Women's Networks and the Social World Of Fertility Behavior

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CONTEXT: Demographic phenomena occur within social contexts and, therefore, should be studied as social processes. However, how to conceptualize and measure the social worlds that individuals inhabit has been the subject of debate.

METHODS: Data from a study conducted in Mali in 1996–1997 are used to explore the social networks of Bamanan women and their impact on fertility decisions. Ordinary least-squares and logistic regression techniques are employed to examine the relationship between selected household and social network characteristics and two fertility mea-sures: children ever born and ever-use of contraceptives.

RESULTS: Household characteristics do not have a significant effect on either outcome, whereas network attributes do. The more prominently conjugal kin are represented in a network, the fewer children a woman has ever had; how-ever, fertility increases if the husband or unrelated older women are part of the network. Ever-use of contraceptives is elevated if the woman participates in a credit scheme, and rises as the proportion of network members located out-side the village increases; it declines sharply as the proportion of network members who are conjugal kin increases, and is significantly elevated if the woman's mother is present. Network effects on fertility are much more pronounced for women aged 30 or older than for younger women, and network effects on contraceptive use are markedly different for younger and older women.

CONCLUSIONS: Programs should consider not only women's individual and household characteristics, but also their larger social networks. Additionally, programs should be designed for specific age-groups, given the different network effects on older and younger women.

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It has become increasingly clear that in the developing world, fertility decisions occur within specified social contexts.[1] Far from being a straightforward outcome of individuals' or even couples' decisions, fertility-related behavior such as spacing births, stopping childbearing and practicing contraception must be understood in the broader context of a woman's so-cial world. Indeed, recent efforts to promote women's re-productive health and rights have stressed the importance of understanding and addressing the broader social envi-ronment within which reproductive behavior occurs.[2]

In this article, we explore the influences of the social en-vironment on the fertility behavior of Bamanan women in Mali. Specifically, we consider a woman's social network and its effect on completed fertility and contraceptive use. Through this analysis, we hope to enhance understanding of factors that influence fertility behavior, and to identify program characteristics that increase women's control over their fertility and reproductive health.

FERTILITY AS A SOCIAL PROCESS

The focus on fertility as a social process is not new to the field of anthropology, where much of the classic literature emphasizes the social (as opposed to biological) dimen-sions of reproduction.[3] In the context of Sub-Saharan Africa, Caldwell has argued that high-fertility regimes have been sustained by cultural norms, embodied in religious and lin-eage systems, that distribute the costs and responsibilities of bearing and rearing children among extended family members.[4] More recently, anthropological demographers have examined the role of kinship systems[5] and the fami-ly[6] on demographic processes. These scholars and others share the view that all demographic processes, especially fertility, are shaped by powerful social forces (e.g., educa-tion and culture), many of which remain ill specified and poorly understood.[7]

While acknowledging the importance of the social world, demographers, with some notable exceptions,[8] have tend-ed to focus on the household as the most important arena of social relations. There are good reasons for this, perhaps the most persuasive one being its analytic convenience. In addition, most large-scale data collection efforts have gath-ered information on households. The widespread applica-tion of Western concepts of the household to the develop-ing country context has further entrenched assumptions that the household is the most critical site of social interaction.[9]

Anthropologists, however, have taken issue with these assumptions and questioned accepted definitions of the household,[10] especially for Sub-Saharan Africa.[11] Claiming that households are neither isolated nor self-sufficient, they conceptualize the household as a dynamic social group-

ing defined by permeable boundaries and embedded in a larger social context. Bohannan's observation of "compounds which were swarming with children one week and almost without children the week after" speaks to the dynamic membership of households.[12] African field researchers know well the difficulty of identifying households whose membership fluctuates as migrant laborers come and go, as young women return home to give birth, as relations come to stay for long periods, or as children arrive to be fostered or are sent to attend schools far from home.

Critics also point to wide cross-cultural variations in the functions, attributes and memberships of households. This heterogeneity raises legitimate questions about what the household represents and what household-based variables measure. Departing from the conventional view of the household as a primary unit of social structure that orders activities, distributes proceeds, and allocates work and resources, Wilk conceptualizes the household as being defined by social relations and practices.[13] Overcoming the contentious assumption of altruism that underlies traditional economic theories of the household,[14] Wilk's characterization allows room for conflict and competition between household members, which may be salient in understanding the social basis of fertility behavior and outcomes.[15]

Given the numerous conceptual and empirical issues that arise from using households as the de facto social world of fertility, we propose that women's support networks may more effectively capture the social processes underlying fertility behavior. Without denying the importance of the household for ordering social relations and activities, we argue that social support networks embody two important mechanisms that influence fertility norms and decisions: instrumental assistance and social interaction. First, we hypothesize that the extent of instrumental support (material and practical) available through a woman's perceived social networks has an important bearing on the number of children she can take care of and the likelihood that she practices contraception. Second, in line with recent demographic theory, we contend that the social interaction implicit in network structure affects fertility behavior.[16]

The demographic literature on interpersonal networks and fertility behavior has grown rapidly in recent years.[17] One body of work examines the role of networks in encouraging innovation through the spread or diffusion of new information.[18] A second, viewing social networks as conservative cultural forces that transmit values and reinforce norms,[19] explores their role in encouraging behavioral conformity (or nonconformity) within a local community. In both bodies of literature, social interaction is seen as the principal mechanism of behavior change.

Two distinctive processes of social interaction have been identified in the literature. The first is "social learning," which refers to the exchange and joint evaluation of information and ideas within a network.[20] Behavior change occurs when discussion within a network reduces an individual's perception of the risk and uncertainty involved in change, and encourages the adoption of "new" ideas.[21] Thus, theoreti-

cally, innovations in fertility behavior, such as the adoption of contraceptive use or the desire to limit family size, occur as a woman is exposed to new information and ideas, and participates in the joint evaluation of their relative benefits, in the context of her network. It follows that social learning is most likely to occur in heterogeneous networks,[22] where ideas about fertility may differ from those to which women are routinely exposed.

The second process is "social influence," in which, to win approval and avoid conflict with the social group, individuals behave according to the dictates of gatekeepers and other promoters of accepted social norms.[23] Broader cultural or institutional norms implicit in gender roles, household power structures and social organization in general may also be conservative forces of social influence to which all women are subject. In both interpersonal and institutional realms, however, a woman's ability to decide freely, innovate or deviate from prevailing norms regarding ideal family size or traditional practices is greatly constrained in highly connected, homogeneous networks. Once changes in fertility behavior are under way, however, the conservative character of social influence may diminish as the community accepts or adapts new ideas from sparser, more heterogeneous networks.[24] Thus, even homogeneous networks may encourage innovation. In one study, both network structure and individuals' knowledge of and interactions about family planning were related to the probability that a woman used family planning, but the social and cultural context partly determined whether social learning or social influence dominated.[25]

Consequently, in exploring how the instrumental and interactive features of social networks influence fertility and contraceptive use, we pay particular heed to the specific function and composition of networks, and to the broader social and cultural context in which social interactions occur. In addition, by incorporating measures of instrumental support, we expand on the existing literature, which focuses solely on social learning and social influence. On the basis of preliminary ethnographic work, we identify practical and material networks as the indicators of instrumental support of greatest relevance to fertility behavior. Likewise, we explore interpersonal effects and distinguish between social influence and social learning through a series of variables that measure network composition.[26]

STUDY SITE AND POPULATION

Mali ranks among the poorest countries according to standard indicators of macroeconomic performance and human development. Seventy percent of its 7.7 million inhabitants live in rural areas, 50% are younger than 15, and just 18% of rural males (aged six or older) and 10% of rural females have attended school.[27] With Mali's gross national product estimated at $250 per capita, basic social services, including health care infrastructure and provision, are extremely limited in scope and coverage.[28] The country also fares poorly on a number of health indicators: In rural areas, 149 of every 1,000 children die before age five, 577 mater-

nal deaths occur per 100,000 live births and 23% of children younger than three suffer acute malnutrition.[29]

Our focus is on the Bamanan, an agricultural people who comprise 35% of Mali's population. Bamanan society is patrilineal and virilocal (i.e., married couples live with the husband's family); the most senior male member of the household controls land use, compound-level goods, the organization of labor and, in polygynous households, the coordination of pregnancy among co-wives. The large corporate household tends to enjoy greater wealth and prestige than small nuclear arrangements,[30] partly because crop production is dependent on the household labor force and its reproduction.

Bamanan society is characterized by a strong sense of egalitarianism and cooperation: Household and community members are expected to work with one another for the greater corporate good.[31] At the same time, within the household, gender relations are defined by the division of roles between a husband and his wives, and between men and women more generally.[32] The practices of early arranged marriages and polygyny, and the frequent separation of spouses due to migration, discourage conjugal intimacy and the development of a strong husband-wife bond.[33] The payment of bridewealth gives men absolute rights to intercourse with their wives, control over their children and authority over their wives' labor to benefit the marital household. Women, by contrast, have no direct claim to land or household labor, but must ask their husbands for assistance from other household members. Despite their apparent social subordination, however, Bamanan women attain a limited degree of financial independence from their husbands by conducting small businesses.[34]

FERTILITY NORMS

Like many populations in rural West Africa, the Bamanan place a high value on fertility, given the importance of reproduction in sustaining the household labor supply and ensuring descent.[35] Through marriage, a woman's reproductive rights are transferred to the conjugal household, with the expectation that she will bear and assume major economic responsibility for her husband's children. It follows that an important source of a woman's self-esteem and social status within her marital family and larger community are accrued through success in childbearing.[36] We propose that instrumental support provided through large material and practical networks sustains high fertility by redistributing the costs of bearing and rearing children. From the perspective of women of reproductive age, investment in childbearing also represents important instrumental support for the future in terms of domestic help from children and, eventually, material and practical assistance from married sons and their wives.

To maximize child survival and to reach optimal family size, a complex set of norms and sanctions guides Bamanan fertility decisions. For example, social sanctions that discourage premarital fertility persist, thus delaying age at first birth. As in other rural areas in the region,[37] the widespread practice of postpartum sexual abstinence and prolonged breastfeeding supports healthy reproduction by maintaining birth intervals of at least two years. Women's practice of sexual abstinence once they become grandmothers reduces the risks associated with reproduction among older women and facilitates their gatekeeper role in monitoring their daughters' and daughters-in-law's observance of postpartum abstinence and childspacing.[38] Together, these traditional norms and sanctions work to increase spacing, thereby enhancing child survival and facilitating the achievement of large families.

SOCIAL NETWORKS

A substantial literature documents that dense and homogeneous networks (i.e., those in which members know each other well and have generally similar attitudes) exert considerable pressure on members to follow normative patterns of behavior.[39] Tight boundaries make it easy to control and coordinate individuals' behavior by assisting those in distress (which produces obligations) and punishing those who transgress. By contrast, contact with peers, professionals and other nonkin, and social learning within these more heterogeneous networks, might encourage changes in fertility-related norms and behaviors; such contact might influence women to reconsider the value of investing in children's education, family-size preferences and modern contraceptive use for pacing or limiting fertility.[40]

Despite the cultural value and presumed material benefits of high fertility, it appears that the Bamanan are increasingly aware of the advantages of limiting births and investing in smaller numbers of children. Although only 13% of our sample report currently using modern contraceptives, the large majority (83%) are aware of modern methods, and many express an interest in their use.

It is therefore reasonable to suppose that a woman's social interactions will influence her capacity to use contraceptives and flout traditional fertility norms. For example, women whose social interaction is largely confined to the conjugal household may be unlikely to depart from traditional fertility norms, because such behavior may incur substantial social risks. These include the potential that women will embarrass their natal family and their husband and his family, and that they will lose social status relative to co-wives or sisters-in-law.[41]

In this article, we examine the social relationships and fertility behavior of Bamanan women and attempt to identify the mechanisms underlying their presumed association. Whereas previous analyses have relied largely on measures of network size, density and social context to disentangle the respective influences of social learning and social influence on fertility, we have developed and tested a set of more textured measures of network function and composition. Social influence is captured through variables that identify the relative importance of conjugal and natal support networks, and we hypothesize that large familial networks encourage behavioral conformity. We also contend that networks in which social gatekeepers such as

TABLE 1. Characteristics of Bamanan women and their children, Mali, 1996–1997, and of women participating in the Demographic and Health Survey (DHS), Mali, 1996

Characteristic	Bamanan (N=502)	DHS (N=9,704)
Women		
% with no formal education	93.5	90.1
% younger than 30	44.8	49.8
Median age at first marriage	16.0	15.9
% in polygynous unions	66.5	46.1
% in first marriage	82.7	u
Median age at first birth	17.6	18.9
Total fertility rate†	7.7	7.6
% who ever used modern contraceptive	19.2	18.4
Mean interval between births (mos.)	28.2	u
Average no. of children per woman	4.55	u
Children		
Total no. of deaths at all ages	607	u
Deaths per 1,000 before age one‡	139	u
Deaths per 1,000 at ages 1–5‡	83	u

†1992–1997. ‡1993–1997. *Note:* u=unavailable.

mothers-in-law, mothers and husbands figure prominently will promote conservative fertility norms. As regards social learning, we hypothesize that fertility innovations such as contraceptive use and small family size will be most likely in the presence of large nonkin, non−village-based networks that support the adoption of nontraditional ideas.[42]

METHODS
Data
The data were drawn from a comparative study of women's social networks and their impact on maternal and child health in Mali conducted from February 1996 to May 1997. A survey was administered in two sites with Bamanan and Fulbe populations, but we restrict this analysis to the Bamanan so that we can focus on intragroup variation. We sampled ever-married women of reproductive age from villages chosen, with the assistance of nongovernmental organizations working in each region, on the basis of size and proximity to market and health care services. Ten Bamanan villages were chosen within the administrative *cercle* of Bougouni, located near Mali's southern border with Côte d'Ivoire. In total, 502 women aged 15−45 were randomly sampled on the basis of complete household censuses conducted in each village. In the majority of cases, only one woman was selected per household, but within households containing six or more eligible women, a maximum of three women were identified for study.

*We asked women to free-list all people in their network and then group them according to the type of support each category provided. We then discussed these support categories with the women to determine the types of helping activities that each category provided. Finally, with the aid of focus groups, we categorized the kinds of support women valued most as follows: material help with milk, money and cereal; practical support with domestic chores, child care and other responsibilities "when your hands are full"; advice or cognitive assistance from respected individuals who provide wise counsel or information "when your heart is stirred up"; and emotional support from persons women could trust and confide in. For further details on the method used to construct networks and problems encountered during data collection, see: Adams A, Madhavan S and Simon D, Measuring social networks through quantitative and qualitative methods, paper presented at the annual meeting of the Population Association of America, Atlanta, GA, USA, May 9–11, 2002.

The multipart questionnaire included items on household composition and socioeconomic status, as well as on specific characteristics of the respondent and her children. Information was solicited on the woman's household position, reproductive history and income sources; the health and nutrition of the woman and her children; and the woman's last live birth in the previous two years.

Data on women's perceived social networks were gathered by means of a free list generated around four domains of support: material, practical, cognitive and emotional. This method and the specific domains identified were the result of formative qualitative research that preceded survey design.* We chose it over a more structured approach, in which the presence or absence of specific individuals is noted, because of the challenges of ascertaining in advance cultural norms that dictate key individuals in a network. After having elicited the free list, however, we probed for a husband, mother-in-law and co-wife if the woman had not mentioned one.

Analysis
We explored two fertility-related outcomes in multivariate analysis: completed fertility and contraceptive use. We used ordinary least-squares regression to assess the effects of network and household attributes on the number of children a woman had had, and logistic regression to explore the effects of household and network features on her likelihood of ever having used a contraceptive. Three models are presented for each set of analyses, to illustrate the effects of household characteristics alone and the additive effects of network function characteristics and network composition variables. All of these variables could not be in-

TABLE 2. Household and network characteristics of Bamanan women

Characteristic	Value
Household	
Median no. of household members	21.1 (2–210)
Mean dependency ratio†	0.7 (0–0.9)
Mean asset score	28.5 (0–47)
% living in extended households	86.4
Network	
Mean no. of members	
Total‡	17.8 (3–54)
Material network	10.4 (1–21)
Practical network	7.3 (1–21)
% female	61.8
% older than respondent	66.8
% by relationship	
Natal kin	41.7
Conjugal kin	38.3
Nonkin	18.7
% by location	
Household	44.4
Village	28.6
Outside the village	25.8
% of women who report their husbands in their network	91.2

†Children younger than 15 as a proportion of total household size. ‡Includes members of cognitive and emotional networks (not shown separately). *Notes:* Figures in parentheses are ranges. Percentage distributions do not add to 100% because some information was missing.

TABLE 3. Coefficients (and standard errors) from ordinary least-squares regression analyses assessing the effects of selected characteristics on the number of children a woman has ever borne, by type of characteristic

Characteristic	Model I (N=376)	Model II (N=373)	Model III (N=373)
Individual			
Woman's age	.663*** (.079)	.668*** (.079)	.666*** (.079)
Woman's age squared	−.006*** (.001)	−.006*** (.001)	−.006*** (.001)
No. of infant deaths	.685*** (.087)	.685*** (.087)	.666*** (.087)
Education	−.067 (.335)	−.084 (.339)	−.149 (.336)
Husband's age	−.004 (.009)	−.004 (.009)	−.007 (.009)
Presence of a co-wife	−.022 (.218)	−.023 (.221)	−.018 (.220)
Household			
Size	.001 (.004)	.001 (.004)	.002 (.004)
Extended household	−.305 (.292)	−.327 (.294)	−.249 (.298)
Asset score	−.008 (.008)	−.007 (.008)	−.007 (.008)
Network function†			
Size of material support network	na	.027 (.024)	na
Size of practical support network	na	.002 (.027)	na
Membership in a tontine	na	.085 (.219)	.023 (.220)
Level of multiplexity in total network	na	−.731 (.574)	−.652 (.588)
Network composition‡			
Presence of mother-in-law	na	na	−.168 (.216)
Presence of husband	na	na	.637* (.378)
Presence of mother	na	na	.016 (.212)
Presence of nonfamilial older women	na	na	.467** (.208)
% of network who are natal kin	na	na	.007 (.005)
% of network who are conjugal kin	na	na	−.016*** (.006)
% of network who are nonkin	na	na	.007 (.006)
% of network who live outside village	na	na	.022* (.012)
R^2	.686	.688	.695

*p<.05. **p<.01. ***p<.001. †The network size variables were run separately because of multicollinearity. ‡The percentage variables were run separately because of multicollinearity. *Note:* na=not applicable.

cluded in the same model because of collinearity between several network variables. For example, network size is correlated with the proportion who are kin, and the proportion who are kin is correlated with the proportion who are nonkin.

Given that we had network and household data only for the time of the survey, we assumed that both network and household characteristics were relatively stable in the context of a woman's current marriage. Findings from the literature support this assumption, indicating that social network characteristics, like personality characteristics, are relatively stable in size and quality.[43] We limited these analyses to women in their first marriage, because we had no information on previous unions. Involuntarily childless women were excluded, bringing the final sample to 408 women.

Independent Variables

• *Household-level measures.* We included three household-level variables in the analyses. To indicate household socioeconomic status, we calculated an asset score, which is based on whether the household owned a radio, bicycle, lamp, cart or moped. We appraised these items in local currency,

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*A tontine is different from a microcredit initiative, which is usually sponsored by a nongovernmental organization or a donor agency. It is made up of village women who periodically contribute a set amount of money that can be used by any member for various purposes.

and computed a score (range, 0–47) that represents the sum value of the items owned.

Household size represents the total number of members residing in the household at the time of survey. Because of polygyny, several domestic units often share one dwelling. For this study, we defined a household as a unit whose members cook and work together.

Household structure categorizes households into two basic forms: nuclear (coded as zero) and extended (coded as one). Nuclear households are single parents and their biological children; households composed of a household head, his wife or wives, and their children; or nuclear households with foster children, hired help or boarding students. The extended-household category encompasses a more complex amalgamation of household types: three-generation arrangements, in which the parents and grandchildren are present; and laterally extended households, which include siblings and cousins of the household head. We expected size and structure to influence fertility, on the assumption that large households and those with an extended structure are better able to sustain the material and non-material costs of bearing and rearing children. Not surprisingly, household size and structure are correlated (r=.25).

• *Social support variables.* We assessed four types of network function. A woman's material support network is measured as the number of people who provide tangible assistance with money, food or clothing; her practical support network is measured as the number of people who provide help with household work and child care. We expected that these forms of instrumental support promote high fertility by redistributing the costs of childrearing. Third, we examined membership in a *tontine* (local cooperative scheme*) as a dichotomous variable (coded one for yes and zero for no), given our hypothesis that exposure to a group of unrelated women who are peers may result in social learning that encourages the adoption of nontraditional fertility practices or promotes nontraditional perspectives. Finally, we included a measure of multiplexity, or the degree to which a network's members provide different types of support, to test the hypothesis that homogeneous, highly supportive networks bolster traditional norms that encourage large family size. Multiplexity is a continuous variable that represents the proportion of individuals in a woman's network who provide more than one type of support.

• *Network composition variables.* Given the role of older Bamanan women in enforcing traditional practices that support two-year birth intervals and abundant reproduction,[44] we hypothesized that respondents who report influential elder women in their networks will have a larger completed family size than others and be less likely ever to have used contraceptives. To test this hypothesis, we created dichotomous variables that indicate the presence of a woman's mother-in-law and the presence of her own mother in a network. We further hypothesized that support from a husband would work in a similar manner.

A final group of network composition measures were in-

corporated to test the hypothesis that networks composed of homogeneous conjugal or natal kin are likely to support high fertility norms. The variables derived to test this hypothesis are the proportion of a woman's network who are conjugal kin and the proportion who are natal kin. We then considered the obverse hypothesis: that the greater the heterogeneity in a network, the greater the likelihood that social learning will occur about the value of smaller family size and modern contraceptive use. To this end, we identified three variables that capture heterogeneity in a network: the proportion of network members residing outside the village, the proportion who are nonkin and the presence of nonfamilial older women.

•*Other control variables.* Because of their known influence on women's fertility and contraceptive use, we included as controls age, age squared, husband's age, presence of a co-wife, education and the total number of infant children a woman has lost.

RESULTS
Sample Characteristics

A comparison of our sample with the sample from the 1996 Mali Demographic and Health Survey (DHS)[45] reveals that selection biases were minimal (Table 1, page 61). A larger proportion of women in our sample than of DHS respondents were in polygynous marriages (67% vs. 46%) because our sample was restricted to ever-married women, whereas the DHS sample included all women of childbearing age. Consistent with DHS findings are the low median age at marriage (16.0), the large proportion of women without formal education (94%) and the low median age at first birth (17.6).

The large majority of our sample were in their first marriage (83%). The high total fertility rate is partly explained by the low median age at first birth and the low proportion of women who had ever used modern contraceptives (19%). The average length of the closed birth interval* conforms with the two-year average prescribed by Koranic law; high rates of infant and child mortality are consistent with the average for rural West African populations.[46]

On average, respondents lived in households of 21 members; as might be expected, extended family structures predominated over nuclear forms (Table 2, page 61). The age distribution of household members is skewed toward younger ages: As the dependency ratio indicates, children younger than 15 made up more than two-thirds of the average household. The mean socioeconomic status, as measured by the asset score, is moderate.

Total network size averaged almost 18 members, although the range was wide (3–54). Material support networks were larger (10 members) than practical networks (seven members). Respondents said that their support networks were predominantly female (62%) and older than they (67%). Natal and conjugal kin made up quite substantial proportions of networks (42% and 38%, respectively). Underscoring the need to consider social dynamics beyond household boundaries, only 44% of reported network members were located in the same household, while 29% were from elsewhere in the village and 26% were from outside the village.

Nearly all of the women (91%) included their husbands as network members. Nevertheless, we caution against making any assumptions about the nature of gender relations, given that the normative expectations of women (inherent in measures of perceived support) may differ substantially from the reality of their conjugal relationship.

Network Effects on Fertility

In the analysis controlling for respondents' background and household characteristics, woman's age behaves in the expected manner: Increasing age is associated with increasing total fertility, and the age squared term indicates a curvilinear effect (Table 3). Not surprisingly, the higher the number of infant deaths a woman has experienced, the more children she has had. Household size, structure and socioeconomic status have no effects on the number of children ever born.

Network function characteristics have no effect, but sev-

TABLE 4. Coefficients (and standard errors) from ordinary least-squares regression analyses assessing the effects of selected characteristics on the number of children a woman has ever borne, by type of characteristic, according to woman's age

Characteristic	<30		≥30	
	Model I (N=179)	Model II (N=179)	Model I (N=194)	Model II (N=194)
Individual				
Woman's age	–.087 (.265)	–.067 (.267)	2.06*** (.542)	2.10*** (.537)
Woman's age squared	.008 (.006)	.008 (.006)	–.024*** (.007)	–.024*** (.006)
No. of infant deaths	.730*** (.127)	.705*** (.126)	.655*** (.121)	.611*** (.120)
Education	–.110 (.306)	–.045 (.304)	–.035 (.597)	–.162 (.594)
Husband's age	.004 (.009)	.009 (.009)	–.012 (.015)	–.017 (.015)
Presence of a co-wife	–.075 (.200)	.028 (.203)	.067 (.393)	.172 (.387)
Household				
Size	–.001 (.002)	–.001 (.002)	.003 (.007)	.005 (.007)
Extended household	–.416 (.339)	–.449 (.347)	–.067 (.459)	–.038 (.463)
Asset score	.005 (.007)	.002 (.007)	–.018 (.014)	–.014 (.014)
Network function†				
Size of material support network	.009 (.021)	na	.040 (.040)	na
Size of practical support network	–.014 (.024)	na	.017 (.048)	na
Membership in a tontine	–.028 (.202)	–.047 (.200)	.151 (.372)	–.047 (.378)
Level of multiplexity in total network	–.034 (.503)	–.152 (.517)	–.954 (1.01)	–.904 (1.03)
Network composition‡				
Presence of mother-in-law	na	.244 (.194)	na	–.580 (.369)
Presence of husband	na	.347 (.334)	na	.818 (.661)
Presence of mother	na	–.047 (.190)	na	.078 (.359)
Presence of nonfamilial older women	na	.213 (.179)	na	.766* (.388)
% of network who are natal kin	na	–.006 (.005)	na	.018* (.009)
% of network who are conjugal kin	na	.004 (.006)	na	–.035*** (.010)
% of network who are nonkin	na	.000 (.007)	na	.013 (.011)
% of network who live outside village	na	–.003 (.010)	na	.048** (.019)
R^2	.682	.692	.305	.341

*p<.05. **p<.01. ***p<.001. †The network size variables were run separately because of multicollinearity. ‡The percentage variables were run separately because of multicollinearity. *Note:* na=not applicable.

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*Reporting errors are minimal because interviewers were extensively trained in the use of a fertility history, with particular attention given to determining dates of births.

TABLE 5. Coefficients (and standard errors) from logistic regression analyses assessing the effects of selected characteristics on the likelihood that a woman has ever used contraceptives, by type of characteristic

Characteristic	Model I (N=376)	Model II (N=373)	Model III (N=373)
Individual			
Woman's age	.025 (.127)	.029 (.131)	.052 (.131)
Woman's age squared	−.001 (.002)	−.001 (.002)	−.001 (.002)
No. of infant deaths	−.279** (.141)	−.288** (.145)	−.317** (.149)
No. of children ever born	.216*** (.079)	.217** (.083)	.200** (.085)
Education	.737* (.416)	.720* (.429)	.637 (.429)
Husband's age	.006 (.013)	.009 (.014)	.010 (.014)
Presence of a co-wife	−.640** (.305)	−.750** (.316)	−.782** (.319)
Household			
Size	−.003 (.005)	−.002 (.005)	−.001 (.006)
Extended household	.743 (.451)	.754 (.457)	.753 (.470)
Asset score	.001 (.012)	−.001 (.011)	−.001 (.011)
Network function†			
Size of material support network	na	.044* (.033)	na
Size of practical support network	na	−.012 (.038)	na
Membership in a tontine	na	.895** (.368)	.902** (.374)
Level of multiplexity in total network	na	−.628 (.884)	−.562 (.916)
Network composition‡			
Presence of mother-in-law	na	na	.096 (.322)
Presence of husband	na	na	.637 (.678)
Presence of mother	na	na	.550* (.313)
Presence of nonfamilial older women	na	na	.422 (.329)
% of network who are natal kin	na	na	.015* (.009)
% of network who are conjugal kin	na	na	−.021** (.009)
% of network who are nonkin	na	na	.004 (.010)
% of network who live outside village	na	na	.044*** (.015)
Pseudo-R²	*.051*	*.079*	*.098*
Log likelihood	*−178.2*	*−172.3*	*−168.7*

*p<.05. **p<.01. ***p<.001. †The network size variables were run separately because of multicollinearity. ‡The percentage variables were run separately because of multicollinearity. *Note:* na=not applicable.

eral network composition variables are associated with fertility. The final model shows a positive effect of the husband's presence in a network, as well as a strong but unexpected positive effect of the presence of nonfamilial older women. Additionally, as the proportion of network members who are conjugal kin grows, the number of children ever born appears to decline. Finally, we note a weak positive effect of the proportion of network members who are from outside the village; this finding runs counter to our hypothesis that more distal sources of support increase network heterogeneity and the possibility of social learning about the advantages of small family size.

Some of the effects found in the first set of multivariate analyses may be explained by an age interaction, so we repeated the analyses, including network function and composition characteristics, separately for women younger than 30 and aged 30 or older (Table 4, page 63). Interestingly, the results indicate that network composition effects are significant only for older women. In particular, the negative association between the presence of conjugal kin in the network and a woman's number of children suggests that these proximate networks are effective in monitoring spacing or encouraging retirement from childbearing among women nearing the end of their reproductive careers. The positive effects of nonfamilial older women, natal kin and non−village-based network members are therefore per-

plexing. All three might be explained by a cohort effect, whereby older women, throughout their lives, may have felt pressured by these groups to have children.

Network Effects on Contraceptive Use

In all three logistic regression models, we find, as expected, that a woman's likelihood of ever having used contraceptives falls as the number of infant deaths she has experienced rises, and that this likelihood increases with the number of children she has borne (Table 5). Education has a positive effect in the first two models, but this association disappears once network composition characteristics are included. The presence of a co-wife reduces the likelihood of ever having used contraceptives. This finding can be explained by the system of wife rotation, whereby pregnant and breastfeeding women are excused from conjugal duties; competition among co-wives to produce children could also play a role.

While household-level characteristics do not influence ever-use of contraceptives, some notable network effects are apparent. The significant positive association between the size of the material support network and contraceptive use might be attributable to the availability of resources to procure contraceptives. The positive effect, in both models including network variables, of membership in a credit scheme supports our hypothesis that involvement with a group of heterogeneous peers exposes women to innovative ideas about fertility control.

As regards network composition, the positive effects on ever-use of contraceptives of mother's and natal kin's presence in the network counter initial expectations about the conservative nature of kin-based networks. By contrast, the strong negative effect of the presence of conjugal kin supports this hypothesis. Finally, an increasing proportion of the network located outside the village has a strong positive effect on ever-use, confirming that heterogeneous networks offer opportunities for exposure to new ideas.

The effects of both biological and network characteristics differ sharply by woman's age (Table 6). As might be expected, the negative effect on contraceptive use of an increasing number of infant deaths and the positive effect of an increasing number of children ever born are apparent only among women aged 30 or older, who have had a longer period of childbearing than younger women. By contrast, the presence of a co-wife reduces the likelihood of ever having used contraceptives only among younger women, who have a continued need to attain status through childbearing.

The positive effect on ever-use of a contraceptive of membership in a tontine, although apparent only for younger women, confirms our hypothesis about the role of heterogeneity in promoting innovations. The availability of material support has a strong positive effect on ever-use of contraceptives only for older women.

Among the network composition variables, the presence of a mother-in-law or nonfamilial older women and a rising proportion of natal kin increase the likelihood of ever-use for older women only. As expected, for younger women,

the proportion of network members who are conjugal kin exerts a strong negative effect, and the proportions who are nonkin and who are located outside the village exert positive effects.

DISCUSSION

Four important findings from our analyses merit attention. One, while network features have some important associations with fertility outcomes, household factors have virtually no effects when age, total number of infant deaths and network characteristics are taken into account. The absence of household effects shows that women's social worlds clearly transcend domestic space—in particular, the power of the patriarch.

Two, initial expectations that the availability of instrumental support would promote fertility were only weakly borne out by the data, and the effects were confined to older women. The likely explanation for this finding is the lack of variation in the size of material and practical networks among Bamanan women: Most women reported relatively large networks for both domains.

Three, network characteristics had more notable effects on contraceptive use than on fertility. This is understandable, given that contraceptive use is a relatively recent innovation in Mali and is viewed, as in other African contexts, mainly as a means to ensure the health of mother and child.[47] Therefore, we would expect networks to matter more for women's decisions to practice contraception than for their decisions to limit fertility.

Finally, we find age-specific effects of networks on both fertility and contraceptive use. For the number of children ever born, network effects are found only among women aged 30 or older. We speculate that older women surrounded by supportive conjugal kin, and presumably less subject to reproductive competition from co-wives and sisters-in-law, may feel less compelled than younger women to bolster their social position through demonstrated fertility and, eventually, more supported in their decision to retire from childbearing. Given that the network members discussed in this study are perceived as support givers, the positive association between the membership of natal kin and total fertility may result from selection effects. A woman is likely to include all natal kin, regardless of their fertility preferences, in her network because they are kin, but she might be more selective when it comes to conjugal family members: She might choose particular conjugal family members as part of her network because they deviate from high-fertility norms and favor smaller family size.

Membership in a tontine and having nonkin or nonresidents of the village make up a large proportion of a network increase the likelihood of ever having used contraceptives only among younger women, suggesting important age-dependent differences in social learning. Younger women are more likely than their older counterparts to be exposed and receptive to contraceptive information through heterogeneous networks, and more likely to discuss and try out innovative ideas. However, younger women also are

TABLE 6. Coefficients (and standard errors) from logistic regression analyses assessing the effects of selected characteristics on the likelihood that a woman has ever used contraceptives, by type of characteristic, according to woman's age

Characteristic	<30		≥30	
	Model I (N=179)	Model II (N=179)	Model I (N=194)	Model II (N=194)
Individual				
Woman's age	.531 (.706)	.604 (.737)	−.130 (.697)	.169 (.771)
Woman's age squared	−.009 (.015)	−.011 (.016)	.001 (.008)	−.002 (.009)
No. of infant deaths	−.065 (.331)	−.130 (.350)	−.339* (.174)	−.417** (.188)
No. of children ever born	−.041 (.184)	.121 (.197)	.293*** (.104)	.256** (.115)
Education	.772 (.645)	.710 (.663)	.412 (.674)	.125 (.737)
Husband's age	.026 (.023)	.017 (.024)	−.005 (.019)	−.003 (.022)
Presence of a co-wife	−1.16** (.500)	−1.46*** (.545)	−.634 (.470)	−.741 (.505)
Household				
Size	−.004 (.008)	−.005 (.008)	−.003 (.009)	.010 (.010)
Extended household	1.05 (.911)	1.22 (.925)	.711 (.597)	.530 (.638)
Asset score	.002 (.017)	.006 (.018)	.003 (.017)	.001 (.018)
Network function†				
Size of material support network	−.012 (.050)	na	.129*** (.049)	na
Size of practical support network	−.010 (.059)	na	.008 (.052)	na
Membership in a tontine	1.23** (.599)	1.43** (.645)	.824 (.516)	.843 (.538)
Level of multiplexity in total network	−1.75 (1.23)	−1.92 (1.33)	.985 (1.36)	1.05 (1.46)
Network composition‡				
Presence of mother-in-law	na	−.746 (.520)	na	.899* (.465)
Presence of husband	na	.024 (.811)	na	.021 (.676)
Presence of mother	na	.656 (.495)	na	.626 (.440)
Presence of nonfamilial older women	na	.179 (.464)	na	1.53** (.614)
% of network who are natal kin	na	.009 (.015)	na	.025* (.013)
% of network who are conjugal kin	na	−.034** (.016)	na	−.019 (.015)
% of network who are nonkin	na	.033* (.017)	na	−.018 (.016)
% of network who live outside village	na	.060** (.024)	na	.035 (.025)
Pseudo-R²	*.107*	*.138*	*.141*	*.202*
Log likelihood	*−81.4*	*−78.6*	*−82.4*	*−74.2*

*p<.05. **p<.01. ***p<.001. †The network size variables were run separately because of multicollinearity. ‡The percentage variables were run separately because of multicollinearity. *Note:* na=not applicable.

subject to the social influence of gatekeepers who encourage high fertility, such as mothers-in-law and conjugal kin. A somewhat different regime operates for older women, who have already established their status through childbearing. In this case, the same gatekeepers appear to increase the likelihood of contraceptive use. Given the tendency in Bamanan culture to view contraception as a means of spacing in order to ensure maternal and child health instead of limiting childbearing, it is understandable that contraceptive use might be accepted by even the most conservative elements in a woman's social world.

If social influences have made contraceptive use acceptable for spacing and, thus, protecting maternal and child health, even though use for limiting births is not gaining acceptability, we need to assess our ability to differentiate social influence from social learning. Given the density and homogeneity of kin-based social networks among the Bamanan, social influence likely is the prevailing mechanism through which networks of social support affect fertility outcomes. However, does contraceptive use for spacing, which is consistent with high-fertility norms, signal that social learning is taking place? It is difficult to distinguish

social influence from social learning in cross-sectional analysis, because we cannot identify the mechanisms by which social networks are related to fertility behavior.[48] Our analysis has attempted to address this issue by focusing on particular network features (i.e., proximity, relationship) that would enable us to identify the most likely conduits of social learning and social influence. We conclude that social learning—defined as the acceptance of contraceptive use for any purpose—is occurring among the Bamanan, but that it is consistent with the maintenance of high-fertility norms.

Several limitations of our study warrant mention. First, because we tested onetime household and network measures against a cumulative indicator of total fertility, effects may have been underestimated. Second, the analysis was restricted to women in their first marriage. In additional analyses (not shown), no major differences were found between these women and women who have had multiple marriages; nevertheless, it would be instructive to explore whether network effects operate differently for women who have been in more than one marriage. Third, using cross-sectional data to study the effects of membership in a credit scheme on contraceptive use raises problems of selectivity.[49] Credit schemes might attract contraceptive users. Ideally, we would have panel data to conduct comparisons of the effects of membership on the adoption of contraceptive use. Finally, it is important to mention the difficulty of collecting network data. Although women free-listed their support givers, the degree of actual support provided is not clear. In addition, because networks are dynamic entities, even if their size and composition remain stable, the nature of relationships within them can change.

These limitations aside, a social networks approach has potential for informing reproductive health programming. Our findings suggest that programs should go beyond a woman's individual and household characteristics to consider her larger social network. While research has increasingly recognized the need to move beyond the individual, the programmatic implications have been, thus far, fairly limited.

It is also clear from our findings that programs should be designed specifically for different age-groups, given the vastly different pressures to bear children that younger and older women face. Efforts to integrate women into heterogeneous networks that facilitate social learning about contraceptive use, and the benefits of smaller numbers of children, may provide a useful counterpoint to prevailing norms that promote high fertility and compromise the health of women in rural West Africa.

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RESUMEN

Contexto: *Los fenómenos demográficos ocurren dentro de los contextos sociales, y por lo tanto, deben ser estudiados como procesos sociales. No obstante, la forma de conceptualizar y medir los mundos sociales que los individuos habitan ha sido un tema de debate.*

Métodos: *Se utilizaron datos obtenidos de un estudio realizado en Malí, en 1996–1997, para explorar las redes sociales de las mujeres Bamanan y su impacto en las decisiones relativas a la fecundidad. Se emplearon métodos de mínimos cuadrados ordinarios y análisis de regresión logística para examinar la relación entre características de hogares y sociales y dos medidas de fecundidad: el número de hijos tenidos y el uso de anticonceptivos.*

Resultados: *Las características de los hogares no producían ningún efecto significativo sobre los resultado estudiados, pero sí lo hacían las características de las redes sociales. Cuanto más prominente es la representación de los parientes conyugales en la red social, menor es el número de hijos que tiene una mujer; sin embargo, la fecundidad aumenta si el esposo o las mujeres no relacionadas forman parte de esa red. Es elevado el uso de anticonceptivos si la mujer participa en un programa de desarrollo económico de microcrédito, y aumenta a medida que aumenta la proporción de miembros de la red ubicados fuera del pueblo; el uso disminuye sensiblemente a medida que aumentan los miembros de la red que son parientes conyugales, y es significativamente elevado si la madre de la mujer se encuentra presente. Los efectos de la red social sobre la fecundidad son mucho más pronunciados entre las mujeres de 30 y más años de edad que entre las más jóvenes, y sus efectos con respecto al uso anticonceptivo son marcadamente diferentes entre las mujeres jóvenes y mayores.*

Conclusiones: *Los programas deberían considerar no solamente las características individuales y del hogar de la mujer, sino también el marco social más amplio de las redes sociales. Además, los programas deben ser desarrollados para atender los grupos por edad específica, tomando en cuenta los diferentes efectos que las redes socials se producen entre las mujeres más jóvenes y las mayores.*

RÉSUMÉ

Contexte: *Dès lors qu'ils se produisent dans un contexte social, les phénomènes démographiques devaient être étudiés tels des processus sociaux. La conceptualisation et la mesure des environnements sociaux dans lesquels les personnes évoluent alimentent cependant le débat.*

Méthodes: *Les données d'une étude menée au Mali en 1996–1997 servent à explorer les réseaux sociaux des femmes bamanan et l'impact de ces réseaux sur les décisions de fécondité. Les techniques des moindres carrés et de régression logistique permettent d'examiner le rapport entre certaines caractéristiques de ménage et de réseau social et deux mesures de fécondité: enfants nés et pratique de la contraception.*

Résultats: *Les caractéristiques de ménage ne produisent d'effet significatif sur aucune des deux issues, contrairement aux at-*

tributs de réseau. Plus la parenté conjugale est représentée dans un réseau, moins la femme avait jamais eu d'enfants. La fécondité s'accroît toutefois si le mari ou des femmes plus âgées sans relation de parenté font partie du réseau. L'usage, actuel ou passé, de la contraception est élevé si la femme participe à un système de crédit; il s'accroît proportionnellement au nombre de membres du réseau extérieurs au village. Il diminue nettement lorsque la proportion de membres du réseau faisant partie de la parenté conjugale augmente, et est significativement élevé si la mère de la femme est présente. Les effets du réseau sur la fécondité sont beaucoup plus prononcés pour les femmes âgées de 30 ans et plus que pour leurs cadettes. Sur la contraception, ils diffèrent nettement suivant l'âge des femmes.
Conclusions: *Outre les caractéristiques individuelles et de mé-*

nage des femmes, les programmes devraient considérer leur réseau social plus large. Ils devraient du reste être conçus en fonction de groupes d'âge spécifiques, étant donné les effets distincts du réseau selon que les femmes sont plus ou moins âgées.

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CALL FOR PAPERS

The reproductive health of women around the world is compromised by violence, often perpetrated by intimate partners or used as a strategy of social control or a tactic of intimidation during war. Still, relatively little is known about its frequency and effects, and how it varies geographically and culturally. To address this lack of information, the December 2004 issue of *International Family Planning Perspectives* will focus on gender-based violence. We are seeking papers on levels of violence and the effects of actual and threatened violence on contraceptive use, protection against HIV and other sexually transmitted infections, fertility and other aspects of reproductive health. We are also interested in gender-based violence occurring during war and in refugee camps. We will consider commentaries as well as qualitative and quantitative research.

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