Households and Networks: Measuring the Social Worlds of Fertility Behaviour

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Abstract

It is now widely accepted that demographic phenomena – fertility, mortality and migration – occur within social contexts and therefore, should be studied as social processes. However, there has been lively debate on how to conceptualize and measure the social worlds that individuals inhabit. The conventional practice in demography is to use the residential household as the arena from which proxy measures of social relations are drawn i.e. household size, household type and dependency ratio. In light of concerns about the degree to which household-based measures adequately represent the complex web of social relationships in which individuals are embedded, this paper explores the broader social networks of women and their impact on fertility decisions among the Bamanan of Mali, West Africa. Data are drawn from a study on Women's Social Networks and Health carried out in Mali from 1995-1997. Using bivariate and multivariate techniques, we examine the relationship between selected household and social network characteristics and two indices of fertility: pace of childbearing measured by the hazards of having a birth and the volume of fertility measured by children ever born. Results suggest that large networks providing emotional and practical support increase the hazard of having another birth. At the household level, there is a positive association between large household size and shorter birth intervals and a weak negative relationship between extended household structure and the hazards of having another birth. As regards total fertility, beyond expected biological associations, the only variable that exhibits significance in multivariate analysis is the density of conjugal kin in a network: the greater the support from conjugal kin, the fewer children ever born.

Introduction

In understanding fertility dynamics and fertility transition in the developing world, it has become increasingly clear that fertility decisions occur within specified social contexts (Bongaarts and Watkins 1996). Far from being the straightforward outcome of individual or even couple decisions, fertility-related behaviour such as spacing, stopping and use of contraception must be understood in the broader context of a woman's social world. Indeed, recent efforts to promote women's reproductive health and rights have stressed the importance of understanding and addressing the broader social environment within which reproductive behaviour occurs (UN 1995). This paper explores the influence of the social environment on the fertility behaviour of Bamanan women in Mali. In particular we consider two social structures – the household and the broader social network – and their respective effects on the pace at which women reproduce and the total number of children that they bear. Through this analysis we hope to yield a better understanding of who constitute potential agents of fertility behavior change, and to identify programmatic levers that increase women's control over her fertility and reproductive health.

Literature Review

The focus on fertility as a social process is not new to the field of anthropology where an emphasis on the social (vs.biological) dimensions of reproduction is apparent in much of the classic literature (Fortes 1958, Goody 1976). In the context of sub-Saharan Africa, Caldwell (1976) has argued that high fertility regimes have been sustained by pervasive cultural norms embodied in religious and lineage systems that distribute the costs and responsibilities of child bearing and rearing among extended family members. More recently, the growing field of anthropological demography has examined the specific role of kinship systems (Das Gupta 1997) and the family (Skinner 1997) on demographic processes. These scholars and others (Adams and Castle 1994; Townsend 1997; Castle 2001) share the view that all demographic processes, especially fertility, are shaped by powerful social forces (e.g. education, modernization), many of which remain ill-specified and ill-understood.

While acknowledging the importance of the social world, demographers have tended to focus on the household as the most important arena of social relations. There are good reasons for this, with perhaps the most persuasive one being its analytical convenience. The widespread application of western concepts of the household to the developing country context has further entrenched assumptions that the household represents the most critical locus of social interaction

(Skinner 1997). Anthropologists, however, have taken issue with these assumptions and questioned accepted definitions of the household (Netting et al. 19984; Wilk 1989) especially for Sub-Saharan Africa (Guyer 1981). Claiming that households are neither isolated nor self-sufficient, they conceptualize the household as a dynamic social grouping defined by permeable boundaries, and embedded in a larger social context. Bohannan's observation that he knew "compounds which were swarming with children one week and almost without children the week after" speaks to the problem of dynamic membership (quoted in Guyer 1981:98). African field researchers know well the difficulty of identifying households characterized by fluctuating membership as labor migrants come and go, as young women return home to give birth, as relations come to stay for long periods, or as children are fostered in or boarded out to attend schools far from home.

Critics also point to the diverse number of household forms that exist cross-culturally and their lack of uniformity in terms of function, attribute, and membership. Indeed, this heterogeneity in form and function raises legitimate questions about what in fact the household represents, and what household-based variables presume to 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 (1989:27) prefers to conceptualize the household as social relations and practices. Overcoming the contentious assumption of altruism that underlies traditional economic theories of the household (Becker 1981), Wilk's (1989) characterization of the household allows room for conflict and competition between members which may be salient in understanding the social basis of fertility behaviour and outcomes (Sen 1990; Folbre 1994).

Given the numerous conceptual and empirical issues that arise from using households as the de facto social world of fertility, in this paper 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 ego-based support networks identify the extent of instrumental support available to women and as such may have important bearing on the feasibility of additional childbearing. As suggested in recent demographic theory (described below), the second mechanism through which social networks might affect fertility behaviour is through social interaction. Here we use support networks as proxy measures of the level of social interaction that women experience and examine network heterogeneity and membership to explore the likely nature of this interaction effect.

The demographic literature on interpersonal networks and fertility behaviour has grown rapidly in the past few years (Montgomery and Casterline 1996; Entwistle and Godley 1998; Kohler et. al. 2001). One body of work examines the role of networks in encouraging innovation through the spread or diffusion of new information (Montgomery and Casterline 1993; Godley 1997). A second body of demographic research concerns the role of networks in encouraging behavioural conformity within a local community. In this instance, social networks are seen as a conservative cultural force that transmit values and reinforce norms (Kohler et al. 2001). In both literatures, social interaction occurring in the context of interpersonal networks is seen as the principal mechanism of behaviour change. Two distinctive processes of social interaction have been identified in this literature. The first is "social learning" which refers to the exchange of information and ideas within a network and their joint evaluation (Montgomery and Casterline 1993; Rosero-Bixby and Casterline 1993, 1994). Behaviour change occurs when discussion within a network acts to reduce an individual's perceived risk and uncertainty and encourage the adoption of "new" ideas (Kohler et al. 2001). Thus, it is hypothesized that innovations in fertility behaviour such as the adoption of contraceptive use or the desire to limit family size will occur as a woman is exposed to new information and ideas in the context of her network, and participates in the joint evaluation of their relative benefits. It follows that social learning is more likely to occur in diffuse and heterogeneous networks that embody ideas about fertility that may be different than those to which women are routinely exposed.

A second process is "social influence", whereby behaviour is dictated by prevailing social norms in an effort to win approval and avoid conflict with the social group (Montgomery and Casterline 1996). Here, the conservative nature of dense and homogeneous networks are evoked as individuals attempt to conform to prevailing values about ideal family size and observe traditional practices that uphold these norms (e.g. optimal birth spacing). Once fertility changes are underway, however, the information transmitted by social influence may change as diffusion of new ideas from sparser more heterogeneous networks are accepted by or adapted to the local context (Bledsoe et al. 1994).

In their recent article, Kohler et al. (2001) report that both network structure and content (in this case, knowledge and interactions about birth control) are related to the probability that a woman uses family planning but that the social and cultural context partly determine whether social learning or social influence dominates. Thus, in exploring how the instrumental and/or interactive features of social networks operate to influence the pace and volume of fertility, we pay particular heed to social and cultural context. Based on preliminary ethnographic work, we

identify practical and material networks as the indicators of instrumental support of greatest relevance to fertility behaviour. Likewise, we explore interaction effects and distinguish between the processes of social influence and social learning through a series of variables that measure the network heterogeneity and composition (Granovetter 1973, Valente 1994).

When exploring effects on fertility, we need to specify aspects of fertility – pace of childbearing measured by the length of the birth interval, volume measured by children ever born or family planning measured by contraceptive use. In this analysis, we only consider effects on the pace and volume of childbearing because contraceptive use in this population (both ever use and current use) is too low to permit meaningful analysis. The pace of fertility refers to the rate at which childbearing occurs whereas the volume refers to a woman's completed fertility. While higher fertility is linked to shorter birth spacing, it should be noted that different pacing schedules can result in the same volume of fertility. Furthermore, we argue that the factors influencing when a woman chooses to have a child may be different than those that determine when her family size is complete. For example, large instrumental networks might enable a woman to forgo a long waiting period between births but they may have very little to do with the number of children she ends up with. In other words, pacing and completed fertility are two different processes, each subject to a different set of influences.

Description of Site and Population

Mali ranks among the poorest of developing countries according to standard indicators of macro-economic performance and human development. Seventy percent of its 7.7 million inhabitants live in rural areas, 50% are under 15 years of age, and just 18% of rural men (aged 6+) and 10% of rural women have attended school (EDS 1996). With a GNP estimated at $250 per capita, basic social services in Mali are extremely limited in scope and coverage, including health-care infrastructure and provision (WDR 1997). The country also fares poorly on a number of health indicators: in rural areas, under-five mortality is 149 per 1000, maternal mortality is 577 per 100,000 live births, and 23% of children under three years of age suffer acute malnutrition (low weight/height) (EDS 1996).

Chosen for their distinctive demographic, health and socio-cultural characteristics, the agricultural Bamanan comprise 35% of Mali’s national population. Bamanan society is patrilineal, virilocal and hierarchical in organization such that the most senior male member of the household controls land-use, compound-level goods, and the production and reproduction of

labor. The Bamanan favor large extended families due in part to the substantial labor requirements of dryland millet cultivation, and the relative abundance of land. Further characterizing Bamanan society is a strong ideology that favors egalitarianism and cooperation, whereby both household and community members are expected to work with one another for the greater corporate good (Lewis 1979). Within the Bamanan household, gender relations are defined by the segregation of roles between husband and wife/wives, and between men and women more generally (Adams and Castle 1994). 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 (Oppong and Abu 1987). With the payment of bridewealth, men gain absolute rights to intercourse with their wives, have control over children born of such unions, and command their wives' labor to benefit the marital household (Adams and Castle 1994). Women, on the other hand, have no direct claim to land or household labor, but must request these from their husbands. Despite their apparent social subordination, however, Bamanan women maintain a considerable degree of financial independence from their husbands. While this provides women with some autonomy in decision-making, issues concerning the health and welfare of children remain largely in the control of the husband and the marital family (Adams and Castle 1994).

Social Support and Fertility Norms among the Bamanan

Social Support and Childbearing

Among the rural Bamanan, the large corporate household tends to enjoy greater wealth and prestige than smaller nuclear arrangements (Adams 1992; Toulmin 1992). This is partly a consequence of rainfed agriculture, whereby crop production is dependent on the household labour force and its reproduction over time. In this paper we propose that instrumental support provided through large households and large networks ensures that high fertility regimes are sustained by redistributing the costs of childbearing and rearing. 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.

Bamanan Fertility Norms

As in much of rural West Africa, fertility is highly valued by the Bamanan given the importance of reproduction in sustaining household labour supply and ensuring descent (Caldwell and

Caldwell 1987). 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 women's self-esteem and social status within her marital family and larger community is accrued through success in child bearing (Adams and Castle 1994).

To maximize child survival and to reach optimal family size, a complex set of norms and sanctions guide Bamanan fertility decisions. For example, in rural areas, social sanctions still persist that discourage premarital fertility, thus delaying age at first birth. The widespread practice of postpartum sexual abstinence and prolonged breastfeeding similarly supports healthy reproduction by maximizing birth intervals to at least two years in duration (Caldwell and Caldwell 1977; Page and Lesthaeghe 1981). The resort to terminal female sexual abstinence once women become grandmothers also functions to reduce the risks associated with reproduction among older women, and ensures that they are available to provide support to the fertility regimes of their daughters and daughters-in-law i.e. monitoring observance of the full post-partum period and optimal child spacing. Together, these traditional norms and sanctions work to maximize spacing such that child survival is enhanced, and large completed family size is attained.

Social Networks and Fertility: social learning vs. social influence

Despite the cultural value and presumed material benefits of high fertility among the rural Bamanan, as women shoulder the rising costs of child rearing, there is increasing awareness of the advantages of limiting births and investing in fewer numbers of children. While only 13 percent of our sample report using modern contraception, the large majority are aware of modern contraceptive methods (83%), and many expressed an interest in their use. It is hypothesized here, however, that the nature of a woman's social interactions will influence her capacity to flout traditional fertility norms such as the premium on large family size, and/or the preferred use of traditional methods to pace births at culturally acceptable two year intervals. For women whose social interaction is largely confined to the conjugal or natal household, for example, departure from traditional fertility norms may incur substantial social risk. These include the potential of embarrassing their natal family and/or husband and his family by defying their perceived need for many children, and/or of losing social status relative to rival co-wives or their sisters-in-law (Madhavan 1998). Indeed, a substantial literature documents how dense and homogeneous networks exert considerable pressure on individuals within them to follow normatively defined patterns of behaviour (Bott 1971; Birkel and Reppucci 1983; Dyson and Moore 1983). Tight

boundaries make it easy to control and coordinate behaviour of an individual through assistance of those in distress (and the obligations this produces) and punishing those who transgress. By contrast, contact with peers, professionals and other non-kin network members, and social learning within these more heterogeneous networks might encourage changes in fertility norms and associated behaviours (Montgomery and Casterline 1993, 1996; Rosero-Bixby and Casterline 1993, 1994; Lockwood 1995) such as the increasing value of investing in children's education, preferences for smaller family size, and the use of modern contraception to pace and/or limit fertility.

In this paper we explore whether social influence or social learning predominate in explaining the fertility outcomes of Bamanan women by testing a series of variables chosen to represent these processes. Social influence is captured through variables that identify the relative importance of conjugal and natal support networks with the hypothesis that large familial networks will encourage behavioural conformity. We also propose that conformity will result in the presence of large cognitive networks that include respected older women who provide advice and support around post-partum abstinence and breastfeeding that maintains high fertility norms (Brett-Smith 1994). As regards social learning, we hypothesize that fertility innovations such as extended birth spacing and small family size, will be more likely in the presence of large emotional or non-kin networks that support the adoption of non-traditional ideas, and networks that incorporate female peers via membership in cooperative credit or work schemes.

Data and Methods

The data used in this paper are drawn from a comparative study of women's social networks and their impact on child and maternal health in Mali conducted during the period February 1996 to May 1997 (Adams and Castle 1995). The survey was administered in two geographically distinct sites that represent Bamanan and Fulbe populations but we restrict this analysis to the Bamanan. With the assistance of NGOs working in each region, a range of villages were chosen based on criteria of village size, and proximity to market and health care services. In total, ten Bamanan villages were chosen within the administrative Cercle of Bougouni located near Mali's southern border with Côte d'Ivoire. In total, 503 women respondents aged 15 to 45 years were sampled randomly based on complete household censuses conducted in each village. Although in the majority of cases only one woman was selected per household, within large households with six or more eligible women, a maximum of three women were identified for study. The multi-part questionnaire included background data on household composition and socioeconomic status, in

addition to data specific to the sampled women and their children. Information was solicited on women's household position, birth history, income sources, the health and nutrition of herself and her children and the woman's last live birth in the previous two years. In addition, life histories were collected from a sub-sample of women.

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 was conducted prior to survey design. It was chosen over a more structured approach in which the presence or absence of specific individuals is noted, given the challenges of ascertaining in advance cultural norms that dictate key individuals in a network. After having elicited the free list, however, probes were applied if individuals such as husband, mother-in-law, co-wife, were conspicuously absent.

Methods

Two fertility related outcomes are explored in multivariate analysis: 1) the hazards of having another birth and 2) the total number of children ever born. Cox regression is employed to look at the hazards of having another child since the last birth with time varying and time constant co-variates. All live births are treated as events and coded 1 whereas end of observation is treated as censored and coded 0. For our second outcome of interest - total number of children ever born in woman's current marriage – OLS regression is used to model the effects of network and household attributes on the number of children a woman has had over the course of current marriage. Our main independent variables of interest for both models are the following:

Household-level Measures

Three household-level variables are included in analysis. To indicate household socioeconomic status (SES), an *asset score* is calculated based on whether a radio, cycle, lamp, cart, and/ or moped is owned by the household. These items are appraised in local currency and a score computed (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, while *household structure*, categorizes households into two basic forms: nuclear (coded as 0) and extended (coded as 1). Nuclear households include single-parents and their biological children, and households comprised of a household head, his wife/wives and their children. Also classified into this group are nuclear households with foster children, hired help and/or boarding students.

The extended category of household encompasses a more complex amalgamation of household types including three-generational arrangements in which the parents and/or grandchildren are present, and laterally extended households in which siblings and cousins of the household head are included. Size and structure variables are expected to influence fertility based on the assumption that large households, and those that are extended in structure are better able to sustain the material and non-material costs of child bearing and rearing. Not surprisingly, household size and structure are correlated with a coefficient of .25.

Social Support Measures

Four types of perceived support are assessed as continuous, time constant variables. *Material support* consists of tangible assistance with money, food or clothing, while *practical support* refers to help with household work and childcare. Both forms of instrumental support are thought to promote high fertility by redistributing the costs of child rearing. The third type of support considered is *cognitive support* in the form of advice and information. Here we hypothesize that that counsel received from predominantly kinship-based networks will serve to uphold traditional fertility norms such as optimal birth spacing of two years in duration, and large family size. The fourth category of network function is e*motional or affective support* as provided by relationships characterized by love, caring, trust, empathy, and intimacy. By strengthening ego's self-esteem, and reinforcing a sense of mastery and pride in her coping efforts, emotional support is presumed to help control stress, and maintain both physiological and psychological health. We hypothesize that the presence of a supportive emotional network would enhance a mother's capacity to control her own fertility as evidenced by fewer children ever born and extended birth spacing. Finally, *membership in a tontine* (local cooperative scheme) is also specified given our hypothesis that exposure to diverse sources of information and ideas may result in social learning that facilitates the adoption of non-traditional fertility practices (e.g. use of contraception) or promotes non-traditional perspectives such as the social and economic advantages of small family size (Boulay and Valente 1999).

In addition we consider a number of network composition measures that we believe may have effects on the timing and volume of fertility. Given the role of older Bamanan women in enforcing traditional practices that support a two-year birth spacing and abundant reproduction, we hypothesize that those who report influential elder women in their networks will experience an increased hazard of having another birth and larger completed family size. To test this hypothesis we have created time constant dichotomous variables (coded 1/0) that indicate the

presence of a mother-in-law, birth mother and non-familial older woman in a network. A fourth variable, *support from a husband*, is hypothesized to work in a similar manner. A final group of network composition measures are incorporated to test the hypothesis that networks comprised of dense and homogeneous conjugal and/or natal kin are likely to support high fertility norms that sustain the household's productive and reproductive capacity. The variables derived to test this hypothesis are *the percentage of a woman's network who are conjugal kin*, and *the percentage of network who are natal kin*. A measure of *multiplicity*, which denotes the degree to which a network is comprised of a small number of individuals providing many different types of support, is also used to test the hypothesis that homogeneous, multiplex networks bolster traditional norms that encourage large family size. Multiplicity represents the number of individuals in a woman's network who provide more than one type of support expressed as a proportion of the total number of unique individuals in a woman's network. We then consider the obverse hypothesis that the greater the heterogeneity in a network, the greater the likelihood that social learning will occur (e.g. more investment in fewer children), that results in deviation from traditional high fertility regimes. To this end, we identify two variables that capture heterogeneity in a network: *the percentage of network members residing outside of the village, and the percentage of network members who are non-kin.*

Given that we only have household and network data at the time of survey, we make the assumption that both network and household characteristics are 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 (Sarason et al. 1986). This is confirmed by life history interviews conducted as part of the Networks study that underscore the point of marriage as the most tumultuous period in a woman's life. Only births that occurred during the woman's current marriage are included in the analysis given that we have no information on previous unions.

Other Control Variables

Due to their known influence on women's fertility, additional control variables are included in analysis such as mother's age, age squared, parity, length of the previous birth interval, and education. We also control for infant deaths occurring during the birth interval given evidence that they shorten the birth interval (Ronsmans 1996; Koenig et al. 1990). Husband's age is hypothesized to have a negative effect on the pace and volume of fertility given the increasing risk of male infertility with age. Finally, a dichotomous variable is created that indicates *whether*

or not the woman has a co-wife. Research in West Africa has shown a small negative effect of polygyny on the hazards of having a birth as a result of both decreases in coital frequency and, in some cases, sub-fecundity (Garenne and van de Walle 1989). All these variables are time varying co-variates.

For our second outcome of interest - total number of children ever born in the current marriage - control variables include age, age squared, husband's age, presence of a co-wife, education and the total number of infant children she has lost. The household level and network measures remain the same. Childless women are excluded from the sample bringing the final sample to 454 women.

Results

Table 1 shows the basic demographic characteristics of the Bamanan women sampled as part of the Networks study.

INSERT TABLE 1

Consistent with DHS findings is the low median age at marriage, the large percentage of women without formal education (93.5%), and the high proportion of women in polygynous unions (66.5%) (EDS1996). Regarding fertility, the relatively high TFR is partly explained by the low percentage of women ever having used modern contraception and the low median age at first birth. The average length of the closed birth interval conforms with the two year average prescribed by Koranic law, while high rates of infant and child mortality are in accordance with the average for rural West African populations. Table 2 presents the attributes of the households in which the sampled women reside.

INSERT TABLE 2 HERE

As found in the ethnographic literature on the Bamanan, mean household size is large, and as might be expected, extended family structures predominate over nuclear forms. The age distribution of household members is skewed toward younger ages and is reflected in relatively high dependency ratios. Household SES is also quite high as indicated by mean values of the variable "asset score" and its distribution over the sample. The network characteristics of women included in analysis are presented in Table 3.

INSERT TABLE 3

On average, total network size is almost 18 members, although actual network size ranges from 3 to 54 members. Material support networks are the largest in size (10 members), followed by practical (7 members), cognitive (6.5 members) and emotional (2 members) network types. The composition of support networks is predominantly female (62%) and older in age (67%) than the reference woman. The proportions of natal kin (42%) and conjugal kin (38%) reported by women in the sample are also quite substantial. Underscoring the need to consider social dynamics beyond household boundaries, only 44% of reported network members are located in the same household, while 29% are found within the village but outside the household, and 4% beyond the village. Table 4 examines bivariate relationships between women's household and network characteristics and the two fertility outcomes of interest: the hazards of having another birth and the number of children ever born.

INSERT TABLE 4

Among the household-level variables included in analysis, no significant bivariate effects were noted for the hazard of having another birth. By contrast, increasing household SES and membership in extended households were found to negatively influence the volume of fertility. Both results are the likely consequence of life cycle effects whereby younger women with lower completed fertility disproportionately reside in extended households (which also tend to be wealthier) compared to older women with higher completed fertility. Bivariate analyses of women's social network characteristics indicate that the size of practical, cognitive and emotional support networks exert a positive effect on the hazards of having another birth. As regards the composition of support networks, significant effects were noted only for children ever born. Specifically, we find a strong negative effect of the presence of a mother or mother-in-law in a network and a (weak) positive effect of the presence of non-familial elder woman. Again, all three effects can be explained by life cycle stage. While mothers and mothers-in-law are more likely to be present in younger women's networks who have lower completed fertility, older non-familial women may figure more prominently in the networks of older women who have higher completed fertility. The negative effect of the percentage of network that is conjugal kin on children ever born may also be a consequence of live cycle stage. Unlike older women who have had greater opportunity to construct diverse networks of support, younger women (with lower completed fertility) are more likely to report conjugal kin as network members. Confirming this interpretation is the positive effect of the percentage of non-kin in a network on the total number of children ever born. The older a woman is and the higher her completed fertility, the more

likely she is to expand her network beyond kin. We now move on to multivariate analysis predicting the hazards of having another birth.

INSERT TABLE 5

In model I, age has the expected positive effect but the negative effect of the age squared term indicates a curvilinear relationship. The hazards of having another birth increases with parity but decreases with the length of the previous birth interval. These relationships hold in all three models. Consistent with bivariate results, none of the household-level characteristics identified in the model appear to influence the hazards of having another birth.

Model II explores the influence of the size, type, multiplicity of social support networks and membership in a credit scheme on the pace of childbearing. Note that, due to multicollinearity among the different support types, each model was run separately even though the coefficients are shown together. There were no notable changes in the other coefficients or the pseudo-R2. When controlling for social support characteristics, we find a weak positive effect of household size and a weak negative effect of household structure suggesting that the immediate household environment plays a significant role in a woman's decision to have another child. Interestingly, while size and structure are correlated, they have opposite effects on the length of the birth interval. These differences are most probably due to the unique manner in which they interact with network measures. The positive effect of household size on the hazard of having another birth is likely a result of the greater availability of practical help that is found in large households. By contrast, the negative effect of being in an extended household may reflect a selection effect of network members. Given that the comparison is with women who reside in nuclear households, this effect might be reflecting the social influence of resident sisters-in-law or other non-kin who promote lengthened birth spacing. This model also reveals the significant positive effect of practical and emotional networks on the hazard or having another birth. To ascertain the implications of these effects on traditional norms supporting birth intervals of two years in duration, we also ran analyses using a dichotomous variable indicating birth intervals above and below 20 months (not presented here). Results indicate that emotional network size significantly increases the odds of having a birth interval shorter than is traditionally prescribed.

In Model III, we examine the influence of network composition measures controlling for household size, structure and socioeconomic status. We find that the greater the percentage of natal kin in a network, the greater the hazard of having another birth supporting our hypothesis

that natal kin are more likely to uphold traditional norms of high fertility. The positive effect of household size persists in this model, but the negative effect of household structure disappears with the inclusion of network composition variables. We now turn to modeling effects on the total number of children ever born.

INSERT TABLE 6

Of immediate note are the dramatically higher R-squares which hover around 57% in all three models. This is clearly the effect of applying household and network measures taken at the time of survey to a completed fertility measure at the time of survey. Woman's age and age-squared terms behave in the expected manner. Not surprisingly, the higher the number of infant deaths a woman has experienced, the more children she has. Interestingly, we find no effect of any of the households measures on completed fertility once woman's age in included in the analysis. Underscoring the different mechanisms that influence spacing and completed fertility, Model II indicates no significant effects for network size or function. When network composition variables are included in Model III, the percentage of conjugal kin in a woman's network begins to exert a negative effect on the number of children ever born. The more conjugal kin there are in a woman's network, the fewer children she has. This is interesting if compared to Table 5 in which conjugal kin has no effect on the pace of childbearing, but where the density of natal kin exerts a positive influence. This difference suggests that while natal kin play an important role in determining the timing of the next birth, they have no effect on the number of children a woman bears. Conversely, conjugal kin appear to make no difference to a woman's fertility timing but they do have a negative effect on her completed fertility.

Discussion

This analysis has revealed important connections between the fertility regimes of women and the broader support networks in which they are embedded. As regards the pace of childbearing, we find that the size of a woman's practical and emotional support systems have a positive effect on the hazards of having another birth. For practical support, these findings confirm our initial hypothesis that instrumental assistance from others eases the burden of child rearing and domestic work such that a subsequent pregnancy can be feasibly undertaken. By contrast, the positive result for emotional support contradicts initial expectations that women with large emotional networks are able to contravene prevailing fertility norms. The apparent strength of traditional fertility norms among the Bamanan, however, gives us cause to reconsider the role of emotional

support providers as persons who encourage adherence to (and not deviation from) culturally prescribed objectives such as optimal birth spacing of two years in duration. The only network composition variable that is significant in multivariate analysis of factors influencing the hazard of having another birth is the percentage of network comprised of natal kin. Here we surmise that women whose natal kin figure prominently in their network may feel the imperative of bearing children at a pace that meets parental expectations and acceptable community norms.

Very different patterns are exhibited for the second outcome of interest, total children ever born. Most notably, the size and type of support networks that women report appear to have no effect on the total number of children a woman bears over the course of her current marriage. Contrary to bivariate results, the strong negative effect of mothers and mothers-in-law on total fertility, and the positive influence of non-familial elder women is not evident in multivariate analysis. This is most probably a result of controlling for age, thereby removing the known impact of lifecycle stage on the composition of networks and completed fertility. By contrast, the influence of large networks of conjugal kin on the volume of children born prevails in both bivariate and multivariate models. Here we speculate that women surrounded by supportive conjugal kin, and presumably less subject to reproductive competition from cowives and sisters in law, may feel less compelled to bolster their social position through demonstrated fertility, and eventually, more supported in their decision to retire from childbearing. Keeping in mind that network members of any type are all perceived by the woman as support givers, the opposite effects of natal and conjugal kin might be explained by selection effects. A woman is likely to include natal kin who follow high fertility norms in her network due to kinship but she might be more selective when it comes to conjugal family members. In other words, she might choose particular conjugal family members as part of her network because they "deviate" from high fertility norms and favor smaller family size.

Variations in the direction and significance of social support by fertility outcome suggest fundamental differences in the social processes underlying the pacing and volume of childbearing. For example, the positive effect of percentage of natal kin on the hazards of having another birth does not translate into higher completed fertility. In the same way, the negative effect of conjugal kin density on completed fertility does not necessarily mean longer birth spacing. While results suggest that the social actors and processes underlying women's decisions regarding the pacing and volume of childbearing may be distinct, common to both is the role of social influence in mediating and maintaining traditional fertility norms. Given the density and homogeneity of kin-based social networks among the Bamanan, it is likely that social influence acts as the prevailing mechanism through which networks of social support effect fertility outcomes. Supporting this interpretation are null findings regarding the hypothesized importance

of membership in non-familial networks in which greater diversity and possibilities for "non-traditional" social learning might exist. We find no effect of the density of non-kin members in a network, the percentage of networks located outside the village, or membership in informal credit groups (tontine) comprised of non-familial members on the pace or volume of fertility.

Prior to considering the research and programmatic implications of study findings, several limitations warrant mentioning. First, it should be noted that both network and household measures were taken at time of survey but applied retrospectively to closed birth intervals. Effects may also have been underestimated in testing one-time household and network measures against a cumulative indicator of total fertility. These limitations aside, results reveal the significant influence of network variables that proxy the social world of women on fertility outcomes. Further, study findings underscore the need to better understand the nature of these influences in attempts to improve women's reproductive health and to increase women's control over reproductive decisions and outcomes. To this end, a support networks approach to capturing the dynamic social processes that influence fertility is judged a useful analytic strategy that may be preferable to more static household-based analysis. Finally, we note the potential of a social networks approach to reproductive health programming. Efforts to integrate women into heterogeneous networks that facilitate social learning about contraceptive use (Kincaid 2000), and the benefits of fewer 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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Table 1. Characteristics of Bamanan women in sample and their children, Mali 1997

Sample Characteristics		
Women	Number of sampled women	503
	% of sample with no formal education	93.5
	% of sample < 30 years of age	44.8
	% of sample > 30 years of age	55.2
	Median age at first marriage*	16.0
	% in polygynous unions	66.5
	Median age at first birth*	17.6
	Total fertility rate (1992-1997)	7.7
	% of sample ever having used modern contraception	19.2
	Average length of closed birth interval (in months)	28.2
Children	Total number of live births	2463
	Total number of deaths at all ages	607
	Probability of dying before age 1 (1993-1997)	139/1000
	Probability of dying between age 1 and 5 (1993-1997)	83/1000

* These figures are based on retrospective data.

Table 2. Household characteristics of Bamanan women, Mali 1997

Household Characteristics	
Mean household size	21.1
Mean dependency ratio (children under 15 years /total hhold size)	.656
Mean socioeconomic status (asset score)	28.5 (0-47)
# of women in extended households	430
# of women in nuclear households	72

Table 3. Network characteristics of Bamanan women, Mali 1997

Network Characteristics ***(means [min-max])***	
Total network size	17.8 (3-54)
Material network size	10.4 (1-21)
Practical network size	7.3 (1-21)
Cognitive network size	6.5 (1-20)
Emotional network size	2.1 (1-10)
% of network that is female	61.8
% of network that is older in age	66.8
% of network located in the household	44.4
% of network located in the village	28.6
% of network located close to the village	21.6
% of network located far from village	4.2
% of network who are natal kin	41.7
% of network who are conjugal kin	38.3
% of network who are non-kin	18.7
N	454

Table 4. Bivariate effects of household and network attributes on the hazards of having a birth and the number of children ever born

	Hazards of Having a Birth	**Children Ever Born**
Household size	NS	NS
Household socioeconomic status (asset score)	NS	-.024**
Household structure (extended=1; nuclear=0)	NS	-1.34***
Size of material support network	NS	NS
Size of practical support network	.011*	NS
Size of cognitive support network	.013**	NS
Size of emotional support network	.053**	NS
Level of multiplicity in network	NS	NS
Membership in a tontine (yes=1; no=0)	NS	NS
Presence of mother-in-law in network	NS	-1.29***
Presence of mother in network	NS	-1.40***
Presence of non-familial elder woman in network	NS	.598*
Presence of husband in network	NS	NS
% of network who are conjugal kin	NS	-.025***
% of network who are natal kin	NS	NS
% of network who are non-kin	NS	.033***
% of network located outside village	NS	NS
N	1837	454

*** significant at the .001 level ** significant at the .01 level * significant at the .05 level

Table 5. Cox regression estimates for hazards of having another birth

	Model I	**Model II**	**Model III**
Woman's Attributes			
Age	.014***	.014***	.136***
Age squared	-.001***	-.001***	-.004***
Parity	.062***	.065***	.051**
Length of previous birth interval	-.004*	-.003*	-.005**
Infant death in the interval	NS	NS	NS
Education	NS	NS	NS
Husband's age	NS	NS	NS
Presence of a co-wife	NS	NS	NS
Household Characteristics			
Size	NS	.002*	.002*
Structure (ref= nuclear)	NS	-.132*	NS
SES (asset score)	NS	NS	NS
Network Characteristics[+]			
Size of material support network	----------	NS	----------
Size of practical support network	----------	.012*	----------
Size of cognitive support network	----------	NS	----------
Size of emotional support network	----------	.064**	----------
Membership in a tontine	----------	NS	NS
Level of multiplicity in total network	----------	NS	NS
Network Composition Characteristics			
Presence of mother-in-law	----------	----------	NS
Presence of husband	----------	----------	NS
Presence of mother	----------	----------	NS
Presence of non-familial older woman	----------	----------	NS
% of network natal kin[++]	----------	----------	.004**
% of network conjugal kin	----------	----------	NS
% of network non-kin	----------	----------	NS
% of network residing outside of village	----------	----------	NS
Pseudo-R^2	.0086	.0094	.0093
N	1562	1542	1562

[+] models are run separately due to multicollinearity
[++] models for natal, conjugal and non-kin are run separately due to multicollinearity
*** significant at the .001 level ** significant at the .01 level * significant at the .05 level

Table 6. OLS regression estimates for number of children ever born

	Model I	**Model II**	**Model III**
Woman's Attributes			
Age	.602***	.602***	.685***
Age squared	-.006***	-.006***	-.003***
Total number of infant deaths	.971***	.971***	.843***
Education	NS	NS	NS
Husband's age	NS	NS	NS
Presence of a co-wife	NS	NS	NS
Household Characteristics			
Size	NS	NS	NS
Structure (ref= nuclear)	NS	NS	NS
SES (asset score)	NS	NS	NS
Network Characteristics[+]			
Size of material support network	----------	NS	----------
Size of practical support network	----------	NS	----------
Size of cognitive support network	----------	NS	----------
Size of emotional support network	----------	NS	----------
Membership in a tontine	----------	NS	NS
Level of multiplicity in total network	----------	NS	NS
Network Composition Characteristics			
Presence of mother-in-law	----------	----------	NS
Presence of husband	----------	----------	NS
Presence of mother	----------	----------	NS
Presence of non-familial older woman	----------	----------	NS
% of network natal kin[++]	----------	----------	NS
% of network conjugal kin	----------	----------	-.023***
% of network non-kin	----------	----------	NS
% of network residing outside of village	----------	----------	NS
R2	.570	.574	.587
N	415	415	415

[+] models are run separately due to multicollinearity
[++] models for natal, conjugal and non-kin are run separately due to multicollinearity
*** significant at the .001 level ** significant at the .01 level * significant at the .05 level