMSPs. Sexual behaviors are deeply embedded in social norms and expectations. These norms often clearly prescribe the acceptability or non-acceptability of having EMI for both men and women and variation in these norms may partially account for the wide range in reported EMSPs across different cultures (Caraël, Cleland and Coll 1993). If social norms have a strong effect on the level of non-marital sexual relationships in a society, then the attitudes, behaviors, and beliefs of family and friends may directly influence an individual's probability of forming EMSPs. Qualitative research supports this hypothesis. Research in Thailand and Indonesia, for example, indicates that married men's friends exert substantial influence on whether men use condoms with EMSPs, particularly in the context of commercial sex (Ford, Wirawan and Muliawan 2002; Vanlandingham et al. 1998). Other studies in the urban slums of Nairobi, Kenya find that young men face considerable pressure from their peers to have many sexual conquests (Zulu, Ezeh and Nii-Amoo Dodoo 2000). Focus group discussions among youths in KwaZulu-Natal, South Africa suggest that both males and females fear ridicule from their peers if they fail to have multiple sexual partners (Varga 1997).

Moreover, an increasing number of quantitative studies in the demographic literature show an important effect of social networks on other sexual behaviors, contraceptive use, and reproductive health outcomes. In most of these studies *social networks* are identified by the respondent as those individuals including friends, neighbors, acquaintances, and family members with whom they have regularly or recently interacted. Often these social networks are defined with respect to specific conversation topics such as individuals with whom they have discussed family planning or HIV/AIDS, such groups of individuals are often referred to as *conversational social networks*. Numerous studies have examined the influence of conversational social networks on adoption of modern family planning methods, typically showing that conversational social networks are effective mechanisms for disseminating information and possibly modifying behaviors regarding family planning and contraception (Behrman, Kohler and Watkins 2002; Entwisle et al. 1996; Kohler 1997; Kohler, Behrman and Watkins 2001; Kohler, Behrman and Watkins 2000; Montgomery and Casterline 1998; Montgomery and Casterline 1996; Montgomery et al. 2001; Valente et al. 1997). A study among men in Mexico City indicates that talking to more friends

about personal problems increases the likelihood of using condoms to protect against STIs/HIV (Marston, Juarez and Izazola 2004). Emerging evidence suggests that conversational networks may also be critical in shaping individuals' perception of HIV risks (Behrman, Kohler and Watkins. 2003; Helleringer and Kohler 2005; Morris, J and Dean 1995). Some researchers have even credited at least part of Uganda's success in reducing its HIV prevalence via behavioral change to the effectiveness of its social networks in spreading information about HIV/AIDS and encouraging behavior modification (Stoneburner and Low-Beer 2004). Yet, despite widespread recognition that social structures and norms play an important role in determining many sexual behaviors, previous studies of EMI have focused on individual traits with little emphasis on the social context in which decisions are made. Specifically, the potential influence of social networks on extra-marital sexual behaviors has not been assessed in quantitative studies.

Third, previous studies have examined the covariates of EMSPs from the perspective of only one spouse, typically relying on self-reports from the husband.[1] With respect to HIV risks, however, non-marital sexual relationships pose not only a direct threat to the individual who has EMSPs, but also an indirect risk to their spouse. Given the high frequency of unprotected sex within most marital unions and the relatively high transmission rate following new infections, the indirect risk from EMI to spouses is far from negligible. Indeed, a quarter of women in Malawi name their spouses as their main source of risk with respect to HIV (Schatz 2003). Although recognized as an important risk factor, little is known about spouses' perception of their husbands' or wives' non-marital sexual behaviors. What makes a husband or wife suspect that their spouse has EMSPs? Do husbands and wives know when their spouse has had EMSPs, thereby placing them at risk? Men and women who suspect or know that their spouses have had EMSPs represent an especially vulnerable group for whom conventional protection strategies such as abstinence and using condoms are difficult to implement, while simply remaining faithful themselves is ineffective. Employing alternative protective strategies, such as separating from their spouse, insisting that he or she uses condoms with outside partners, or adopting new technologies such microbicides (when they become available) will depend on their ability to correctly detect that they are at risk via their spouses' non-marital sexual relationships. Orubuloye and colleagues (1992) maintain that among married couples in Nigeria there is a "façade of ignorance" maintained by husbands and wives with respect to husbands' EMSPs. While a startlingly high percentage of married men in Nigeria reported currently having EMSPs (more than 90%), only 10% of these men thought that their wives knew about these partnerships. In contrast, three-fifths of these men state that at least some of their relatives were aware of these non-marital sexual relationships, alluding to the greater communication about EMI within social networks than between spouses.

[1] One exception is Ahlburg and colleagues (Ahlburg, D.A., E.R. Jensen, and A.E. Perez. 1997. "Determinants of extramarital sex in the Philippines." *Health Transition Review* 7 Supplement:467-479.), who use wives' reports about their husbands' EMSPs as a measure of EMI among husbands rather than as an indication of wives' perceptions.

Finally, all of the previous studies conduct their analyses on *male* EMI. The focus on husbands' EMI rather than wives' has been justified on two grounds. First, the concerns about misreporting about EMSPs are even greater for wives than husbands. Second, although by no means limited to males, husbands are widely believed to have more EMSPs than wives. Empirical data based on self-reports show that married men are four times more likely to acknowledge having had an EMSP than married women in Malawi (Schatz 2003). Similarly large differences are reported elsewhere in sub-Saharan Africa (Caraël et al. 1995). These differences are likely inflated by a greater tendency among husbands to over-report their sexual liaisons, a strong reluctance among wives to report theirs, or both. Indeed, the extent of misreporting may reflect social norms that consider multiple sexual partnerships after marriage for men to be "natural" and even healthy, while female EMI may be perceived as more aberrant and less acceptable behavior (Cleland et al. 1999; Orubuloye, Caldwell and Caldwell 1997). Even with considerable misreporting, it seems likely that EMI occurs significantly more frequently among husbands than among wives. This conclusion is bolstered by longitudinal studies on new HIV infections within marriage which find that husbands are roughly twice as likely to bring HIV into marriage as are wives, suggesting their greater number of extra-marital sexual encounters (Carpenter et al. 1999; Hugonnet et al. 2002; Serwadda et al. 1995).

In this paper, given low levels of self-reported EMSPs among wives in Malawi, we are unfortunately also limited to exploring male EMI only. However, we build upon the existing literature by addressing the three other limitations mentioned above. In particular, using of a unique set of longitudinal data on matched married couples enables us to minimize biases resulting from misreporting about sexual behaviors and omitted variables. Using both random and fixed-effects models, we investigate how both personal and social factors affect husbands' proclivity to have EMSPs. In addition, we explore whether similar social, marital and individual characteristics are associated with wives' perceptions that their spouses have EMSPs. This paper asks three specific questions. First, how do married men's individual, marital union, and social network characteristics affect their likelihood of having EMSPs? Second, which married women are most likely to suspect that their husbands have EMSPs? And third, how accurate are wives in predicting whether their husbands have had EMSPs and what improves their accuracy? In the final section we conclude by discussing possible policy implications for these results.

EMSPs AND SOCIAL NETWORKS IN MALAWI

The small land-locked country of Malawi has one of the lowest per capita incomes in the world, depending mainly on subsistence farming and fishing in Lake Malawi, which flanks its eastern border. Like many of its neighbors, Malawi is experiencing an epidemic in HIV/AIDS with prevalence among women attending antenatal clinics ranging from 21.7% in the urban area to 14.5% in rural regions (National AIDS Commission 2003). As in many other countries, sexual relationships outside of marriage are considered one of the primary behaviors fueling the epidemic. Marital unions tend to proceed in a gradual and step-wise fashion with sexual relations, financial exchanges, and living arrangements signifying different levels of commitment. Divorce and separation

are also common in Malawi, with an estimated 40% of marriages dissolving within 10 years (Bracher, Santow and Watkins 2003). The boundaries defining both entry into and exit from marriage are relatively fluid. Nonetheless, marital unions are distinct with respect to their sexual behaviors, social recognition, kinship structures, and economic obligations, which vary by region and religion. Matrilineal and matrilocal customs (called chikamwimi) are dominant in the southern region of Malawi, which is also largely Muslim. In contrast, the mostly Catholic and Protestant northern region follows a patriarchal tradition (chitengwa) which includes the payment of bridewealth (or lobola) at the time of marriage. Residents living in the central part of the country practice a mix of these customs.

Qualitative studies in Malawi primarily based on journals kept by a selected group of men and women in southern Malawi document that men freely discuss their own and others' extra-marital sexual relations with one another (Kaler 2004; Watkins 2004). They frequently gave specific reasons for selecting one sexual partner versus another. For example, some claimed that they always went for younger girls who lived in the village because they were less likely to be infected, while others countered that even village school girls are not necessarily safe. Other men offered specific advice to their friends about which girls were likely to accept their advances and which would reject them. While some male friends openly encouraged other men to have EMSPs and sometimes facilitated these encounters, other males unequivocally discouraged promiscuity among their married friends. One man, a self-described Protestant "born-again", related several stories in which he chastised philandering male friends and admonished them to be faithful in the future. The high proportion of sexual relations with bargirls reported to have occurred after a night of drinking with friends further suggests an intimate link between socializing with male peers and having EMSPs.

Among women's social networks, discussions about their own non-marital sexual liaisons was more limited, but reports of who is having sexual relationships with whom dominated their discussions, particularly as EMI related to HIV/AIDS risks (Tawfik and Watkins 2003; Watkins 2004). Women's friends, relatives and neighbors appeared to keep a watchful eye out for promiscuous men and women. While a few women made oblique references to having "found out" about their husbands' EMSPs from friends or neighbors, more often women would "tell on" other women who were having sexual relations with married men especially if they were "jealous" or wished ill of the woman.

CONCEPTUAL FRAMEWORK

Such intense discussion of EMI among both men's and women's social networks lead us to develop two conceptual models which explicitly incorporate i) the role of men's and women's social networks on the probability of husbands having EMSPs and ii) the role of social networks on wives' perception that their husbands have EMSPs.

Factors associated with husbands' EMI

In our first conceptual model, we maintain that having EMSPs is the result of a complex decision making process driven by specific characteristics of the individual and their

marital relationship, and also deeply embedded in the husbands' and wives' social structures and relationships. We, therefore, situate husbands' decisions about whether or not to have EMSPs in the context of his personal attributes, the quality of the marital union, and his social milieu. Moreover, we emphasize that several typically unobserved (or unmeasured) characteristics such as men's underlying libido (or sex drive), their beliefs about masculinity and marriage, and other sexual preferences are among the most important individual-level factors determining whether husbands seek EMSPs. Following previous findings in the literature, we contend that specific individual characteristics such as being a migrant or having access to disposable income will likely increase the probability of having EMSPs.

In our models, we draw a conceptual distinction between individual characteristics of the husbands and qualities of the marital union, which take into account characteristics of wives and aspects of the relationship between husbands and wives. In general, we hypothesize that husbands in "closer" unions with greater spousal communication, greater homogamy, and high levels of marital satisfaction will be less likely to seek non-marital sexual partners. Practicing abstinence during menses, pregnancy or post-partum, in contrast, is likely to increase EMI for husbands. Finally, we expect that there will be two different effects for polygamy. Husbands who currently have multiple wives will be less likely to seek sexual partnerships outside of these marital unions, while men in the process of seeking additional wives (regardless of whether they are currently in a monogamous or polygamous marriages) will be more likely to have EMSPs.

Of particular interest in this paper is the social context which may either encourage or discourage male EMI. We theorize that male non-marital sexual behavior, while partially motivated by biological forces and personal factors, is largely predicated on social expectations and norms. Specifically, our model maintains that the behaviors and composition of male peer networks will greatly influence the non-marital sexual behaviors of its members. Given the intimate nature of these non-marital sexual behaviors, we further contend that the members of these social networks will have a more direct and stronger impact on the non-marital sexual behaviors of husbands, than will the attitudes and beliefs of more socially distant role models, such as religious or political leaders, although these too could mold non-marital sexual behaviors. Such a view is supported by Bandura (1991:108) who maintains that "[b]ecause of their proximity, immediacy, and prevalence, the interpersonal influences operating within one's immediate social network claim a stronger regulatory function than do general normative sanctions." In their work in Ghana, for example, Montgomery and colleagues (2001) find rather small effects of distant influences such as exposure to newspapers or radio programs compared to the effects of social networks on the use of contraception.

Several studies on the effects of social networks on other behaviors such as the use of contraception propose that social networks have two main ways of affecting the behavior of their members: social influence and social learning (Montgomery and Casterline 1996). Social networks exert social influence if individuals model their behaviors on the behaviors of the members of the network. Social influence occurs if

members of the group cast judgment and exert peer pressure for others to adopt or discontinue particular behaviors according to the practices of the other group members (Kohler et al. 2001; Montgomery and Casterline 1996). Thus, social networks can have either a positive or negative effect on a given behavioral outcome depending on the "shared values" of the group as exemplified by their behaviors. Social learning, by contrast, maintains that the size and composition of the network matters because exposure to different types of people with different experiences, behaviors, and knowledge provides opportunities to gain new information (Behrman et al. 2002; Kohler 1997; Montgomery and Casterline 1993; Montgomery and Casterline 1996; Valente et al. 1997).

Though it is beyond the scope of this paper to distinguish between these two mechanisms, comments recorded in the journals (described above) suggest that men's social networks may affect their non-marital sexual behaviors through both social influence and social learning. Men appear to experience considerable peer pressure (social influence) to follow the example of their male friends with respect to whether or not they have EMSPs. Male social networks may also operate through social learning. For example, men may tell other men where to find commercial sex workers, which local girls are willing to have new sexual partners, how to hide extra-marital relationships from wives, which means of preventing both STIs and pregnancy are most effective, and which types of girls are considered safest. Men's social networks may also transmit information about the risks associated with having EMSPs. Our conceptual model does not assume that social networks are exogenously formed. Indeed, one of the proposed mechanisms for social influence relies on the threat of expulsion from the group if the behavior of the individual does not conform to group norms. Men may also gravitate towards other men with similar characteristics and behaviors. Thus, the association between the characteristics and behaviors of social network members and the individual will be driven both by a selection into specific social networks and by the influence of social network members on the individual.

Our primary hypothesis is that husbands who associate with men who have EMSPs will be more likely to have EMSPs as well. We maintain that not only are "birds of a feather likely to flock together", but that the behaviors of men's peers will likely influence their own behaviors, although we will not be able to determine the relative magnitude of the causal impact in either direction. Our model further suggests that, holding other factors constant, the size of men's social networks and the degree of intimacy or closeness within that social network may also be correlated with men's propensity to have EMSPs. For example, men with large and diffuse social networks filled with many acquaintances may have the greatest opportunity to find EMSPs. Alternatively, men who socialize with a smaller and more intimate group of close friends and confidants may be more likely to have EMSPs since qualitative literature suggests that men frequently engage in commercial sexual relationships following evening spent socializing with friends (Vanlandingham et al. 1998; VanLandingham and Trujillo 2002). The predicted effect of network size is ambiguous. Men with large social networks may greater access to information about potential EMSPs, though they may also have greater

information about the potential risks of having EMSPs. Thus the combined effect will depend on the type of information conveyed within these networks.

Finally, and arguably of secondary importance relative to their own social networks, the social networks of their wives may also affect husbands' inclination to have EMSPs. Husbands who know that their wives have strong and well-connected social networks may be particularly reluctant to engage in EMI, particularly within the same village or with women who have over-lapping social networks.

Factors associated with wives' perception of husbands' EMSPs

In our second conceptual model, we consider how personal, marital and social network characteristics may affect wives' perception that their husbands either have or do not have EMSPs. There are numerous ways a wife may become suspicious that her husband has EMSPs, such as by finding condoms in his pockets or frequent, extended visits to the local canteen, or the presence of a new sexually transmitted infection, when she is certain of her own fidelity. In our model we emphasize that social networks, through social learning, may also play an important role in determining not only wives' overall level of *suspicion* about their husbands' EMSPs, but also their *knowledge* about such behaviors.

When considering which women are most likely to suspect their husbands of having EMI, several characteristics operating at multiple levels may be important. To the degree that women are accurate in their suspicions about their husbands' behaviors, the individual and marital characteristics associated with husbands' self-reports of EMI should also be correlated with greater suspicion among wives. For example, if polygamous men are more likely to have EMSPs before selecting another wife, then senior wives whose husbands take additional wives should report greater levels of suspicion. Also if migrants are more likely to engage in extra-marital sex then having a husband who works away from the village should elevate women's suspicion. However, if wives are largely unaware of their husbands' non-marital sexual behaviors, then such associations would not be found. Arguably one of the most important individual-level determinants of a woman's level of suspicion is the degree to which she is "naturally suspicious," a characteristic which is largely unobservable. The size, composition, and behaviors of women's social networks may also be related to women's reported levels of suspicion. For example, having larger social networks consisting primarily of unrelated individuals may increase women's exposure to "gossip" about EMI and therefore heighten their levels of suspicion. If women observe that many of their friends, relatives, and neighbors have EMSPs, then they may also be more suspicious about their husbands. Perhaps most importantly if their husbands' social network consists of peers who have EMSPs, wives may be much more likely to suspect their husbands of engaging in EMI as well.

Yet, the personal, marital and social factors which elevate women's level of suspicion may not be the same ones which improve the accuracy of knowledge about her husbands' actual non-marital sexual behaviors. We therefore modify our second conceptual model to examine the predictors of wives' knowledge about their husbands' EMSPs. In principle, one may expect that older and more educated women as well as

those with closer marital ties would be better at predicting both when their husbands have had EMSPs and when they have not. Moreover, to the extent that social networks provide specific information about their husbands' non-marital sexual activities rather than generalized "gossip" about EMI, women with better informed social networks may exhibit far greater levels of accuracy and awareness regarding the sexual behaviors of their spouses. Specific information heard through social networks may not only alert wives about their husbands' EMSPs, but it may also allay their anxieties if they do not hear that their husband has been "sleeping around" or if they learn that he has explicitly refused offers for non-marital sexual relations with specific girls. Thus larger and more diverse social networks may aid women in correctly determining whether their husbands' behaviors are potentially placing them at risk.

DATA

To examine individual and social covariates associated with husbands' self-reports of EMSPs and wives' perceptions about husbands' EMSPs, we use data from the first two waves of the Malawi Diffusion and Ideational Change (MDIC) survey conducted in 1998 and 2001. The structure of these data, their substantive focus, and data quality issues are described by Watkins et al. (2003). Additional detailed information about these data is available at http://www.malawi.pop.upenn.edu/. These longitudinal data present a rare opportunity to investigate male EMI in the context of marriage among couples in Malawi. Collected in three rural sites located in a northern district (Rumphi), central district (Mchinji), and southern district (Balaka), these data capture much of the diversity in ethnicity, religion, and lineage systems in Malawi. Villages within these areas were randomly selected and then married women aged 15-49 were chosen at random from the registries of regular household members. If available, the spouses of selected women were also interviewed, but in many instances husbands were not interviewed because they were separated, working during the day, or had migrated to another area. We limit our analyses to matched married couples in which both the husband and wife were interviewed. In the first wave of the survey, conducted in 1998, our final sample consisted of 883 wives and 853 husbands. (There are fewer husbands because some men were married to multiple women in the survey.) Three years later, in 2001, a second survey was conducted, which re-interviewed about 80% of the women and 70% of the men selected in the 1998 as well as any different or additional marital partners of these individuals. Further analyses of individuals lost to follow-up suggest that their omission was not sufficiently systematic to bias our results (Bignami-Van Assche, Reniers and Weinreb 2003). These new marital partners included those from remarriage after the dissolution of the previous marriage as well as additional junior wives in marriages that remained intact. The sample of matched husbands and wives in 2001 consists of 1,109 married women and 896 married men.

Interviewer made up to three attempts to contact all eligible individuals in selected households. Efforts were made to ensure privacy and all participants were assured of confidentiality. Husbands and wives were interviewed separately about a wide array of sexual and reproductive health issues.

Dependent Variables
Three dependent variables are examined: 1) husbands' self-reports of EMSPs, 2) wives' level of suspicion about their husbands' EMSPs, and 3) wives' accuracy in knowing whether their husbands have had EMSPs.

Self-reports of EMSPs. Table 1 shows self-reports of having EMSPs and suspicion regarding spouse's EMSPs. Both husbands and wives were asked whether they had sex with anyone other than their spouse in the last 12 months. For men in polygamous unions, EMI was defined as having sexual relations with women to whom he was not married. If they responded in the affirmative, they were asked how many non-marital partners they had had in the last year. In both 1998 and 2001 only about 1% of wives, but slightly less than 10% of husbands, acknowledged having had EMSPs in the last year. Very few women reported more than one additional partner, while men had between zero and 20 partners. In comparison, in the nationally representative Demographic Health Survey from Malawi conducted in 2000 found that a much higher percentage of men in rural Malawi (17%) reported having an EMSPs in the last year, while a similarly low percentage of married women (< 1%) reported additional partners (National Statistica l Office [Malawi] and ORC Macro 2001). Among men in the MDIC who reported at least one sexual partner, the average was 2.4 in 1998 and 1.7 in 2001. In the second wave (only), respondents were also asked whether they *ever* had any sexual partners besides their spouse during the course of their marriage. Almost 20% of male respondents reported having had other sexual partners.

(insert Table 1 about here)

Suspicion Regarding Spouse's EMSPs. In addition to reporting their own EMSPs, husbands and wives were asked whether they thought that their spouse had *ever* had EMSPs during their marriage. Specifically they were asked "do you suspect or know that your husband/wife has had sexual relations with other women/men from you since you were married?" Respondents answers were classified as: 1) respondent knows their spouse had EMSPs, 2) respondent suspects their spouse had EMSPs, 3) respondent cannot tell whether their spouse had EMSPs, or 4) respondent does not suspect their spouse had EMSPs. In 1998, 11.0% of wives said they "knew" that their husbands had had at least one EMSPs during their marriage. This had risen to 19.5% by 2001. In comparison, only about 2% of husbands reported knowing that their wives had ever had EMSPs. A sizeable proportion of both husbands (about 15%) and wives (about 30%) reported either that they suspected their spouses of having EMI or reported that they could not know what their spouses did. The later is interpreted as tacit recognition that their spouses probably had EMSPs, but they had never caught them "red-handed" (Susan Watkins, Principle Investigator of MDIC, personal communication, May 5, 2003). For purposes of analyses, these first three categories are combined to create a dichotomous variable indicating some level of suspicion. Only about half of wives, but over four-fifths of husbands, reported that their spouses probably never had other sexual relationships (Table 1). Given the low levels of both wives' self-reported EMSPs, multivariate analyses about women's EMI are not conducted.

Accuracy Regarding Spouse's EMSPs. As a rough gauge of wives' accuracy, we compare wives' level of suspicion about their husbands' EMSPs to their husbands' self-reported EMSPs. Unfortunately, since the first wave of the survey only asked husbands about EMSPs in the last year rather than over the course of their marriage, these comparisons can only be made using cross-sectional data from the second wave. Figure 1 shows wives' level of suspicion by whether their husbands report having any EMSPs during their marriage for data collected in 2001. In couples where the husband acknowledges ever having had an EMSP, 38.3% of wives know about his EMSP, 10.7% suspect and another 23.0% cannot tell, leaving only 28.1% of wives who believe he has been completely faithful. In contrast, among couples where the husband reports that he never had an EMSP, more than half of the wives (57.2%) reported that they did not suspect him of having had EMSPs.[2]

(insert Figure 1 about here)

To produce indicators of "accuracy", we need to consider the probability that wives correctly identify when their husbands have had EMSPs and when they have not. We, therefore, borrow the concepts of sensitivity (the percentage of husbands suspected by their wives among men who report having EMSPs) and specificity (the percentage of husbands not suspected by their wives who report having had no EMSPs) from epidemiology, taking husbands' reports to represent the "truthful" underlying condition.[3] As shown in Figure 1, the sensitivity with which wives' "accurately" detect that their spouses have had EMSPs is 71.9% (including wives who cannot tell, suspect or know that their spouses have had EMSPs). In other words, 71.9% of men who said they had ever had EMI were suspected (to some degree) by their wives. In contrast, wives exhibit surprisingly low specificity. Among men who reported never having had an EMSP, 42.8% were suspected, leaving only 57.2% of faithful husbands "correctly" identified by their wives as having had no other sexual partners. A Cohen-Kappa analysis suggests higher agreement than would be expected from random guesses indicting that these two measures are not independent, but with a kappa-score of only 0.18 the inter-rating of these measures is very low. On the whole, Figure 1 indicates that while wives exhibit considerable ability to identify unfaithful husbands, their predictions are by no means perfect. If we take men's self-reports of EMI as being the "truth," it appears as if many wives are "overly" suspicious about their husbands' behaviors.

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[2] As a comparison, we investigate wives' accuracy and knowledge about their husbands' other characteristics, specifically his highest level of education. As above, wives' reports about their husbands' educational backgrounds are compared to husbands' self-reports of their educational status. About 6% of wives in the MDIC-2 reported either did not respond or stated that they did not know whether their husbands had EMSPs. In comparison about 5% of wives' did not respond or stated that they did not know their husbands' highest level of education. Overall, the correlation between wives' perception of their husbands' education level and their husbands' actual educational attainment were high (correlation coefficient = .82) compared to a correlation coefficient of only .23 for wives' perceptions of their husbands' EMSPs. Among men who reported having no education, 72.4% of their wives also reported that their husbands have no formal education, while among men reporting no EMSPs, 57.2% of wives also reported that their husbands never had EMSPs.

[3] Selecting husbands' self-reports of EMI as the "truth" is somewhat arbitrary. One could argue that while wives may have poorer information regarding male EMI, they may be more truthful in divulging such information.

Independent Variables

Individual and marital union characteristics. The individual and marital union characteristics of husbands and wives in both waves are presented in Table 2. As expected, husbands are older (by almost seven years) and more educated than their wives. They have similar religious affiliations with the majority of respondents identifying as Protestant, while about a fifth are Catholics and a similar percentage Muslims. Husbands and wives also reported whether they own each of five common household items: a bed with a mattress, a radio, a bicycle, a pit latrine, and a paraffin glass lamp. As a rough indicator of economic status, we estimate the average number of household items owned. Alternative measures incorporating ownership of livestock, acres of land, and meat consumption in the last week were also evaluated, but deemed inferior measures in this rural population.[4] Husbands report slightly higher levels of economic assets suggesting either systematic misreporting by gender or some of these items are considered individual rather than communal property (Miller, Watkins and Zulu 2001).

We also measure several aspects of the marital union including differences in spouses' ages and their educational levels, the duration of the marital union and whether it is polygamous or monogamous. Nearly a fifth of the women were in polygamous unions in the first wave, though this number rises sharply by the second wave as their husbands took additional wives and these wives were also interviewed. For the purpose of better understanding how polygamy may affect EMSPs, we further specify marital unions that were polygamous at the time of the index marriage and those that became polygamous afterwards. Additional household characteristics assessed include the number of children ever born which increased over time but remained higher for husbands (as expected given polygamous unions). There was also a substantial improvement in the quality of housing between the surveys, with the percentage of respondents living in huts made of either sun- or fire-burnt bricks rather than mud increasing by 10 percentage points.

(insert Table 2 about here)

Unfortunately, as mentioned above, since we limit our sample to couples in which both husbands and wives are interviewed, we are strongly selecting on non-migrant households. Thus, 94.7% of wives in our sample reported that their husbands usually lived at home. Among all women interviewed (regardless of whether their husbands participated), 80.2% reported that their husbands usually lived in the village.

Social networks characteristics. Both waves of the survey also gathered extensive information about the ego-centric social networks of both husbands and wives. Respondents were first asked to report the number of people, other than their spouse, with

[4] Similarly, using a method of principal components recommended by Filmer, D.and L. Pritchett. 2001. "Estimating wealth effects without expenditure data--or tears: An application to educational enrollment in states of India." *Demography* 38(1):115-132.), to calculate wealth quintiles did not prove to improve on our crude measure.

whom they "chatted" about AIDS. We refer to these individuals as their *social network members* (SNMs) to distinguish them from their *extra-marital sexual partnerships* (EMSPs). Since these social networks are limited to persons with whom the respondent discussed AIDS, they are not necessarily representative of the respondents' broader social network, but they are likely to be individuals with whom the respondent feels comfortable discussing important issues related to sexual behavior. For both men and women the average number of individuals with whom they discussed AIDS increased substantially in the intervening three years, but men reported consistently larger numbers of conversational partners. In Wave 1 women spoke to an average of 4.4 other individuals about AIDS, compared with 6.5 for men (Table 3).

Respondents then provided detailed information on up to four of these conversational social network partners. Since these individuals represent only a subset of the respondents' full conversational social networks, we refer to them as *censored social networks.* All characteristics about social network members presented in Table 3 are derived from these censored social networks. On average, wives provided detailed information on 2.6 censored SNMs in 1998 and 3.3 in 2001, while husbands reported on the characteristics of 3.1 and 3.6 censored SNMs in 1998 and 2001, respectively. Men's and women's social networks are highly segregated by sex with over 90% of husbands' networks consisting of men and over 90% of wives' networks consisting of women. When asked about their level of closeness to each of their network members, both men and women reported the largest number of members to be friends, with less than one-quarter of individuals per network being considered as a confidant and even fewer being labeled as mere acquaintances.

(insert Table 3 about here)

Of particular interest in this study, respondents were queried as to whether they thought their network members had had other sexual partners besides their spouse or regular sexual partner in the last year. On average women in Wave 1 reported that they suspected about 8.5% of their SNMs of having non-marital sexual partners. By 2001 the proportion had increased to 13.3%. Men were even more likely to suspect their SNMs of having non-marital partners ranging from 13.5% in 1998 to 20.0% in 2001. Note that reports about suspicion regarding social network members' non-marital sexual activity tend to be higher than self-reports of EMSPs in the last year for both men and women. These SNMs are not a random sample of the population so it is possible that individuals who are more likely to be included as SNMs are also more likely to have non-marital sexual partners. In addition, some of the SNMs are unmarried and therefore may have more sexual partners. Nonetheless, these differences may also signify either under-reporting of respondents' sexual behaviors or misinformation about SNM's behavior. Using similar ego-centric reports, an evaluation study showed that respondent's reports of their social network members' use of contraceptives often differed from those individuals' self-reports (White and Watkins 2000). Others have also noted the problems of relying on respondents' perception of their peers behaviors rather than direct reports by these individuals (Billy and Udry 1985).

METHODS

Since the two main dependent variables, 1) whether husbands has had EMSPs in the last year and 2) whether wives suspect that their husbands have had EMSPs, are both dichotomous, we employ random-effects and fixed-effects logistic models to examine the associations of individual, marital union, and social network characteristics with these outcomes. These non-linear models can be directly estimated using commands xtlogit commands with either fixed or random effect in Stata Version 8.0.[5] These models can be used with either balanced or unbalanced panel data. The results presented in Tables 4 and 5 use unbalanced data, though similar coefficients are obtained if we restrict our analyses to samples with no missing data in either wave. In the logistic regression models of husbands' infidelity π_{it} is the probability that husband *i* had an EMSP during the year prior to time *t*, while in the logit models of wives' suspicion about their husbands' infidelity π_{it} is the probability that wife *i* suspects that her husband ever had an EMSP prior to time *t*.

Thus, our basic model is:

$$\ln(\frac{\pi_{it}}{1-\pi_{it}}) = X_{it}\boldsymbol{\beta}_1 + MU_{it}\boldsymbol{\beta}_2 + \overline{H'SN}_{it}\boldsymbol{\beta}_3 + \overline{W'SN}_{it}\boldsymbol{\beta}_4 + D_t\beta_5 + \mathrm{f}_i + u_{it} \qquad (1)$$

where:

X	=	Observed individual characteristics,
MU	=	Observed marital union characteristics,
H'SN	=	Average husbands' social network characteristics,
W'SN	=	Average wives' social network characteristics,
D	=	Dummy for year of survey,
f	=	Unobserved individual-level fixed factors, and
u_{it}	=	Idiosyncratic error, which varies within individuals over time.

Like most models of the effects of social networks on demographic outcomes, we measure the average characteristics of the members of husbands' and wives' social networks (Behrman et al. 2003; Behrman et al. 2002; Helleringer and Kohler 2005; Montgomery and Casterline 1996; Montgomery et al. 2001). Such models assume that all members of the social network exert equal influence and therefore should be weighted equally. Thus, in the model of husbands EMSPs, the coefficients of H'SN and W'SN measure the association between the average attributes of husbands' and their wives' social networks-- such as their size, closeness to the respondent, and number of members with EMSPs-- and husbands' propensity to have EMSPs. As has been widely noted, such

[5] Stata assumes a normal distribution for the random error component and uses the Gauss-Hermite quadrature to calculate the log-likelihood of these random- and fixed- effects logits. Given that there are only two time periods and a relatively low proportion of the total variation is accounted for by the within-individual variation, this approach produces stable estimates regardless of the number of quadrature points used.

associations between social networks and outcomes cannot be given a causal interpretation because people are known to typically exhibit "homophily" with respect to their selection of network members (i.e. people tend to select social network members who are similar to themselves in characteristics and behaviors) (Billy and Udry 1985). "Homophily" are a particularly thorny type of the reflection problem clearly and thoroughly described by Manski (1995). In our model, for example, a positive association between individuals who have EMSPs and whose SNMs have EMSPs could indicate either that having friends who engage in EMI encourages the respondent to have EMI or that respondents who desire to have EMI deliberately seek out friends who already engage in such behaviors. Similarly, with respect to wives' suspicion about their husbands' EMSPs, having large social networks may engender greater suspicion among wives or wives who are suspicious of their husbands may establish larger social networks. Thus, it is difficult to distinguish whether peers influence the respondents' behavior or whether the respondent selects peers similar to himself or herself, unless we simply assume that social networks are formed prior to reported behavioral outcomes (Behrman et al. 2003; Behrman et al. 2002; Helleringer and Kohler 2005)[6] or we rely on data from more than two time periods allowing for a lagged effect of social networks (Montgomery and Casterline 1998; Montgomery et al. 2001).

Our models also include f_i which signifies unobserved individual-fixed factors such as the individuals' sex drive or beliefs about marital monogamy (for husbands) or their natural level of suspicion (for wives). Other variable such as proclivity to misreport by either exaggerating or omitting sexual behaviors may also be captured within the vector f_i if these characteristics remain constant over time. In the random-effects logistic models, which pool observations from 1998 and 2001, we account for similarities between observations of individuals who were interviewed in both surveys (and therefore contribute two observations apiece), but individual-fixed characteristics remain in the error term. To the extent that these individual-fixed characteristics may be correlated with the observed individual, marital union and social network characteristics, failing to control for them may bias the estimated coefficients (Petersen 2004).

To overcome this potential problem we also employ fixed-effects logistic models, which can eliminate the influence of both observed and unobserved characteristics that remain constant within an individual over time (f_i). Unfortunately, fixed-effects models also face several limitations. The main drawback of all fixed effects models is that we can no longer estimate the effects of observed time-constant individual-level and marital union predictors such as age, marital duration, educational attainment, religion, and region of residence, which are of considerable interest to our analyses. (These variables are no longer included in X or MU.) Moreover, in fixed effects models only individuals that experience a change over time contribute to the analyses. In our logistic fixed effects models, these observations that remain static are dropped, severely reducing our sample size. Finally, because fixed-effects models by differencing out all of the "fixed component" of the variation across individuals, tends to bias the coefficients towards

[6] This assumption with respect to the MDIC studies may be at least partially justified based on qualitative reports that women's social networks are not formed with strategic intentions Watkins, S. 2004. "Navigating the AIDS epidemic in rural Malawi." *Population and Development Review* 30(4):603-705.

zero. Indeed, by relying on the within-individual variation only these fixed effects models rely on only a faction of the variance available in the random effects mode. For example, the within-individual variance accounts for only 37% of the variance in the random-effects model of male EMSP reported in Table 4 and only 14% of the variance found in the random-effects model of wives' suspicion (Table 7). Thus, the ability to detect significant relationships is often difficult with these models.

Given the added complexity and difficulty in estimating and interpreting logistic fixed-effects models, many researchers have preferred to use linear probability models. In our analyses we find that both random- and fixed-effect linear probability models produced substantively similar results to our logistic regressions. However, these linear probability models offer the additional advantage of allowing for a well-established test, known as the Hausman test, to test whether fixed-effect result in sufficiently different estimates to warrant its use. Specifically, the Hausman test compares the covariance matrices of the fixed and random effects model and tests the null hypothesis that there is no significant correlation between the unobserved individual-specific random effects and the observed regressors. With respect to husbands' EMSPs (shown in Table 4), we reject the null hypothesis at $p < 0.03$, indicating that the fixed effects model is preferable. For wives' suspicion, we also find that the random effects model does not pass the Hausman test of unobserved individual-specific effects ($p < 0.03$), Nonetheless, we report the results from both random- and fixed-effects models for both husbands' EMSPs and wives suspicion because they allow us to answer slightly different, yet independently interesting, questions.

Our last set of regression models (presented in Table 8), draw on data from the second wave of the survey only, to assess women's sensitivity and specificity in predicting whether or not their husbands ever had EMSPs during the course of their marriage. These simple multivariate logistic regressions explore which individual, marital union, and social network characteristics appear to improve wives' ability to know when their spouse has been unfaithful and which ones help correctly reassure them when he has been faithful.

RESULTS

Husbands' EMSPs

The first two models in Table 4 show the logistic coefficients for whether husbands reported having had any EMSPs in the last year using both random effects (Model 1) and fixed effects (Model 2). There are marked differences with respect to EMI by region, with the central district of Mchinji and the northern district of Rumphi reporting far less extra-marital behavior than respondents living in the matrilineal southern district of Balaka.[7] In the random effects model, higher educational levels are associated with

[7] Cross-tabulations on region and number of EMSPs of men in the Malawi 2000 DHS also find that the southern region reports higher levels of EMI National Statistica l Office [Malawi] and ORC Macro. 2001. *Malawi Demographic and Health Survey 2000*. Zomba,
Malawi and Calverton, Maryland, USA: National Statistical Office and ORC Macro..

higher odds of having EMI, with the husbands who went to secondary school being seven times as likely to report extra-marital partners (holding other characteristics constant at their means). Since men's educational attainment rarely changes after marriage, these effects cannot be tested in the fixed-effects model. No other individual or marital union characteristics are strongly correlated with having had an EMSP in the last year. In both models there is some suggestion (at the 10% significance level) that men living in brick huts are less likely to have EMSPs than those living in mud huts. Given the expected positive correlation between wealth and number of sex partners, the negative effect of quality of housing on changes in EMI is somewhat surprising, unless it indicates of permanency of a couple's relationship rather than household wealth. Indeed, we find a positive relationship between ownership of economic goods and EMI, though this relationship is not significant.

(insert Table 4 about here)

In sharp contrast to men's individual and marital union characteristics which are not highly predictive, several attributes of men's social networks are strongly and systematically associated with male EMI. In both the random- and fixed-effects models (Models 1 and 2), we find evidence that more intimate networks, which consist primarily of confidants and friends as opposed to acquaintances, are associated with having at least one EMSP. Men whose social networks grew in the intervening three years were less likely to have EMSPs in the last year, perhaps suggesting that discussing HIV/AIDS with a larger group of individuals provides greater opportunity for social learning about the risks associated with having multiple sexual partners. Similarly men who were more concerned about HIV may have both reduced their number of non-marital sexual partners and sought out more individuals with whom to discuss HIV/AIDS. Of particular interest in this study, we find that men who socialize with individuals who have EMSP are more likely to have EMSPs themselves. For each additional SNM believed to have a secondary sexual partner, the odds that the respondent will have an EMSP increase 2.6 times (Model 1) and by 2 times in Model 2. This corresponds to roughly a 10 percentage point increase in the probability of being unfaithful if the number of husbands' promiscuous friends increases from zero to one, among men with typical characteristics (i.e. those owning 2.5 economic goods, residing at home, and having the sample average composition of social network members). The decline in the coefficient on whether SNMs had non-marital sexual partners between Model 1 and Model 2 suggests that the association observed in Model 1 is partially, but not primarily, attributable to unobserved time-constant characteristics, such as men's proclivity to under- or over-report both their own and their SNM's sexual relationships. There appears to be clear evidence that men who have non-marital partners socialize with each other as do men who only have marital partners.

The effect of wives' social networks on men's extra-marital sexual behaviors is minimal, though there is some suggestion that wives with more friends as opposed to acquaintances and wives whose friends have multiple partners are less likely to have husbands with EMSPs. One possible interpretation of these results is that husbands

whose wives have closer and more sexually active networks may be more reluctant to have EMSPs for fear of "getting caught".

To further investigate different aspects of male EMI, additional models are presented in Tables 5 and 6. From the perspective of HIV and other STI risks, it is important to consider not only whether a husband has EMSPs, but also how many EMSPs he has had. In Table 5, we examine the characteristics associated with having zero, one, two, or three or more EMSPs last year using random- and fixed- effects linear regression models.[8] The results reported in Table 5 resemble those found in the dichotomous models (Models 1 and 2 of Table 4) with a few notable exceptions. In the random-effects model we find that husbands who usually reside at home have fewer EMSPs. All of the effects of social network remain consistent with smaller social networks consisting of more intimate friends and members who have non-marital or multiple sexual relationships fostering greater EMI among husbands. Lastly, there appears to be a significant decline in the number of EMSPs reported between 1998 and 2001 (Model 1 of Table 5), although the decline in the probability of having any EMSPs was not significant in Model 1 of Table 4.

(insert Table 5 about here)

In Table 6, we examine whether the characteristics of men who had EMSPs in the last year are the same as those who report ever having had EMSPs during the course of the marriage. Since information about having ever had EMSPs was only asked in the second wave of the survey, we limit our cross-sectional logistic regression analyses to data collected in 2001. This survey round also asked additional questions about the last time they attended a religious service allowing us to estimate the effects of religiosity as well as religious denomination on EMI. Table 6 shows that husbands who attended services at a church or mosque more than six months ago were significantly more likely to have had at least one EMSP in the last year than those who attended within the last week. After controlling for religiosity, Protestants, Muslims, and members of other religious denominations were much less likely to have EMSPs than Catholics. Higher educational attainment for husbands is positively associated with having EMSPs in the last year, but this relationship was weaker with having ever had EMSPs. While marital duration does not have a significant effect on EMI in the last year, it does increase the probability of ever having had an EMSP, reflecting the longer exposure time.

(insert Table 6 about here)

As in the previous models, being in a polygamous union is uncorrelated with having had EMSPs in the last year. However, we find that marrying an additional wife strongly increases the likelihood of having ever had EMSPs during the course of the index marriage. The odds that a husband reports ever having EMI are three times higher if he takes any additional wife. To further investigate the relationship between having EMI and marrying subsequent wives, we looked at whether men who married additional

[8] Alternative specifications including using ordered logits and the natural log of the number of sexual partners did not differ significantly from the linear models by year.

wives between 1998 and 2001 where more likely to report having EMSPs in 1998. We find that husbands who married additional wives between the two surveys were more than two times as likely to report having EMSPs in 1998 (21% vs. 9%). These results indicate a clear and strong relationship between having EMI and the process of searching for and finding additional wives. Finally, we note that having SNMs with non-marital partners is highly correlated with having EMSPs among husbands in these cross-sectional analyses.

Wives' Suspicion of Husbands' EMSPs

In addition to studying husbands' reports of EMI, we also examine wives' beliefs about their husbands' EMSPs. The degree of suspicion reported by a wife may reflect not only her level of awareness about her husbands' EMSPs but also her overall inclination towards suspicion. To the extent that a woman's tendency towards suspicion or to report suspicion does not change over time, we can disentangle these two components, using random-effects and fixed-effects logistic regressions.[9] Results are shown in Models 1 and 2 of Table 7, respectively. While wives' age is positively associated with her level of suspicion, controlling for age, having greater spousal age differences tends to lower wives level of suspicion regarding their husbands. In general, Catholic wives are the most suspicious while Muslim wives are the least. Having a husband who usually resides at home does not significantly decrease suspicion, which is somewhat surprising given our strong *a priori* expectation that men who migrate are more likely to have EMSPs. This result, however, is driven by the exclusion of couples whose husbands were not interviewed. An analyses of all women, including those whose husbands are away, shows that having husbands' residence outside the village significantly increases wives' level of suspicion ($p < 0.000$) (results not shown).

The marital union characteristic with the strongest effect on suspicion is polygamy. Table 7 shows that women who marry men with previous wives are not significantly more likely to suspect their husbands of having EMSPs. However, women whose husbands took additional wives after their marriage are more much more likely to suspect that they have had EMSPs (odds ratio of 3.3). This result holds in the fixed effects model as well (Model 2). These differences in polygamous wives' perceptions of EMI according to when their spouses became polygamous helps allay some of our concern that although the question explicitly excludes all other wives, women in polygamous union may mistakenly include these other wives when reporting on their husbands' EMSPs. These results are also consistent with the interpretation that polygamists engage in non-marital sexual relationships before marrying a new wife, but are not necessarily more likely to have EMSPs afterwards, as reported by husbands in Table 6.

(insert Table 7 about here)

[9] Alternative linear and multinomial models measuring the level of suspicion as a categorical variable (1= probably not, 2=cannot know, 3=suspects, and 4=yes) yielded similar and entirely consistent results as these dichotomous specifications. Similar substantive relationships are also found if women who report that they "cannot know" whether their spouses have EMI are removed from the dichotomous models.

Both if wives associate with individuals who have EMSPs and if husbands socialize with individual who have non-marital partners increase wives' level of suspicion about their husbands. One may argue that the association found in the random-effects model between wives' level of suspicion about their friends' non-marital sexual behaviors and their husbands' EMI may be driven by the woman's underlying inclination to suspect others of infidelity. However, this positive correlation persists in the fixed-effect model. Most strikingly, if their husbands report that their friends have multiple or non-marital partnerships, the odds that their wives' suspect them of infidelity increases by 1.3. These findings suggest that wives' too may make the connection between husbands socializing with men who have non-marital partners and their husbands' behaviors.

Wives' Accuracy in Detecting Husbands EMSPs

Simply being more suspicious, however, does not necessarily make wives more accurate in judging their husbands' behaviors. To assess the socio-demographic and social network characteristics that enhance or diminish wives' knowledge about their husbands' EMSPs, we use the measures of sensitivity and specificity defined above, using data from the second wave of the MDIC. The first model of Table 8 examines the characteristics of women who "correctly" identify husbands who have had EMSPs (i.e. "true positives"). This sample is limited to the small number of matched couples wherein the husband reported having ever had an EMSP during the course of the marriage (n=185). Although none of the specific traits of the woman or her marital union are correlated with greater sensitivity (at the 5% level), women with larger social networks demonstrate more skill at detecting when their husbands have "grazed" outside of marriage. Specifically, holding other characteristics near their means, wives with three SNMs rather than two SNMs experience a 16 percentage point increase in their probability of correctly reporting that their husbands have ever had EMSPs. Women with broader, less intimate social networks containing more acquaintances than friends and confidants also appear to be better informed. In contrast, the extra-marital sexual behaviors of SNMs have no effect on sensitivity. These findings are consistent with the interpretation that social networks pass on specific information about particular husbands' behaviors rather than simply providing information about the practice of EMI in the general population. Thus, having a larger and broader social network enhances women's awareness of their husbands' behaviors, regardless of the personal behaviors of these members.

(insert Table 8 about here)

The predictors of specificity, e.g. properly identifying husbands who report having had no EMSPs, differ markedly from those of sensitivity. In Model 2 of Table 8, we find that older women with small spousal age differences are particularly poor judges of when their husbands have been faithful. Longer marital durations further diminish women's specificity rather than improving it, as does the addition of new co-wife. Among couples where the husband claims to have had no EMSPs, women whose husbands took additional wives are three times more likely to suspect their husbands of having EMSPs. Furthermore, if their husband has many friends who have EMI, wives are significantly less likely to think that their spouses have been faithful even when their

spouse reports he has been. Thus although marrying additional wives or socializing with promiscuous friends increases husbands' propensity to have EMSPs, wives may rely too heavily on these cues causing them to be "overly" suspicious of their husbands—assuming, as we have, that the husbands' reports are more valid than the wives'.

To further identify differences in husbands' and wives' reports of marital infidelity, we examine factors which continue to influence wives' level of suspicion even after controlling for husbands' self-reports of EMI. In the final model of Table 8, we find that husbands who report having ever had EMSPs are significantly more likely to be suspected by their wives, compared to those who report no EMSPs (78% vs. 49%). Thus, even after controlling for a variety of their own, their spouses', and their social networks' attributes, it appears that married women are at least somewhat cognizant of their husbands' extra-marital sexual behaviors and there is some agreement between husbands' and wives' about these behaviors. However, discrepancies persist. After controlling for husbands' self-reporting of EMI, several characteristics remain significant, suggesting that some women worry too little about their husbands' outside sexual relationships, while others worry too much (relative to their husbands' self-reports). The pattern that emerges in Model 3 is nearly identical to the one shown in Model 2, except that the signs are reversed, demonstrating that the characteristics which reduce women's specificity do so mainly by rendering them "overly" suspicious.

DISCUSSION AND CONCLUSION

In this paper we build on the existing literature on male EMI as well as the influence of social networks on sexual behaviors. Using longitudinal data helps mitigate some of the well-known problems stemming from reporting errors and omitted variables which plague much of the research in both these areas. Moreover, by examining and comparing matched husbands' and wives' reports, we take advantage of a rare opportunity to gain insights into both the practices of and awareness about male EMI from within the marital union. Nonetheless, the limitations of the available data for answering these questions should not be underestimated. The measures of both actual EMI and suspicion of EMI likely remain fraught with severe measurement error, since both husbands and wives may be reticent about disclosing this information to interviewers. To the extent that these issues are under-reported our estimated coefficients may represent conservative estimates of these associations. Moreover, we assume that many of our important unobserved characteristics such as the propensity to under- or over- report, latent desire for multiple sexual partnerships, and underlying level of suspicion remain constant within individuals during the interval between the surveys. If this assumption is violated then even the estimates in the fixed-effects models will be biased. Despite these potential problems, our results show several clear patterns with respect to the relationships between individual, marital union and social network characteristics and the practice and perception of male EMI.

Consistent with previous literature on male infidelity, we find that most of the common individual-level characteristics are poor predictors of male EMI. With the possible exception of significantly greater EMI among the highly educated, married men across a wide range of ages, religions, and socio-economic levels appear to engage in

EMI with only small differences in their levels of participation—albeit that some important individual characteristics such as migration status and income were poorly measured. By far the most important marital union factor determining whether husbands have EMI and whether their wives suspect them of EMI is the process of taking additional wives. Once polygamous unions are formed, polygamist men are no more likely to have non-marital partners, but choosing these new marital partners is strongly associated with having EMSPs. Whether these men seek EMSPs whom they intend to marry or whether non-marital sexual relationships evolve into marital partnerships cannot be determined with these data. However, our results suggest that a better understanding of how the formation of polygamist unions relates to multiple sexual partnerships could have important implication for HIV and EMI.

Finally, this study provides new quantitative evidence that both husbands' and wives' social networks play at least two important roles. First, we find that social networks are closely related to husbands' extra-marital sexual behaviors. In particular, men who belong to smaller circles of friends and confidants are more likely to engage in EMI. The strongest and most consistent finding is that men who socialize with men who have non-marital sex are twice as likely to do so themselves. Wives' are also more likely to suspect their husbands of infidelity if they have friends with non-marital partners. These empirical associations bolster growing qualitative reports from focus groups, in-depth interviews, and journals that men's social groups have a strong influence on their non-marital sexual behaviors. They also support the thesis that men choose friends who behave as they do. Thus, these results attest to the potential value of peer-based programs and social network interventions as a means of modifying men's risky sexual behaviors outside of marriage. The success in promoting the norm of condom use with commercial sex workers in Thailand by targeting peer groups is well-known. Several other network-based interventions encouraging male sexual behavior modification in other countries have also proven effective (Amirkhanian et al. 2003; Wolf, Tawfik and Bond 2000). This study suggests that social-network interventions aimed at reducing EMI as an HIV/AIDS prevention strategy may also have a substantial "multiplier-effect" if SNMs truly exert social influence on their peers.

Second, women's social networks influence their level of suspicion about their husbands, but do not necessarily improve their accuracy or assist women in evaluating their risks of HIV. Larger and more diffuse social networks enable wives to detect when their spouses have EMSPs. Yet, several other attributes of husbands such acquiring junior wives or interacting with other men who have multiple sexual partners actually diminish women's capacity to know when their husbands' have been faithful by making them "overly" suspicious. In general, women's rather poor knowledge about their husbands' EMSPs may reflect the reality that, given the rather limited and personally costly HIV protection options currently available to women with unfaithful spouses, women may feel little incentive to know whether their spouse has EMSPs and may deliberately resign themselves to ambiguity. Women may begin to actively seek out more accurate knowledge if anti-retroviral drugs are introduced for serodiscordant couples, if female controlled microbicides become available, or if the stigma of condom use within marriage lessens. In the meantime, evidence suggests that women who fear

exposure via their husbands' other sexual relationships perceive themselves to be quite vulnerable and will sometimes express their concern to their husbands (Orubuloye et al. 1997). This communication may be subtle and it often emphasizes the need to protect their children as well as each other (Zulu and Chepngeno 2003). Yet, it may also include specific protection strategies such as encouraging him to be faithful, to consistently use condoms with his EMSPs, or even to use condoms within marriage (Schatz 2003). In cases where these approaches have failed, women who believe their husbands to be careless with their EMSPs may seek separation or divorce (Schatz 2003). Social networks may also play a crucial role in determining which, if any, of these strategies women with unfaithful spouses may take.

Thus, continuing to investigate how social networks affect women's knowledge of and reaction to their spouses' EMI could be a fruitful area of future research. As Ulin (1992:64) notes, "[t]hroughout much of Africa, rural women have always found strength in informal organization, mobilizing themselves around specific needs and activities, using kinship ties, neighborhood groups and other informal networks to accomplish their aims". Could women's social networks be organized to discourage married men from having EMSPs by increasing the probability that such relationships will be reported to their wives? Are there other forms of support and assistance that these networks could offer-- for example by providing both social approbation and material resources to wives who wish to separate from husbands with EMSPs or from husbands who refuse to use condoms with their EMSPs? Could such networks also exert social influence over its members by sanctioning women who have sexual relations with married men? Such explicit objectives of women's networks may seem unrealistic, but in a weaker and less formal manner may already be operating in many settings.

For both men and women in Malawi, the topics of EMI and EMSPs provoke frequent and lively discussion. Yet, program officers, reproductive health educators, and researchers often find the subject difficult to broach, despite widespread recognition of the link between men's EMI and the spread of HIV/AIDS. This research shows that social networks play a significant role in both husbands' proclivity to have EMSPs and wives' suspicion about such sexual partnerships. By leveraging the social influence of men's networks, specific policies such as the "zero-grazing" policy aimed at reducing the number of EMSP may result in more rapid behavioral change than anticipated if social networks trigger a cascade effect. In addition, women could, at least theoretically, improve the accuracy with which they perceive their HIV risks, if their social networks were enlarged and strengthened. Indeed, social networks may prove to be one of the critical venues through which to address this common, but notoriously intractable, route of HIV transmission.

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Table 1. Self-reported EMSPs and Suspicion about Spouses' EMSPs by Husbands and Wives.

	Wave 1 (1998)		Wave 2 (2001)	
Outcome Meausres	**Wives n=883**	**Husbands n=858**	**Wives n=1109**	**Husbands n=896**
Self-reports of EMSPs				
Had EMSP's last year (%)	1.0	9.0	1.2	8.4
Had other sexual partners at some point during this marriage (%)	na	na	1.5	18.9
Number of EMSPs last year (ave.)	0.01	0.22	0.01	0.14
Among respondents with EMSPS, number of EMSPs last year (ave.)	1.33	2.42	1.15	1.72
Suspicion of Spouses' EMSPs				
Suspect spouse of other sexual partners (%)				
Knows	11.0	2.1	19.5	2.4
Suspects	14.6	5.4	8.2	2.4
Cannot tell	16.2	9.7	20.7	10.6
Does not suspect	58.2	82.8	51.5	84.6
Suspect spouse of other sexual partners (indicator)				
Yes / Suspect / Cannot tell	41.8	17.2	48.4	15.4
No	58.2	82.8	51.6	84.6

Table 2. ***Individual and Marital Union Characteristics of Husbands and Wves.***

Individual and Marital Union Characteristics	Wave 1 (1998) Wives n=883	Wave 1 (1998) Husbands n=858	Wave 2 (2001) Wives n=1109	Wave 2 (2001) Husbands n=896
Individual Characteritics				
Age (ave.)	30.3	36.8	33.6	40.0
Education (%)				
None	34.5	19.8	31.6	16.2
Primary	60.0	64.3	62.5	68.2
Secondary	5.4	15.9	5.9	15.6
Religion (%)				
Catholic	18.9	18.9	18.6	18.2
Protestant	57.6	55.1	55.9	56.0
Muslim	16.7	18.2	20.2	19.5
Other (revivalist, traditionalist, none)	6.8	7.8	5.3	6.3
Region (%)				
Balaka (South)	25.2	26.0	29.3	25.8
Mchinji (Central)	40.3	41.8	37.7	41.4
Rumphi (North)	34.5	32.3	33.0	32.8
Ownership of up to 5 consumer goods (ave)	2.4	2.7	2.7	3.0
Marital Union Characteristics				
Spousal age difference (ave)	6.6	6.5	7.0	6.9
Spousal educational level difference (ave)	0.3	0.3	0.3	0.3
Marriage duration, years (ave)	9.5	10.4	12.3	11.8
Polgamous union (%)	18.1	14.3	28.4	17.7
Married other wife/wives before (%)	9.9	na	23.1	13.9
Married other wife/wives after (%)	8.2	na	24.3	11.3
Children ever born (ave)	4.2	5.2	5.0	6.2
Number of living children (ave)	3.1	3.9	3.7	4.6
Had child in last two years (%)	40.2	38.6	38.4	39.2
Household material (%)				
Mud	61.5	61.0	48.1	50.0
Sun or fired brick	38.5	39.0	51.9	50.0
Husband usually resides in the household (%)	94.7	93.8	94.7	96.1

Note: These are matched couple responses, but there are fewer husbands than wives due to polygamy.

Table 3. ***Characteristics of Husbands' and Wives' HIV Social Networks.***

	Wave 1 (1998)		Wave 2 (2001)	
Social Network Characteristics	**Wives n=883**	**Husbands n=858**	**Wives n=1109**	**Husbands n=896**
Size of Social Networks (ave)				
Size of uncensored social network	4.4	6.5	5.8	7.6
Size of censored social network	2.6	3.1	3.3	3.6
Composition of Censored Social Networks (%)				
Sex of network partners				
Male	5.8	93.5	5.5	94.7
Female	93.8	6.1	93.9	5.0
Network partners' closeness to respondent				
Confidant	22.2	25.8	23.3	25.0
Friend	58.5	55.5	60.9	61.1
Aquaintance, met once or twice	18.8	18.3	15.6	13.6
Network partners suspected of having EMSP by respondent				
Had EMSPs	8.5	13.5	13.3	20.0

Table 4. ***Characteristics of Husbands' Who Had EMSPs Within Last Year*** *(MDIC 1998 & 2001)*.

Variables	*Model 1 (RE)* n=1298			*Model 2 (FE)* n=190		
	Coef.	**Std. Err.**	***Sig.***	**Coef.**	**Std. Err.**	***Sig.***
Individual Characteristics						
Husbands' age	-0.09	0.09				
Husband's age squared	0.00	0.00				
Husbands' education						
No schooling (ref)						
Primary schooling	1.23	0.56	*			
Secondary schooling	1.96	0.81	*			
Husbands' religion						
Catholic (ref)						
Protestant	-0.16	0.37				
Muslim	0.20	0.60				
Other	0.06	0.61				
Ownership of economic goods	0.10	0.11		0.21	0.25	
Marital Union Characteristics						
Spousal Age Difference	-0.01	0.03				
Spoual Educational Difference	-0.49	0.31				
Marital duration (yr)	-0.01	0.03				
Polygamous Union (ever)	0.34	0.38		0.32	0.81	
Housing material						
Mud (ref)						
Brick	-0.69	0.39	+	-1.48	0.77	+
Husband resides at home	-0.27	0.54		-0.31	1.12	
Husbands' Social Network Characteristics						
Size of network	-0.48	0.22	*	-0.92	0.35	**
Closeness to husband						
Aquaintance (ref)						
Friend	0.61	0.23	**	1.16	0.34	**
Confidant	0.56	0.20	**	0.98	0.29	**
SNM has EMSPs	0.94	0.15	***	0.71	0.23	**
Wives' Social Network Characteristics						
Size of network	0.15	0.16		0.29	0.29	
Closeness to wife						
Aquaintance (ref)						
Friend	-0.17	0.16		-0.51	0.29	+
Confidant	-0.26	0.21		0.03	0.37	
SNM has EMSPs	-0.45	0.24	+	-0.57	0.45	
Region						
Balaka-south (ref)						
Mchinji-central	-1.81	0.62	**			
Rumphi-north	-1.79	0.62	**			
Year	-0.30	0.27		-0.30	0.32	
Constant	-0.33	2.04				

Significance: * = p<0.05, ** = p<0.01, *** = p<0.001

Table 5. ***Characteristics of Husbands' With EMSPs Within Last Year*** *(MDIC 1998 & 2001)*.

	Number of ESMPs					
	Model 3 (RE)			***Model 4 (FE)***		
Variables	**n=1942**			**n=1913**		
	Coef.	**Std. Err.**	***Sig.***	**Coef.**	**Std. Err.**	***Sig.***
Individual Characteristics						
Husbands' age	-0.02	0.01	*			
Husband's age squared	0.00	0.00	*			
Husbands' education						
No schooling (ref)						
Primary schooling	0.07	0.04				
Secondary schooling	0.08	0.06				
Husbands' religion						
Catholic (ref)						
Protestant	-0.03	0.03				
Muslim	0.01	0.05				
Other	-0.01	0.05				
Ownership of economic goods	0.01	0.01		0.02	0.02	
Marital Union Characteristics						
Spousal Age Difference	0.00	0.00				
Spoual Educational Difference	0.01	0.03				
Marital duration (yr)	0.00	0.00				
Polygamous Union (ever)	0.01	0.03		0.07	0.08	
Housing material						
Mud (ref)						
Brick	-0.02	0.03		-0.10	0.06	+
Husband resides at home	-0.18	0.05	***	-0.13	0.09	
Husbands' Social Network Characteristics						
Size of network	-0.03	0.02	*	-0.05	0.02	*
Closeness to husband						
Aquaintance (ref)						
Friend	0.04	0.01	**	0.08	0.02	***
Confidant	0.03	0.02	+	0.09	0.03	***
SNM has EMSPs	0.15	0.01	***	0.15	0.02	***
Wives' Social Network Characteristics						
Size of network	0.01	0.01		0.04	0.02	+
Closeness to wife						
Aquaintance (ref)						
Friend	0.00	0.01		-0.02	0.02	
Confidant	-0.02	0.02		-0.03	0.03	
SNM has EMSPs	-0.02	0.02		-0.07	0.03	*
Region						
Balaka-south (ref)						
Mchinji-central	-0.13	0.05	**			
Rumphi-north	-0.11	0.05	*			
Year	-0.07	0.02	**	-0.09	0.03	***
Constant	0.69	0.17	***	0.12	0.12	

Significance: * = p<0.05, ** = p<0.01, *** = p<0.001

Number of EMSPs range from zero to three or more.

Table 6. ***Characteristics of Husbands' Reporting Having Had EMSPs in the Last Year and During the Entire Period of the Marriage*** *(MDIC 2001).*

	Had EMSPs in Last Year			***Ever Had EMSPs***		
	Model 1			***Model 2***		
Variables	**n=1093**			**n=1100**		
	Coef.	**Std. Err.**	***Sig.***	**Coef.**	**Std. Err.**	***Sig.***
Individual Characteristics						
Husbands' age	0.05	0.09		0.01	0.06	
Husband's age squared	0.00	0.00		0.00	0.00	
Husbands' education						
No schooling (ref)						
Primary schooling	1.39	0.52	**	0.48	0.35	
Secondary schooling	1.48	0.67	*	1.02	0.50	*
Husbands' religion						
Catholic (ref)						
Protestant	-1.51	0.38	***	-0.47	0.25	+
Muslim	-1.05	0.53	*	-0.79	0.40	+
Other	-1.96	0.69	***	-0.67	0.39	+
Religious Attendence						
Last week (ref)						
Last 6 months	0.28	0.31		0.27	0.20	
More than 6 months	1.94	0.45	***	0.43	0.37	
Ownership of economic goods	0.15	0.10		0.04	0.07	
Marital Union Characteristics						
Spousal Age Difference	-0.02	0.02		0.00	0.02	
Spoual Educational Difference	-0.01	0.24		0.11	0.18	
Marital duration (yr)	0.00	0.02		0.05	0.02	**
Polygamous (married before)	0.55	0.34		0.05	0.27	
Polygamous (married after)	0.50	0.35		1.11	0.22	***
Housing material						
Mud (ref)						
Brick	0.02	0.41		0.52	0.22	*
Husband resides at home	-0.89	0.54		-0.51	0.41	
Husbands' Social Network Characteristics						
Size of network	-0.18	0.22		-0.22	0.15	
Closeness to husband						
Aquaintance (ref)						
Friend	0.04	0.19		0.16	0.12	
Confidant	-0.14	0.27		0.22	0.16	
SNM has EMSPs	0.81	0.11	***	0.42	0.09	***
Wives' Social Network Characteristics						
Size of network	0.06	0.16		0.04	0.11	
Closeness to wife						
Aquaintance (ref)						
Friend	-0.13	0.15		0.01	0.10	
Confidant	0.07	0.21		-0.01	0.13	
SNM has EMSPs	-0.23	0.17		-0.07	0.11	
Region						
Balaka-south (ref)						
Mchinji-central	-2.06	0.57	***	-0.12	0.36	
Rumphi-north	-1.26	0.57	*	-0.47	0.38	
Constant	-1.49	2.29		-1.65	1.52	

Significance: * = p<0.05, ** = p<0.01, *** = p<0.001

Clustered by husband

Table 7. ***Characteristics of Wives Who Suspect Their Husbands Have Had EMSPs*** *(MDIC 1998 & 2001)*.

Variables	*Model 1 (RE)* n=1313			*Model 2 (FE)* n=638		
	Coef.	**Std. Err.**	***Sig.***	**Coef.**	**Std. Err.**	***Sig.***
Individual Characteristics						
Wife's age	0.11	0.05	*			
Wife's age squared	0.00	0.00	+			
Wives' education						
No schooling (ref)						
Primary schooling	-0.18	0.22				
Secondary schooling	-0.76	0.43	+			
Wives' religion						
Catholic (ref)						
Protestant	-0.39	0.18	*			
Muslim	-0.77	0.32	*			
Other	-0.74	0.32	*			
Ownership of economic goods	0.06	0.05		-0.09	0.10	
Marital Union Characteristics						
Spousal Age Difference	-0.03	0.01	*			
Spoual Educational Difference	-0.34	0.14	*			
Marital duration (yr)	0.02	0.01				
Polygamous (married before)	0.25	0.21				
Polygamous (married after)	1.18	0.21	***	1.13	0.30	***
Housing material						
Mud (ref)						
Brick	0.08	0.18		0.41	0.30	
Husband resides at home	-0.08	0.34		0.56	0.37	
Husbands' Social Network Characteristics						
Size of network	0.00	0.09		-0.16	0.12	
Closeness to husband						
Aquaintance (ref)						
Friend	0.03	0.08		0.07	0.12	
Confidant	0.10	0.10		0.31	0.16	+
SNM has EMSPs	0.31	0.08	***	0.25	0.11	*
Wives' Social Network Characteristics						
Size of network	0.12	0.09		0.09	0.11	
Closeness to wife						
Aquaintance (ref)						
Friend	-0.10	0.08		-0.08	0.11	
Confidant	0.07	0.11		0.17	0.14	
SNM has EMSPs	0.17	0.10	+	0.31	0.15	*
Region						
Balaka-south (ref)						
Mchinji-central	-0.23	0.30				
Rumphi-north	-0.64	0.30	*			
Year	-0.18	0.15				
Constant	-2.22	0.99	*	-0.05	0.15	

Significance: * = p<0.05, ** = p<0.01, *** = p<0.001

Table 8. ***Sensitivity and Specificity of Wives in Identifying Whether Husbands had EMSPs*** *(MDIC 2001)*.

Variables	*Sensitivity* Model 1 n=185			*Specificity* Model 2 n=762			*Suspicion* Model 3 n=948		
	Coef.	Robust Std. Err.	*Sig.*	Coef.	Robust Std. Err.	*Sig.*	Coef.	Robust Std. Err.	*Sig.*
Husband reports having EMSPs							1.04	0.20	***
Individual Characteristics									
Wife's age	-0.05	0.16		-0.22	0.06	***	0.17	0.05	***
Wife's age squared	0.00	0.00		0.00	0.00	***	0.00	0.00	**
Wives' education									
No schooling (ref)									
Primary schooling	0.58	0.64		-0.01	0.26		0.03	0.23	
Secondary schooling	0.14	1.27		0.07	0.49		-0.20	0.45	
Wives' religion									
Catholic (ref)									
Protestant	-1.06	0.58	+	0.18	0.22		-0.31	0.19	
Muslim	-0.57	0.97		0.32	0.37		-0.41	0.33	
Other	-0.09	0.95		0.12	0.39		-0.10	0.34	
Ownership of economic goods	0.12	0.18		-0.05	0.06		0.05	0.06	
Marital Union Characteristics									
Spousal Age Difference	0.02	0.04		0.02	0.01	+	-0.02	0.01	
Spoual Educational Difference	0.00	0.46		0.17	0.18		-0.16	0.16	
Marital duration (yr)	0.02	0.04		-0.04	0.01	**	0.03	0.01	*
Polygamous (married before)	-0.25	0.46		-0.37	0.21	+	0.27	0.19	
Polygamous (married after)	0.89	0.46	+	-1.18	0.21	***	1.18	0.18	***
Housing material									
Mud (ref)									
Brick	-0.33	0.50		-0.17	0.22		0.07	0.19	
Husband resides at home	-0.18	0.68		0.35	0.41		-0.19	0.34	
Husbands' Social Network Characteristics									
Size of network	-0.04	0.33		-0.20	0.14		0.18	0.13	
Closeness to husband									
Aquaintance (ref)									
Friend	0.17	0.27		0.04	0.10		-0.02	0.09	
Confidant	0.65	0.30	*	-0.07	0.14		0.15	0.12	
SNM has EMSPs	-0.11	0.20		-0.40	0.09	***	0.28	0.09	***
Wives' Social Network Characteristics									
Size of network	0.66	0.28	*	-0.09	0.12		0.15	0.10	
Closeness to wife									
Aquaintance (ref)									
Friend	-0.77	0.29	**	-0.12	0.12		0.01	0.11	
Confidant	-0.60	0.25	*	0.04	0.10		-0.09	0.08	
SNM has EMSPs	-0.19	0.23		-0.14	0.10		0.11	0.09	
Region									
Balaka-south (ref)									
Mchinji-central	0.28	0.83		0.04	0.36		-0.04	0.31	
Rumphi-north	-0.88	0.81		0.26	0.36		-0.37	0.32	
Constant	1.01	3.41		5.80	1.35	***	-4.85	1.19	***

Significance: * = p<0.05, ** = p<0.01, *** = p<0.001

Figure 1: Wives' Level of Suspicion by Husbands' Self-Report of EMSPs (MDIC-2001)