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Community Context, Land Use and First Birth

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Abstract

This paper examines the influence of community context and land use on the monthly odds of first birth in a society in the midst of dramatic fertility transition. The theoretical framework guiding our work predicts that proximity to non-family services should delay first births by creating opportunities for competing non-family activities and spreading new ideas that change expectations about family life. On the other hand, living in agricultural settings that provide opportunities for higher returns to the child labor should speed first births. We use a longitudinal, multilevel, mixed-method data from the Nepalese Himalayas to test these predictions. The empirical results reveal that non-family services during childhood and during early adulthood both have important independent influences on the odds of first birth. Also, as predicted, a high density of agricultural land use affects the odds of first births in the opposite direction, speeding first births. This clear pattern of contrasting effects provides important new evidence of the contextual dynamics that produce watershed changes in post-marital birth timing.

Introduction

This paper examines the influence of two aspects of neighborhood context—proximity to non-family service organizations and neighborhood land use—on the pace of having the first child after marriage. Both theory and empirical evidence point to changes that alter the extent to which families organize individuals' daily lives as a fundamental determinant of changes in marital and childbearing behaviors (Axinn and Yabiku 2001; Caldwell 1982; Thornton and Lin 1994). Specifically, changes in the extent to which the activities of daily social life, including production, consumption, socialization, recreation and health care are organized by the family versus other non-family social organizations shape family formation behaviors (Axinn and Yabiku 2001; Thornton and Lin 1994). Increasing access to new non-family organizations and services such as schools, employment centers, market places, bus services, movie halls, and government services influence marriage timing, marriage arrangement, and contraceptive use (Axinn and Barber 2001; Ghimire et al. 2006; Thornton and Lin 1994; Yabiku 2004). We build directly on this existing literature, expanding the investigation of both organizational factors to include local land use and the dimensions of family formation to focus on first birth timing.

In the mainly poor, agrarian, rural populations of Africa, Asia and Latin America, community-level organizational changes can have dramatic effects on the timing of marriage, generally leading to delays in marriage (Thornton & Lin 1994; Yabiku 2005, 2006). Unfortunately we know much less about the effects of community-level change on the length of time between marriage and the first birth. Yet the length of this interval is a critical indicator of changes in the ways that husbands and wives behave with respect to reproduction. Whereas, in a society such as Nepal, where premarital sex is limited, delays in marriage may indicate a postponement

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of initiating a sexual relationship, delays in the transition to pregnancy among the married indicate couples have changed their behavior to either contracept or abstain in order to delay the transition to parenthood. This conscious effort to delay childbearing within marriage is a fundamental shift in the nature of marriage, the nature of parenthood and the pace of childbearing with wide ranging social implications.

In settings in which early parenthood remains quite common, like Nepal (Choe, Thapa & Mishra 2004; Choe, Thapa & Achmad 2001), the timing of initiation of childbearing may have profound consequences for individuals, families, and society. At the individual and family levels, early motherhood is associated with higher total number of children per woman (Kasarda, Billy, & West, 1986; Pebley, Casterline, & Trussel, 1982; Rindfuss, Morgan, & Swicegood, 1988), potentially poor health of both mothers and children (Preston, 1986; Trussel & Pebley, 1984), lower educational aspirations (McLaughlin & Micklin, 1983), lower educational achievement, and poor economic performance (Bumpass, Rindfuss, & Janosik, 1978; McLaughlin & Micklin, 1983; Rindfuss et al., 1988; Sudha, 1997). Each of these potential consequences of early childbearing has the potential for negative effects on individual and family well-being. At the societal level, early childbearing both reduces the length of generation and increases the likelihood of bearing many children, each of which contribute to higher rates of population growth. In most densely populated poor countries in Asia and Africa, policies and programs to slow population growth are a high priority, and delaying first births is generally considered a policy goal. Nepal is characterized by all of these same issues (Ministry of Health and Population [Nepal], New Era and Macro International 2007). Thus more detailed information about the factors promoting delays in first births is a high priority for policies and programs aimed at improving wellbeing at the individual, family, and societal levels.

There is good reason to believe contextual influences on the pace of childbearing following marriage are complex and multi-directional. On the one hand, proximity to non-family service organizations, which provides neighborhood residents opportunity to participate in non-family activities and exposes them to new ideas that compete with historical expectations about family life, is likely to delay initiation of childbearing (Axinn & Yabiku 2001; Yabiku 2004). On the other hand, these same new non-family activities may promote social interactions among young people, reducing arranged marriage and increasing sexual activity early in marriage, speeding up the first birth (Rindfuss & Morgan 1983). Likewise, living in a predominantly poor, rural agricultural neighborhood that provides opportunities for higher returns to child labor is likely to encourage early childbearing (Cain 1981, 185, 1986; Ghimire & Hoelter 2007; Stokes, Schutjer, & Bulatao 1986; Thomas 1991). This paper formulates a theoretical framework integrating these competing neighborhood influences and uses multilevel, mixed method longitudinal measures from rural Nepal to test hypotheses generated by this framework.

This study takes advantage of measures from the Chitwan Valley Family Study (CVFS) specifically designed to study the influences of macro-level community context on individual family formation behaviors. These data provide an ideal opportunity for studying the links between community context and the pace of childbearing after marriage for three reasons. First, this study is set in a predominantly poor rural agricultural setting undergoing rapid changes in arranged marriage, marriage timing and contraceptive use (Axinn & Yabiku 2001; Ghimire, Axinn, Yabiku & Thornton 2006; Yabiku 2004; 2005). Second, the study defines context at local level – a neighborhood cluster of 5 to 15 households (Barber, Shivakoti, Axinn, & Gajurel 1997) – representing a shared physical setting in which most individuals interact on a daily basis rather than census- or government-defined units. Third, in addition this study measures structural characteristics of the neighborhood from multiple points in respondents' life courses, allowing the investigators to estimate the effects of these structural characteristic both at childhood and early adulthood. Finally, data limitations are often cited as the largest obstacle

in explaining contextual influences on individual behavior (Blalock 1984, 1989; Connell & Halpern-Felsher 1997; Huckfeldt 1983; Tienda 1991). This rich body of contextual measures allows us to overcome such limitations.

Theoretical framework

The connections between immediate social context and individual preferences and behavior have been a central focus of sociologists throughout the history of the discipline. Most general social theories suggest an important influence of local context on individuals' attitudes, preferences, and behaviors (Alexander 1988; Coleman 1990; Davis 1966; Durkheim 1984 [1933]; Fischer 1982; Mead 1967[1934]; Mills 1959; Park, 1915; Park & Burgess 1921, 1925; Writh 1938). Contemporary sociologists have employed contextual models to understand the ways that individuals' social context – their families, communities, personal networks, and neighborhood's ethnic and racial composition – shape their behavior in a broad range of substantive areas, including child development (Duncan 1994; Jencks & Mayer 1990), educational and economic attainment (Connell & Halpern-Felsher 1997; Entwisle, Alexander, & Olson 1994), gender relations (Miles-Doan, 1998), criminology (Sampson 1986; Sampson & Groves 1989; Wilson 1987), adolescent sexual behavior (Billy, Brewster, & Grady 1994; Brewster 1994; Crane 1991; Huber 1991; Mosher & McNally 1991; South & Crowder 2000; South & Baumer 2000), and family formation and fertility (Hogan & Kitagawa 1985; Lloyd & South 1996; Smith 1989).

Although research has found that a wide range of contextual characteristics are important predictors of behavior, the potential influences of neighborhood characteristics on first birth timing, which we have conceptualized here as monthly odds of a first birth, have been less thoroughly studied. Brewster et al. (1993) suggest that neighborhood context may influence behaviors related to the monthly odds of a first birth in two ways: the local opportunity structure may facilitate and constrain individual behavior; or the community may promote specific values and norms by delineating boundaries of desirable behaviors for young people (see also Garner & Raudenbush 1991; Axinn & Yabiku 2001). Other research on contextual influences on young people and fertility behaviors suggests that neighborhood characteristics early in life, during childhood, may influence young people's long term personality development (Garner & Raudenbush 1991; Axinn & Yabiku 2001). Thus contextual characteristics at multiple points across the life course may influence the monthly odds of a first birth.

Research investigating contextual influences on fertility has explored many different contextual levels. Many studies have operationalized context at high levels of aggregation, such as the regional level (Dyson & Moore 1983) or the national level (Entwisle & Mason 1986). However, other studies have shown a significant influence of the local community on individual behaviors, particularly in rural agrarian settings in which daily activities are localized (Axinn & Yabiku 2001; Axinn & Fricke 1996; Entwisle et al. 1989; McNicoll 1980, 1984, 1994). Because so much of Nepalese daily social life is organized near the home (Axinn & Yabiku 2001; Yabiku 2004), this study operationalizes context at a local level, investigating the neighborhood within which individuals conduct most of their day-to-day activities.

To link neighborhood characteristics with the monthly odds of a first birth, we draw on three theoretical perspectives: 1) the mode of social organization framework (Thornton, Fricke, Yang, & Chang 1994; Thornton & Fricke 1987); 2) Mead's exposure hypothesis (Mead 1967 [1934]); and 3) the land-labor demand hypothesis (Cain 1985; Stokes, Schutjer, & Bulatao 1986).

Mode of social of organization framework

This framework focuses on the extent to which the activities of daily social life, including authority patterns, information flow, living arrangements, production, consumption, socialization, leisure, and reproduction, are organized by the family versus by other non-family social institutions. This transition is likely to influence the monthly odds of a first birth in at least three important ways.

First, in a substance rural agricultural society in which most of social life is organized within the family, the spread of new non-family organizations and services creates new opportunities to reorganize daily social life outside the family (Axinn & Yabiku 2001; Ogburn & Tibbits 1934; Thornton & Lin 1994). One key prediction from the mode of social organization framework is that increased exposure to non-family social activities among young people leads to greater independence from their parents, resulting in the adoption of new family behaviors (Thornton & Fricke 1987; Thornton, Fricke, Yang, & Chang 1994). The increased exposure to non-family social activities among young people leads to greater participation in non-family activities that compete with childbearing (Thornton & Fricke 1987; Thornton, Fricke, Yang, & Chang 1994). These non-family activities may include education in schools, work in the paid labor force, travel and non-family living for work, and non-family leisure activities (Axinn & Yabiku 2001; Beutel & Axinn 2002; Thornton & Lin 1994). To the extent newly married young people participate in these non-family activities, they are likely to experience significant role incompatibility with family formation (Coleman 1990; Thornton, Axinn & Teachman 1995). Activities that compete with childbearing and childrearing, as a result of this role incompatibility, are well known to exert a strong delaying influence on the monthly odds of the first birth after marriage (Barber 2001; Rindfuss, Morgan, & Swicegood 1988). So, exposure to a context with many non-family social organizations may promote non-family activities that compete with childbearing, thereby delaying the first birth.

Second, recent work using the mode of social organization framework to investigate childbearing behavior finds important consequences of exposure to non-family social organizations in early childhood on childbearing behavior in adulthood (Axinn & Yabiku 2001). This research points toward potentially important long term influences of early non-family experience on personality (Axinn, Ghimire, & Barber 2007; Yabiku, Axinn, & Thornton 1999). Young people who have substantial non-family experience in early childhood themselves, as adults may be slower to create families of their own (Axinn & Yabiku 2001; Axinn & Barber 2001). If so, then childhood exposure non-family social context may lower the monthly odds of first birth independently of adult neighborhood context.

Third, in societies where arranged marriage is common, evidence indicates that greater youth independence, including more involvement of young people in spouse choice, can change the nature of marital relationships, leading to shorter first birth intervals through mechanisms such as increased coital frequency (Feng & Quanche 1996; Fricke & Teachman 1993; Hong 2006; Rindfuss & Morgan 1983; Thornton & Lin 1994; Wu 1996). Recent evidence demonstrates that in such settings participation in non-family activities speeds the transition away from arranged marriage toward youth involvement in spouse choice (Ghimire et al. 2006; Thornton & Lin 1994). Therefore, even if the total effect of exposure to non-family social activities in the local neighborhood is to lower the monthly odds of first births, there is reason to expect an important indirect effect, via participation in spouse choice that may increases the monthly odds of first births. This means that an observed negative total effect of access to non-family activities on the speed of fist births that omits controls for participation in spouse choice may actually represent an *underestimate* of the direct effects via other mechanisms. Appropriate measures of participation in spouse choice are rarely available, so this indirect effect speeding first births is often mixed with the effects delaying first births¹.

Mead's exposure hypothesis

Classical theoretical work and recent empirical work suggest that a simple exposure to neighborhood services such as schools, health services, employment centers, bus stops, or cooperatives is likely to influence the individuals' attitudes and beliefs in important ways (Barber 2004; Mead, 1967 [1934]; Zajonc, 1968). Mead suggests that individuals can develop their "self" in part by interacting with nonhuman "others" such as the institutions around them. For example, the presence of an employment center may make an individual view herself as a potential employee. This may then substantially change the views of that individual about the employment center and at the same time about non-family work (Barber, 2004). Because of role incompatibility, positive attitudes toward non-family activities may delay family formation (Barber 2001). Therefore, we expect that exposure to local non-family organizations and services is likely to affect the monthly odds of a first birth by increasing young people's interest in non-family activities and decreasing their enthusiasm for early childbearing. This purely psychological mechanism may act independently of the social organization mechanisms described above, or it may act jointly with those mechanisms.

The Land-labor demand hypothesis

Even though there are appealing theoretical reasons to suspect important links between local land use and fertility, little empirical research has been done in this area. Some research links the size of land-holdings and land ownership, rather than land use per se, to marital fertility behavior (Cain 1981, 1985; Stokes et al. 1986). This line of inquiry posits two hypotheses. First, the land-security hypothesis posits that land serves as a substitute for children in regard to parental old-age security and suggests a negative relationship between household land ownership and marital fertility. Thus, land ownership should reduce motivation for children. Second, the land-labor demand hypothesis posits that, under circumstances of low mechanization, as the household operational land area increases so do the opportunities for child employment and returns to child labor. Thus, land ownership should increase motivation for children.

Building on these basic concepts, we argue that in an agrarian setting opportunities for child employment are not limited to household landholdings alone, but also apply to the local community. We expect that because several agricultural tasks require high labor inputs at low skill levels, living in a community with a high fraction of land devoted to agriculture increases the opportunities for child employment and returns to child labor. Furthermore, as the returns to child labor increase, the overall cost of raising children declines, leading to increased motivation for children (Easterlin & Crimmins 1985). Thus, we expect that individuals from communities that have more land area under agricultural uses will be more likely to favor high fertility, and consequently have a first birth earlier, than those from communities that have less land area used for agriculture.

Setting

Western Chitwan Valley, which lies in the south central part of Nepal, is the study area for this research. Historically this population is characterized by early marriage, arranged marriage, rapid transitions to the first birth, rare contraceptive use, and large completed family sizes (Axinn & Yabiku 2001; Axinn & Barber 2001; Ghimire et al. 2006; Ghimire & Hoelter 2007; Moragn & Niraula 1995; Niraula 1994; Niraula & Morgan 1996; Yabiku 2005). During the later half of the 20th century, Nepal has undergone dramatic social and economic changes resulting in the dramatic expansion of non-family service organizations, including schools,

¹For example, even in the data we use here, measures of participation in spouse choice are not available for all of those in the analysis sample, so that the observed total delaying effect on first birth timing is likely an underestimate of the true delaying effect through other mechanisms.

health services, bus stops, cooperatives, and employment centers, within the study area. This expansion of service organizations has tremendously increased access to these service organizations. For example, in Figure 1 we present the history of change in the access to service organizations of Chitwan Valley: historical time increases along the x-axis, and travel time in minutes increase on the y-axis. The lines represent, across 43 years (1953–1996), the average time (mean for all neighborhoods) time required to walk to the nearest school, health service, bus stop, market, or employer. The declining slopes of these lines indicate that the average time to walk to each of these services has declined dramatically over the recent history of Chitwan Valley. Importantly, the differences among the lines indicate which of these changes spread through the valley first, second, and third.

In addition, because these service organizations were not opened or available to all the neighborhoods at the same time, and were of varying distances, access varied tremendously. Figure 2 shows the percent of neighborhoods that have a specific service within a given travel time for the most recent year of data (1996). The minutes to the specific service in 1996 are grouped along the x-axis and the percent of neighborhoods is along the y-axis. Each bar represents the percent of neighborhoods that have that specific service within that specific walking time. For example, almost 50% of neighborhoods have a school within a 5-minute walk. Similarly more than 40% neighborhoods have health services, and a little less than 30% have markets within a 5-minute walk. However, less than 5% of neighborhoods have a cinema within a 5-minute walk and for more than half of the neighborhoods the nearest cinema is over an hour away.

Despite the dramatic changes, most parts of the valley are still quite rural. Except for the national highway that runs along the northern border of the study area, most of the roads within the study area are still seasonal and unpaved. Employment centers are basically service-oriented government agencies and a few agro-based industries. And most importantly, despite the massive transformation, this valley remains predominantly an agriculture-based society. Eighty-three percent of the households in the study reported that they were growing crops in 1996. Thus, dramatic variation in neighborhood characteristics – in terms of access to service organizations and land use – and history of rapid first births, makes Chitwan an ideal setting to study the influence of neighborhood characteristics on the monthly odds of a first birth.

Data and Methods

Data

This study uses multiple data sets collected by the Chitwan Valley Family Study (CVFS) since 1996: neighborhood histories, land use mapping, household surveys, individual interviews with life history calendars, and a monthly demographic event registry.

The data to test our hypotheses come from a study of 135 neighborhoods scattered throughout Western Chitwan Valley. For the purposes of this study, a neighborhood was defined as a geographic cluster of five to fifteen households. These neighborhoods were chosen as an equal probability, systematic sample of neighborhoods in Western Chitwan, and the characteristics of this sample closely resemble the characteristics of the entire Chitwan Valley population (Barber et al., 1997). Boundaries of the land surrounding these neighborhoods bisect the areas between the selected neighborhoods and adjoining neighborhoods. This boundary procedure gives every unit of land in Chitwan one and only one chance of falling into the sample.² This procedure also means neighborhoods in more densely settled areas are characterized by smaller land areas than neighborhoods in more sparsely settled areas.

²Note, however, that these sampling procedures produce a sample of the population of Western Chitwan and the land associated with the population sample. Our procedures are not designed to produce a representative sample of the land area in Western Chitwan.

Once a neighborhood was selected, a history of each neighborhood was collected using a calendar method (for details please see Axinn, Barber & Ghimire 1997). The CVFS also gathered mapping information on land area under different uses in those neighborhoods in 1996. Household surveys collected measures of household resources, economic status and farming practices in 1996. All individuals aged 15 to 59 residing in the sampled households were also interviewed using a standardized questionnaire and a life history calendar (LHC). In the standardized interviews, individuals were asked a variety of questions regarding their family background, personal characteristics, experiences, childhood, and community context. The LHC portion of the survey collected information on residence, marital status, children, contraceptive use, schooling, and work experience. The LHC and the structured interview allow these reported events to be linked to personal and contextual characteristics.

Finally, in 1997, the CVFS started collecting information each month from the respondent households on demographic events including migration, living arrangements, marriage, birth, and death. If any original households or respondents moved out of the sample neighborhood, they were followed. This study uses 72 months of monthly data from the household demographic registry.

From the CVFS data, we use a sample of married women aged 15 to 29 in 1996 who had not previously given birth and who were neither sterilized nor married to men who were sterilized. We limit our sample to 373 married women from the 135 neighborhoods in which at least one such woman resided³. Because the outcome (monthly odds of first birth) is measured prospectively, we are able to use all the measures of neighborhood characteristics, including both access to service organizations and land use, and respondents' experiences as predictors. In addition, the prospective measurement also allows us to use the measures of intervening factors: marriage duration, living with one's spouse, and contraceptive use.

Measures of first birth

Because the decision about and risk of having a first child is generally resolved upon conception, we use the timing of pregnancy that resulted in live birth rather than birth itself as the dependent variable.⁴ From the household registry, which provides monthly records of first births, we calculate the occurrence of pregnancy (9 months prior to childbirth) and construct a person-month measure of the occurrence of pregnancy that serves as the unit of analysis in this study. This practice has been used successfully in previous research (Barber, 2001; Ghimire & Hoelter 2007). We create person-month data files from this information by coding the dependent variable "0" in all periods before the respondent becomes pregnant and "1" in the month she becomes pregnant. Once a pregnancy has occurred, the respondent is censored from the analysis. Individuals who did not become pregnant during the observation period are censored at the end of this period. In addition, our analytical strategy also takes into account the duration of hazard, for this we use number of month since respondent got married, as time counter of hazard duration.

³Nepalese society is culturally pro-family, emphasizing universal marriage and childbearing within marriage (Stone, 1978), "For a Hindu, marriage is a sacrament which must be performed regardless of the fitness of the parties to bear responsibilities of a mated existence" (Mace & Mace, 1960, p. 149). Using a retrospective data for a sample of women age 15–59 from Chitwan we estimated the conditional probability of first marriage using the Kaplan-Meier estimator with SAS LIFETEST function. This result yielded a conditional probability of .98, suggesting that a vast majority of women do go on to marry. Therefore, selection into marriage is not a significant issue in our sample.

⁴Although using only the pregnancies that resulted in a live birth result in underreporting of the total number of pregnancies to some extent, because induced abortion is not common (Although recently legalized, the estimate based on the 2001 Nepal DHS data indicate that induced abortions account for only .006 of pregnancies in rural areas of Nepal (Ministry of Health [Nepal] 2002) and the measures of miscarriage and stillbirth are subject to misreporting we limit our outcome measure to pregnancies resulting in live births.

Measures of neighborhood characteristics

In Chitwan, changes in neighborhood characteristics occur largely through the expansion of new non-family service organizations, transportation facilities, and changes in neighborhood land use. Except some non-family services, such as school and health service, several of these changes were first introduced near the urban center Narayanghat, and gradually spread throughout the valley. Many of the measures we use to examine the neighborhood characteristics are measures of spatial location of the neighborhood in relation to non-family services and amount of neighborhood land area devoted to agriculture uses. These measures are useful operationalizations of the neighborhood characteristics in terms of a respondent's opportunity structure and exposure. These measures are in line with Roderick McKenzie's (1968) theorization of context. He notes that individual immediate context or distance is "a time-cost concept rather than a unit of space. It is measured by minutes and cents rather than yards and miles." Thus, an individual's opportunity structure often depends on how far she lives from the different kinds of services. Similarly, Giddens (1984) suggests that the distance to these services and time it takes to reach them constrains the opportunity structure.

Non-family services organizations—As we discussed above in the theoretical framework section, because the timing and sequencing of access and exposure to new service organizations are likely to influence an individual's life in fundamentally different ways, we measure the access and exposure to new non-family services organizations separately for childhood and more recent adulthood. For the convenience of discussion, we call them childhood non-family service organizations and adult non-family service organizations.

Childhood non-family service organizations—Information about childhood non-family services was collected through individual interview conducted in 1996. In that individual interview, respondents were asked a series of questions about whether there was a specific service organization within one-hour walk from their place of residence at any time in their lives before they were 12 years old. For example, respondents were asked "Was there a school within a one-hour walk from your home at any time before you were 12 years old?" If the response to this question is positive, it is coded as "1," and "0" otherwise. This question was repeated for health posts, employment centers and bus stops. From the responses to these questions we construct dummy variables for whether each of these specific non-family services existed within a one-hour walk from the place of the respondent's residence at any time before she or he was 12 years old. Because these measures are correlated, and in order to avoid problems of multicollinearity, we sum these four variables to a scale with values ranging from zero to four. In this scale, a value of zero means the respondent had none of the services within one hour walk, whereas a value of four means the respondent had all four services within one-hour walk of their residence at some point in childhood. These measures of childhood context have been tested for external validity and reliability using a series of ethnographic and archival techniques (Axinn & Pearce 2006) and are extensively used in previous research (Axinn & Yabiku 2001; Axinn & Barber 2001; Barber & Axinn 2004; Yabiku 2004, 2005)⁵.

Contemporary non-family service organizations—The neighborhood history data provides a measure of distance in walking time from the respondents' current neighborhoods to the nearest school, health service, bus stop, employment center, and agriculture cooperative. The measures of access to non-family organizations were gathered using the Neighborhood

⁵This study has made special investment in designing the contextually appropriate measure of social change. Because Nepal as whole, and the study area more specifically, has very few non-family services in the early period of the settlement history, the measure of access to non-family services are measured differently for childhood (within an hour of walk distance for earlier period) childhood and for adulthood (minutes to the nearest service). In addition, in a rural context with a rugged topography such as Nepal and almost no access to transportation services, measure of access to non-family services in terms of time to walk to the service is more relevant than spatial distance, therefore access to non-family services is measured in time rather than in miles or kilometers.

History Calendar (NHC) method in 1996. This method is a mixed-mode data collection approach including semi-structured group interviews, key informant interviews, and verification of archival records, and it was employed to collect the retrospective histories of the sample neighborhoods. The specific techniques involved in this method are described in detail elsewhere, so we do not repeat those here (Axinn, Barber & Ghimire 1997). The calendar techniques improve respondents' recall and produce reliable retrospective measures (Beli 1998; Caspi et al. 1996; Freedman et al. 1998). These data provide dynamic measures of how far away each service was from the neighborhood for each year from 1953 to 1996 (Axinn et al. 1997). These walking times vary from 0 minutes (when the service is located within the neighborhood) to hundreds of minutes (a couple of day's walk from the neighborhood). We create dummy variables indicating whether or not the nearest service was within 15 minutes of walking distance from the respondent's neighborhood in a specific year. We then sum up these responses that give us the total number of years a certain service organization was within a 15-minute walking distance. Finally, we sum up the responses from each of the services and divide by the number of services. This coding system has been successfully used in previous studies (Axinn & Yabiku 2001; Yabiku 2004, 2005).

Neighborhood land area devoted to agricultural uses—Our measures of neighborhood land area under agricultural use come from the land use mapping survey conducted in 1996. A team of field workers physically mapped every square foot of the land area of each neighborhood using compasses and tape measures. Each piece of land measured was coded into a distinct category according to primary type of land use. Thus, the total area of each neighborhood equals the sum of the individual parcels under different uses, and the total area for each type of land use is the sum of all parcels in that category. In our analyses we use these data to construct measures of fraction of neighborhood land area under agriculture.

Measures of controls

The controls include additional neighborhood characteristics, parental experiences, and respondents' characteristics and experiences.

Neighborhood characteristics—We control for three neighborhood characteristics – distance to urban center, neighborhood electrification and neighborhood wealth – that are likely to influence both the monthly odds of a first birth and access to non-family service organizations and agricultural land. Measures of distance to an urban center also come from neighborhood history data. However, unlike the distance to non-family services, the unit of distance here is miles, not minutes. During the neighborhood history data collection the exact latitude and longitude location of each neighborhood was also calculated from 1:25,000 maps based on aerial photographs of the valley. These locations were entered into a Geographic Information System (GIS), which calculated the distance in miles between each neighborhood and Narayanghat, the valley's only urban center.

Measure of electrification comes from neighborhood history calendar, and is coded 1 if the neighborhood has electricity and 0 otherwise. Our measures of wealth come from household interviews conducted at the beginning of the study in 1996. In those household interviews we asked a series of question about different sources of household wealth, including whether the household owned the house plot or not, owned any farm land or not, the number of farm animals owned, the number of pieces of farm and household equipment owned, and housing quality. Because these measures of household wealth are positively correlated, and in order to avoid multicollinearity in our final models, we created a single index measure of household wealth. We accomplished this by standardizing the values in each of the domains of household wealth into Z scores, with mean of 0 and standard deviation of 1, and summing the resulting scores to construct a composite index of household wealth. This household index of wealth was then

averaged across all the households in each neighborhood to create a neighborhood level measure of wealth.

Parental experiences—Because parents are likely to influence both the children's behavior and the place of residence, we control for an extensive set of parental characteristics in our multivariate models. These controls include: mother's total number of children, mother's education, mother's work, father's education, father's work, and parents' contraceptive use. These measures are derived from the respondent's answers to a series of questions about her parents⁶. For example: "How many children did your mother have?" or "Did your mother ever go to school?" All responses except number of children, which is coded in actual number of children ever born, were coded dichotomously, using "1" for yes and "0" for no.

Respondents' characteristics and experiences—Although scholars would expect to "control for all 'relevant' variables" (Blalock 1989), despite the availability of extensive sets of respondent's experiences, we have only control for a limited set of experiences. Our decision to do this is directly guided by the theoretical framework that considers neighborhood characteristics exogenous to respondent's experiences. However, this is not to say that respondent's experiences are not important but that are most likely to be intervening mechanisms. Thus, our limited set of controls includes respondent's ethnicity, marital experiences – age at marriage, marriage duration before 1997 – parental experiences and hazard duration.

As elsewhere, respondent's ethnic background has important influences on family formation behaviors in Nepal (Thapa 1989, 1997). Although the diverse ethnic mosaic of Nepalese society presents a unique complexity, scholars have often categorized ethnicity into five major groups for analytical purposes: High Caste Hindus, Low Caste Hindus, Newar, Hill Tibeto-Burmese, and Terai Tibeto-Burmese (Blaikie et al. 1980; Axinn & Yabiku 2001). We have adopted these categories for this analysis. For more information about these ethnic groups see Bista (1972), Gurung (1980), and Macfarlane (1976). We coded individuals "1" if they are members of a specific category and "0" if not, using High Caste Hindus as a reference group for comparison.

The CVFS collected a complete history of respondents' educational experiences, including adult education (literacy programs), via the life history calendar. This record provides information on the total length of time spent in school and adult literacy classes. Using the total number of years respondents spent in school or adult education, we constructed a series of dummy variables, "0–3," "4–7," "8–11," and "12 or more" years of schooling, and treated "0–3 years of schooling" as the reference group.

Respondent's marital experiences include age at first marriage (coded in years) and duration of marriage (coded as number of months). Because respondents are married at different times, some even before the start of hazard and others during the observation period, we separate the marriage duration into two portions: marriage duration before 1997 (the beginning of the observation period) and marriage during the observation period. We coded marriage duration

⁶Scholars often raise suspicion about the reliability of measures of parent's experiences based upon their children's reports. There is good reason to suspect children's reports of their parents' behaviors will be incomplete, omitting behaviors about which the children had no first hand knowledge. The more private the behavior in question, the more likely this type of measurement error may be. Among the measures we use, parents' contraceptive use is an obvious candidate for this type of measurement error. However in Nepal, especially in the parental generation for this study, sterilization is by far the most common means of contraception, accounting for more than 87% of births averted (NCP 1983). Because sterilization in Nepal is generally performed through mobile camps in public places and it takes days to recover from the surgery, this form of contraception is generally publicly known to family members. Also, in Nepal parents rarely keep the decision to stop childbearing (sterilization) private from children – this experience is highly likely to be known to the children. Finally, because it is children's belief that their parents' contracepted, rather than their parents' actual contraceptive use, that is most likely to influence the children's contraceptive behavior, the respondents' reports about their parents' contraceptive use is a key control to include in our models.

before 1997 in number of months and treated it as a control. Because the marriage duration during the observation period also represents the hazard duration, we included it as the hazard duration. In our models, we have parameterized the functional form of the hazard as series of dummy variables in 6-month increments 1–6, 7–12, 13–18, 19–24, 25–30, 31–36, 37–42 and 42+ months, and treated 42+ months as the reference group. This allows the baseline risk of giving a first birth to vary by six month durations. As most women in Nepal become pregnant within 18 months of their marriage, this functional form is an appropriate approximation for first birth timing in Nepal.

Analytical strategy

We adopted a nested model approach to estimate effects of neighborhood characteristics on the monthly odds of a first birth. First, we estimate the effects of each of the childhood neighborhood characteristics individually, and combined together. Second, we model the effect of each measure of the contemporary neighborhood characteristics first individually, than combined together, controlling for the childhood neighborhood characteristics. Third, we estimate the effect of fraction of neighborhood land area devoted to agriculture with childhood neighborhood characteristics. Finally, we add the fraction of land area devoted to agriculture into the combined model of contemporary neighborhood characteristics.

We use event history methods to model the risk of first birth. Because the data are precise to the month, we use discrete-time methods to estimate these models (Allison 1982, 1984; Petersen 1991). Person-month of exposure is the unit of analysis and we consider women to be at risk after first marriage.⁷ Moreover, because the objective of our analysis is the estimation of effects of community-level characteristics on the monthly odds of first birth we employ a special extension of discrete-time event history methods—the multilevel, random effects, discrete-time hazard model (see Barber et al. 2000 for a detailed explanation of this estimation strategy). This specific modeling strategy has been used successfully before with similar measures and clustering (Axinn & Barber 2001; Yabiku 2004, 2005).⁸ We estimated all of our models using the GLIMMIX macro for SAS following the Barber et al. 2000 strategy.⁹ We discuss the results as odds ratios. These odds ratios can be interpreted as the amount by which the odds are multiplied for each unit change in the respective independent variable. That means that if the odds ratio is greater than 1, the effect is positive and every unit change in the

⁷Although it may appear that the discrete-time method of creating multiple person-months for each individual inflates the sample size resulting in artificially deflated standard errors, this is not the case (Allison 1982, 1984; Petersen 1986, 1991). In fact, the estimated standard errors are consistent estimators of the true standard errors (Allison 1982, pg. 82).

⁸Multilevel estimation is also imperative because in these data individuals are clustered within neighborhoods. Our multi-level models are two-level models with individual and parents' characteristics being level 1 factors and respondents' 1996 neighborhood characteristics being level 2 factors.

⁹There are two basic concerns when using the discrete-time event history models: first, when to start the hazard, and second what functional form for duration of the hazard to use. The start of the hazard should begin when the respondents become at risk of the event. In principle, a woman is at risk of giving birth to a baby when she has sexual intercourse with a man, provided that she is biologically fecund. However, in Nepal, premarital sex is very much discouraged socially and in most cases sexual activities of women usually take place only within marriage. In fact, there is almost no premarital birth in Nepal (Retherford & Thapa 1998) and marriage is still universal (Yabiku 2005; 2006), therefore, we start the hazard at marriage. However, starting hazard at marriage raises two issues. First, on the one hand, starting hazard at marriage will exclude all unmarried women from the analyses and we will not be able to estimate the influence of neighbors on first birth timing that works via timing of marriage. On the other hand, including unmarried makes no sense when there is almost no premarital birth. Out of 1000 unmarried women in our sample, only eight women experienced pre-marital conception, and all eight were then married before giving birth. Also, these women married at different points in time, some were married before the start of the observation period (1997) other married during the observation period. This introduces complication in parameterization of duration in terms of time. To address this issue we treat the duration of marriage before the start of the observation period (1997) and age at marriage as controls and included the time during the observation period as hazard duration in our models.

Second, selection of an appropriate functional form of the hazard duration is an important modeling choice. In our models, we have parameterized the duration of hazard as series of dummy variables in 6-month increments. This allows the risk of having a first birth to vary over time. As most women in Nepal get pregnant soon after their marriages, mostly within 18 months of their marriage, this functional form is an appropriate approximation for first birth timing. However, we also tested three other functional forms: a log function, a linear function, and a quadratic function. The results vary only slightly across these four functional forms. Therefore, because it provided the strongest overall model fit, we chose the six-month discrete increment functional form of the hazard duration.

independent variable increases the odds of first birth. If the odds ratio is less than 1, every unit change in the independent variable decreases the odds of first birth.

Results

Descriptive statistics

Table 1 presents the mean, standard deviation, and minimum and maximum values for measures used in the analyses. Panel I of Table 1 displays descriptive statistics for neighborhood characteristics. Note that the means for measures of childhood neighborhood characteristics are very large, suggesting that the vast majority of respondents had all of the non-family services within a one-hour walk from their place of residence at some time in their lives before they were 12 years old. For example, 98% of the respondents had school within a one-hour walk from their place of residence. The lowest is 78% for employment center and the average for all service institutions is 3.44 out of 4 services.

The next sets include the measures of contemporary neighborhood non-family services. Recall that the measures of contemporary non-family services are the cumulative number of years each of the services existed within the 15-minute walk from the respondent's current neighborhood since Chitwan was opened for settlement (43 years). Again, except for cooperatives, most of these services were within a 15-minute walk from the respondent's current neighborhood for more than 10 years. On average, respondents' neighborhoods had a school within a 15-minute walk for 28 years. The average for five non-family services is 14 years. This suggests that most of the respondents had these non-family services within a 15-minute walk from their neighborhood for most of their early adult life. Finally, the last row of panel presents the measure of land area devoted to agricultural uses. The percent of neighborhood land area devoted to agricultural uses ranges from 0 to 94 with a mean of 71.¹⁰

The Panel II of Table 1 displays descriptive statistics controls: contemporary neighborhood characteristics – distance to urban center, neighborhood wealth and electrification – plus respondent's family background (parents' experiences), ethnicity, educational attainment and marital experiences. The distance to an urban center from current neighborhood ranges from 0.02 to 17.70 miles, with a mean of 8.73 miles. This suggests that the whole study area is fairly small. The mean of .37 for electrification shows that less than half of the neighborhoods currently have electricity. The mean for neighborhood wealth index is .54 with a standard deviation of 9.82. Respondent's family background includes mother's number of children, education and work, father's education and work, and parents' contraceptive use. The number of respondent's mother's children range from 1 to 14 with a mean of 5.38, suggesting that these respondents come from a fairly high level of fertility. A mean of .16 for mothers' education and a mean of .21 for work suggest a low level of mothers' education and work outside home for pay. On the other hand, means for father's education (.51) and work (.49) are relatively high, suggesting a high level of gender differences. A mean of .53 for parents' contraceptive use indicates that more than half of the parents used contraceptive.

¹⁰One of the common concerns in the studies of community influence on individual behavior is that the measures of community are likely to be correlated. As a result, instead of being distinct dimensions as we theorize, these measures could be multiple measures of a single theoretical construct. In order to examine the issue of multicollinearity we calculated the Pearson's correlation across our measures of community context. We found the magnitude of the correlations between childhood exposure to non-family services and adulthood exposure to non-family services ranging from -0.004 to 0.19 ; between childhood exposure to non-family services and percent neighborhood land area under agricultural uses ranging from -0.02 to 0.11 and finally between adulthood exposure to non-family services and percent neighborhood land area under agricultural uses ranging from -0.10 to -0.43 . Although the magnitude of correlation coefficients between adulthood exposure to non-family services and percent of land area under agricultural uses are modest, none of these coefficients are larger than -0.43 . Similarly, the correlation between other 1996 neighborhood characteristics, distance to urban center, electrification and our wealth index range from -0.51 to 0.22 . Because these correlation coefficients are modest we treat these factors as independent dimensions of community context.

In terms of respondents' characteristics, more than half (52 %) are High Caste Hindus, 15% are Hill Tibeto-Burmese, 15% are Terai Tibeto-Burmese, 10% are Low Caste Hindus, and 8% are Newars. In terms of educational attainment 15 % of the respondents have 0–3 years, 10% have 4–7 years, 37% have 8–11 years, and remaining 38 % have more than 11 years of schooling. The mean of 19.57 years for age at first marriage shows that most respondents married before their 20th birthday. The respondents married before 1997 had been married an average of six months. Hazard duration is the proportion of respondents that remained at risk of first birth. The mean of the proportion suggests that more than two-thirds of the respondents were at risk only for less than 18 months during the observation period. Finally, a large proportion (82%) of the respondents experienced first birth during the observation period.

Event history analyses

Table 2 displays the first set of estimates of our event history models. Guided by nested modeling strategy we begin with a simple model with one childhood non-family service at a time with a basic set of controls. Examining the controls first, the respondents' marital experiences, particularly marriage duration has a strong influence on the monthly odds of a first birth. The negative odds multiplier for marriage duration before 1997 and positive odds multipliers for shorter marriage durations after 1997 (1–6, 7–12, and 13–18 months as opposed to more than 42 months) suggest that most women in Nepal have a first birth soon after their marriage, generally, within 2 years of their marriage. This is quite consistent with previous findings from Nepal (Acharya 1998; Suwal 2001; Shrestha 1998) and in the region (Basu 1993; Hong 2006; Feng & Quanche 1996; Rindfuss & Morgan 1983; Zhenzhen 2000). Respondent's ethnicity also has important influence on the monthly odds of a first birth. The negative odds multipliers for low caste Hindu, hill tibeto-burmese and Newar as opposed to high caste Hindus suggest that women from these ethnic groups begin childbearing later than high caste Hindu women. Among parental characteristics, parents' contraceptive use and father's work each has strong negative effects on the monthly odds of first birth, as expected.

Impact of childhood non-family services

Table 2 displays the effect of having non-family services – school, health service, bus stop, and employer – within a one-hour walk from place of residence before the age of 12. As shown in Models 1 through 4, only one of four services, bus stops, has a negative effect on the odds of a first birth, as expected. The odds multiplier of 0.70 indicates that having a bus stop within a one-hour walk from the respondent's childhood place of residence reduces the monthly odds of a first birth by 30%. Next, Model 5 shows the effect of the number of non-family services within a one-hour walk during childhood on the odds of a first birth. As one would expect, given that the negative effects of living near a school or a bus stop are somewhat offset by the positive effects of living near a health service or an employer, the effect of the number of nearby non-family services remains negative, but is not statistically significant.

Overall, the negative effect of number of non-family services in general, and of living near a school or a bus stop in particular, are consistent with the childhood socialization hypothesis that assumes that the context individuals socialize during their childhood leaves a lasting imprint on their lives and affect their later life outcomes (Becker 1996; Elder 1977). These results are also consistent with the related work that finds a significant relationship between childhood neighborhood context and later fertility behavior in this setting (Axinn & Yabiku 2001; Axinn, Ghimire & Barber 2007; Ghimire & Axinn 2006). Finally, as discussed above, because these models do not include controls for participation in spouse choice (because the measures are not available), these observed total effects include an indirect effect via spouse choice that probably speeds first birth. As a result these are conservative estimates of the true delaying effects of exposure to non-family services and organizations.

Impact of contemporary non-family services

Table 3 displays our estimates of the influence of the respondent's current neighborhood non-family services on the monthly odds of first birth, controlling for childhood non-family services). We model the effects of the individual services both ways, first individually (Models 1 through 5) and then summed together (Model 6), following the same analytic strategies as above.

In Model 1 of Table 3, we estimate of the effect of the presence of school within a 15-minute walk from the respondent's neighborhood on the odds of a first birth. The odds multiplier of 0.98 indicates that each additional year of having a school within a 15-minute walk from the respondent's neighborhood reduces the odds of a first birth by 2%. This means women who lived in neighborhoods that have had a school within a 15-minute walk for ten years had monthly odds of a first birth ($0.98^{10} = 0.817$; $1 - 0.817 = 0.18$) 18% lower than women who lived in neighborhoods with no school within 15-minutes walk. Model 2 of Table 3 estimates the impact of the presence of health service within a 15-minute walk from the respondent's neighborhood on the odds of a first birth. Again the odds multiplier of 0.99 indicates that each additional year of having a health service within a 15-minute walk reduces the rate of first birth by 1%. Model 4 of Table 3 estimates the impact of having an employer within 15-minute walk on the odds of first birth. As for the effect of a school and health service, the odds multiplier of 0.99 indicates that each additional year of having an employer within a 15-minute walk reduces the odds of first birth by 1%. Model 5 of Table 3 estimates the impact of having a cooperative within a 15-minutewalk on the odds of first birth. We find a strong negative, statistically significant effect of having a cooperative on the odds of first birth. The odds multiplier of 0.98 indicates that each additional year of having a cooperative within a 15-minute walk reduces the monthly odds of first birth by 2%.

Model 6 of Table 3 estimates the effect of the average number of years of having all five non-family services within 15-minute walk from the respondent's current neighborhood. As shown in Model 6, this has a strong negative, statistically significant effect on the odds of a first birth. The odds multiplier of 0.97 indicates that each additional year of having these non-family services within a 15-minute walk reduces the odds of a first birth by 3%. As discussed above, these are conservative estimates of the true delaying effects of exposure to non-family services and organizations because these models do not include controls for participation in spouse choice (because the measures are not available).

Overall, the effects of having non-family services within 15-minute walk from the respondent's 1996 neighborhood are in the expected direction. More interestingly, these effects are much stronger than the effects of childhood non-family services and consistent with the idea that *the immediate context*, or the real constraints associated with circumstances at the time of behavior, are important predictors of behavior (Ajzen 1988; Ryder 1973).

Influence of neighborhood land area devoted to agricultural uses

Model 1 in Table 4 displays the results for the influence of land area devoted to agricultural purposes on the monthly odds of a first birth, controlling for childhood bus stop services. We find a strong positive, statistically significant effect. The odds multiplier of 1.01 indicates that each additional 1% increase in percent of land area devoted to agriculture increases the odds of a first birth by 1%. Note that this is actually quite a large effect, as our measure of the percentage of land area devoted to agriculture has a large range. So, a one standard deviation difference in this measure produces more than a 22% increase in the odds of a first birth. This effect is consistent with our hypotheses that the poor agricultural setting encourages fertility, including early childbearing. This finding is also consistent with the land-labor hypothesis,

which argues that people in poor rural agricultural societies maintain high fertility to keep up with the labor-intensive land cultivation practices.

Independent effects of non-family services and agricultural land area

Model 2 in Table 4 displays the independent effects of number of non-family services nearby during childhood, average number of years of having all five non-family services nearby during early adulthood, and land area devoted to agricultural purposes. As shown in Model 2, among the non-family services, there is slight reduction in the effects of childhood non-family services, particularly the bus stop, however there is no change in the effect of the average number of years of having five non-family services nearby during early adulthood. On the contrary, the effect of percent of neighborhood land area devoted to agricultural purposes completely disappears. This suggests that while the effects of non-family services are independent of land area devoted to agricultural purpose, the effect of land area devoted to agricultural purpose is not independent of non-family services.

Finally, note that we find substantial and statistically significant effects of various key dimensions of community context in spite the relatively small number of cases in our analysis. That is, even though the small number of cases reduces the likelihood of discovering statistically significant associations, the associations documented here are strong enough we are able to detect them.

Discussion

This study examines the influence of community context on the monthly odds of first birth after marriage – a fundamental dimension of the early marital relationship between husband and wife, the nature of parenthood, and rates of fertility and population growth. We explore these relationships in rural Nepal, a society characterized by rapid transitions from marriage to childbearing until the recent past, but now experiencing dramatic expansion of new non-family service organizations and changes in neighborhood land use. These changes have had a substantial influence on the organization of local peoples' social lives. Changes in the social organization of individuals' lives have stimulated new marriage and childbearing practices. Arranged and young-age marriages, early and prolific childbearing, and infrequent contraceptive use have given way to greater participation in spouse choice, relatively older ages at marriage and childbearing, and widespread use of contraceptives to delay or end childbearing (Axinn & Yabiku 2001; Axinn & Barber 2001; Ghimire et al. 2006; Yabiku 2004, 2005). This setting provides a unique opportunity to examine the influence of various dimensions of neighborhood characteristics on this fundamental transition between marriage and the initiation of parenthood.

The results of this study show, overall, that the neighborhood characteristics have important effects on the monthly odds of first birth after marriage. Having non-family services nearby substantially delays these women's entry into parenthood. More important, the findings also indicate neighborhood characteristics during childhood and early adulthood have influences independent of one another. The findings provide evidence that timing and sequencing of life events – in this case, exposure to various non-family services – may influence individuals' life outcomes through fundamentally different mechanisms. The influences of childhood neighborhood characteristics we find are consistent with hypotheses that young people construct their preferences for parenthood early in life and make decisions consistent with those preferences during the years that follow (Axinn & Yabiku 2001; Becker 1996). The consequences of current neighborhood characteristics we document, on the other hand, are consistent with microeconomic models of the childbearing process hypothesizing that immediate context may influence individuals' life outcomes through local opportunity

structures that facilitate and constrain individual behavior (Brewster et al. 1993; Garner & Raudenbush 1991; Willis, 1973).

The specific mechanisms through which young couples alter their behavior to delay the initiation of parenthood remain to be investigated in future research. The rapid expansion of contraceptive use, which is closely associated with education, media exposure, and other non-family activities, is undoubtedly part of this process (Axinn & Barber 2001; Axinn & Yabiku 2001; Barber & Axinn 2004). Contraceptive use separates sex from pregnancy, allowing young married couple to pursue alternatives to parenthood, such as work or continued education, as they postpone childbearing. Of course, as these new opportunities often involve geographic mobility young couples may also experience physical separation, which may reduce the frequency of sexual intercourse in spite of the fact less arranged marriage increases intercourse (Morgan & Rindfuss 1983). Careful analysis of the proximate determinant of pregnancy during the interval between marriage and the first birth will be needed to adjudicate these potential explanations.

Separate from the expansion of new non-family services, we also found that a higher proportion of land area devoted to agricultural uses speeds women's entry into parenthood. This finding provides support to the land-labor demand hypothesis, which argues that people in poor, rural agricultural societies maintain high fertility to keep up with labor-intensive land cultivation practices (Bandeira and Sumpsi 2009; Cain 1985; Shreffler and Dodoo 2009; Stokes et al. 1986; Thomas, 1991). However, when the percent of neighborhood land area devoted to agricultural uses is modeled with non-family services, the effect of neighborhood agricultural land loses statistical significance. Thus, the analysis indicates that while the effects of neighborhood non-family services are independent of land area devoted to agricultural uses, the effect of neighborhood land area devoted to agricultural uses disappears with the addition of controls for non-family services. Rarely has any research on contextual influence been able to disentangle the influence of expansion of non-family services in an area from the influence of neighborhood land area devoted to agricultural uses. This study suggests that even in a predominantly poor, rural agricultural society, young people are greatly influenced by the non-family services institutions around them.

Social scientists and policy makers alike increasingly emphasize the important role of neighborhood characteristics in individuals' life outcomes, including fertility (Bongaarts & Watkins 1996; Crowder & South 2002; Hogan & Kitagawa, 1985; Lloyd & South 1996; South & Crowder 2000; South & Baumer 2000). The evidence provided here is consistent with that idea. Even in this rural agrarian setting, in which marriages and childbearing at very young ages were almost universal only a decade ago, this study demonstrates that changes in individuals' neighborhood characteristics have had substantial influence on young couples' decisions about the timing of childbearing.

These findings also have important implications for policies aimed at reducing population growth, particularly in poor agrarian societies experiencing dramatic expansion of new non-family services and organizations and persistently high fertility. There is a great deal of debate regarding the relative contributions of public policies and programs such as mass education, health services, employment opportunities, transportation, and family planning programs used to reduce population growth in this type of setting (Caldwell 1982; Caldwell et al. 1983; Mason 1997). The findings of this study indicate the important influence of local neighborhood characteristics, especially the presence of a bus stop, employment center, and cooperative nearby the local neighborhood, on childbearing decisions. Thus the expansion of transportation, employment opportunities, and cooperative markets may help reduce fertility by delaying the initiation of childbearing among married couples.

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Figure 1.
Change over Time in Minutes by Foot to the Nearest Non-family Services

Figure 2.
Proportion of Neighborhoods Having Non-family Services within certain Walking Distance
in Minutes

Table 1

Descriptive Statistics of Measures of Used in the Analyses (N=373)

I. Explanatory variables		Coding	Mean	S. Dev.	Min.	Max.
A. Childhood Non-family Services*						
School within one-hour walk		0=No, 1=Yes	0.98	0.15	0	1
Health service within one-hour walk		0=No, 1=Yes	0.83	0.37	0	1
Bus stop within one-hour walk		0=No, 1=Yes	0.85	0.36	0	1
Employer within one-hour walk		0=No, 1=Yes	0.78	0.41	0	1
Number of non-family services		Index 0 – 4	3.44	0.88	0	4
B. Adult Non-family Services**						
School within 15 minute walk		Number of year	28.23	11.77	0	42
Health service within 15 minute walk		Number of year	10.85	12.69	0	40
Bus stop within 15 minute walk		Number of year	16.10	12.99	0	40
Employer within 15 minute walk		Number of year	12.05	13.61	0	43
Co-operative within 15 minute walk		Number of year	3.21	7.80	0	28
Average number of years of all five non-family services		Number of years	14.09	8.47	0	33.60
C. Land Area devoted to Agriculture						
Percent neighborhood land area devoted to agriculture		Percent	71.14	22.13	0	94.17
II. Control variables						
A. Neighborhood Characteristics						
Distance to urban center		Miles	8.69	4.00	0.02	17.70
Neighborhood Electrification		0=No, 1=Yes	0.37	0.48	0	1
Neighborhood Wealth Index		Index	0.54	9.82	2.98	142.07
B. Family Background						
Parents' contraceptive use		0=No, 1=Yes	0.53	0.50	0	1
Father's work		0=No, 1=Yes	0.49	0.50	0	1
Father's education		0=No, 1=Yes	0.51	0.50	0	1
Mother's work		0=No, 1=Yes	0.21	0.41	0	1
Mother's education		0=No, 1=Yes	0.16	0.37	0	1
Mother's number of children		Number	5.38	2.12	1	14
C. Respondent's Characteristics and Experiences						
i. Ethnicity						

I. Explanatory variables		Coding	Mean	S. Dev.	Min.	Max.
Upper caste Hindus		0=No, 1=Yes	0.52	0.50	0	1
Lower caste Hindus		0=No, 1=Yes	0.10	0.29	0	1
Hill Tibeto-burmese		0=No, 1=Yes	0.15	0.35	0	1
Newar		0=No, 1=Yes	0.08	0.27	0	1
Terai Tibeto-burmese		0=No, 1=Yes	0.15	0.36	0	1
ii. Educational Experience						
0 to 3 years of schooling		0=No, 1=Yes	0.15	0.35	0	1
4 to 7 years of schooling		0=No, 1=Yes	0.10	0.30	0	1
8 to 11 years of schooling		0=No, 1=Yes	0.37	0.48	0	1
More than 11 years of schooling		0=No, 1=Yes	0.38	0.49	0	1
iii. Marital and Childbearing Experiences						
Age at first marriage		Years	19.63	3.10	12	31
Marriage duration before the observation period (1997)		Month	7.15	14.69	0	66
iv. Duration (month)						
1–6 month		0=No, 1=Yes	0.41	0.49	0	1
7–12 month		0=No, 1=Yes	0.20	0.40	0	1
13–18 month		0=No, 1=Yes	0.13	0.33	0	1
19–24 month		0=No, 1=Yes	0.06	0.23	0	1
25–30 month		0=No, 1=Yes	0.03	0.18	0	1
31–36 month		0=No, 1=Yes	0.03	0.18	0	1
37–42 month		0=No, 1=Yes	0.03	0.16	0	1
More than 42 month		0=No, 1=Yes	0.11	0.31	0	1
v. Outcome variable						
First birth		Proportion	0.82	0.39	0	1

Notes: * The measures of childhood community characteristics are for respondent's place of residence at any time until the respondent was 12 years old.

** The measures of contemporary community characteristics are number of years a specific service was within 15 minutes walk from respondent 1996 neighborhood. The measures of neighborhood characteristics are for 135 neighborhoods.

Table 2

Multi-level Discrete-Time Hazard Model Estimates of Influence of Respondent's Childhood Non-family Services On First Birth

	1	2	3	4	5
Childhood Non-family Services					
School within one-hour walk	0.94 (0.16)				
Health service within one-hour walk		1.07 (0.37)			
Bus stop within one-hour walk			0.70** (2.00)		
Employer within one-hour walk				1.08 (0.48)	
Number of Childhood non-family services					0.97 (0.43)
Controls					
Respondent's Marital Experiences					
Age at first marriage	1.02 (0.95)	1.02 (0.96)	1.02 (0.99)	1.02 (0.92)	1.02 (0.97)
Marriage duration before 1997	0.98*** (4.38)	0.98*** (4.39)	0.98*** (4.61)	0.98*** (4.40)	0.98*** (4.39)
Respondent's Ethnicity (a)					
Lower caste Hindus	0.71 [†] (1.47)	0.71 [†] (1.45)	0.70 [†] (1.51)	0.71 [†] (1.47)	0.71 [†] (1.48)
Hill Tibeto-burmese	0.68*** (1.95)	0.69*** (1.90)	0.65*** (2.18)	0.70*** (1.76)	0.67*** (2.00)
Newar	0.93 (0.28)	0.94 (0.25)	0.95 (0.20)	0.93 (0.28)	0.93 (0.27)
Tera' Tibeto-burmese	1.00 (0.00)	1.00 (0.00)	0.99 (0.05)	1.01 (0.06)	0.99 (0.03)
Respondent's Parents' Characteristics					
Parents' contraceptive use	0.74** (2.14)	0.74** (2.15)	0.76** (2.00)	0.74** (2.17)	0.75** (2.11)

Childhood Non-family Services	1	2	3	4	5
Father's work	0.75*** (2.10)	0.74** (2.15)	0.75** (2.10)	0.74** (2.16)	0.75*** (2.06)
Father's education	1.19 (1.30)	1.19 (1.31)	1.18 (1.27)	1.19 (1.31)	1.19 (1.29)
Mother's work	1.06 (0.34)	1.06 (0.36)	1.06 (0.38)	1.06 (0.38)	1.05 (0.32)
Mother's education	1.38 (1.79)	1.37 (1.76)	1.43 (1.98)	1.37 (1.76)	1.38 (1.81)
Mother's number of children	0.95 (1.70)	0.95 (1.70)	0.95 (1.71)	0.96 (1.72)	0.95 (1.75)
Duration (c)					
1–6 months	2.37*** (2.63)	2.35*** (2.63)	2.37*** (2.63)	2.35** (2.62)	2.38*** (2.65)
7–12 months	1.98** (2.02)	1.97** (2.01)	1.99** (2.03)	1.97** (2.01)	1.99** (2.03)
13–18 months	2.00** (1.97)	1.99** (1.97)	2.01** (1.98)	1.99** (1.97)	2.00** (1.98)
19–24 months	1.22 (0.51)	1.22 (0.51)	1.22 (0.50)	1.22 (0.51)	1.22 (0.51)
25–30 months	0.78 (0.52)	0.78 (0.52)	0.77 (0.54)	0.78 (0.52)	0.78 (0.52)
31–36 months	1.28 (0.56)	1.28 (0.56)	1.26 (0.52)	1.28 (0.56)	1.28 (0.55)
37–42 months	0.79 (0.47)	0.79 (0.46)	0.76 (0.53)	0.79 (0.46)	0.78 (0.48)
–2 Res Log L	36337	36330	36449	36322	36362
Deviance	2246	2244	2245	2243	2248
Person Months	5966	5966	5966	5966	5966

Note:

† $P < .1$.

** $P<.05$,
*** $P<.01$;

all probabilities are one-tailed. Odds ratios are reported on the first line, with Z statistics in the parentheses on second line. All models were estimated using multivariate logistic regression. (a) High Caste Hindus as reference group. (c) More than 42 months as reference group

Table 3

Multi-level Discrete-Time Hazard Model Estimates of Impact of Adult Non-family Services on First Birth

	1	2	3	4	5	6
Adult Non-family Services						
School within 15 minute walk	0.98*** (2.35)					
Health service within 15 minute walk		0.99** (2.12)				
Bus stop within 15 minute walk			0.99 (0.27)			
Employer within 15 minute walk				0.99** (2.05)		
Co-operative within 15 minute walk					0.98** (2.02)	
Average years of non-family services						0.97*** (2.51)
Childhood Non-family Service						
School within one-hour walk	0.80 (0.54)	0.74 (0.70)	0.82 (0.48)	0.71 (0.80)	0.73 (0.75)	0.69 (0.86)
Health service within one-hour walk	1.21 (0.97)	1.22 (0.98)	1.16 (0.74)	1.20 (0.91)	1.20 (0.92)	1.25 (1.12)
Bus stop within one-hour walk	0.62*** (2.51)	0.64** (2.24)	0.62*** (2.48)	0.63*** (2.40)	0.65*** (2.23)	0.65*** (2.21)
Employer within one-hour walk	1.11 (0.56)	1.13 (0.67)	1.12 (0.62)	1.06 (0.34)	1.10 (0.54)	1.07 (0.38)
Controls						
R's 1996 Neighborhood Characteristics						
Distance to urban center	0.99 (0.52)	0.99 (0.25)	0.99 (0.33)	0.98 (0.80)	0.99 (0.19)	0.98 (0.69)
Neighborhood electrification	0.97 (0.20)	1.06 (0.30)	0.95 (0.27)	1.01 (0.04)	0.94 (0.36)	1.04 (0.21)
Neighborhood wealth index	1.01	1.01	1.01	1.01	1.01	1.01

Adult Non-family Services	1	2	3	4	5	6
	(0.76)	(0.92)	(0.69)	(1.01)	(0.60)	(1.02)
Respondent's Marital Experiences						
Age at first marriage	1.03 (1.25)	1.03 (1.11)	1.02 (1.03)	1.03 (1.20)	1.03 (1.04)	1.03 (1.29)
Marriage duration before 1997	0.98*** (4.31)	0.98*** (4.38)	0.97*** (4.50)	0.98*** (4.31)	0.97*** (4.53)	0.98*** (4.19)
Respondent's Ethnicity(a)						
Lower caste Hindus	1.07 (0.27)	1.05 (0.18)	0.98 (0.10)	1.03 (0.11)	1.05 (0.19)	1.08 (0.31)
Hill Tibeto-burmese	0.83 (0.86)	0.92 (0.37)	0.84 (0.78)	0.86 (0.71)	0.90 (0.48)	0.90 (0.46)
Newar	0.99 (0.03)	1.05 (0.19)	0.99 (0.04)	1.01 (0.02)	1.04 (0.15)	1.05 (0.19)
Terai Tibeto-burmese	1.35 (1.33)	1.38 (1.38)	1.35 (1.29)	1.30 (1.15)	1.33 (1.26)	1.31 (1.19)
Respondent's Educational Experience						
4 to 7 years of schooling	1.44 (1.26)	1.44 (1.25)	1.49 [†] (1.37)	1.49 [†] (1.37)	1.45 (1.28)	1.45 (1.28)
8 to 11 years of schooling	2.30*** (3.38)	2.08*** (2.98)	2.11*** (3.07)	2.11*** (3.09)	2.04*** (2.89)	2.17*** (3.15)
More than 11 years of schooling	2.23*** (3.14)	2.07*** (2.84)	2.09*** (2.90)	2.00*** (2.77)	2.01*** (2.74)	2.08*** (2.88)
Respondent's Parents' Characteristics						
Parents' contraceptive use	0.67*** (2.81)	0.68*** (2.60)	0.67** (2.71)	0.70*** (2.48)	0.68*** (2.62)	0.69*** (2.57)
Father's work	0.70*** (2.52)	0.71*** (2.43)	0.72*** (2.33)	0.73*** (2.20)	0.71*** (2.35)	0.71*** (2.41)
Father's education	1.25 (1.57)	1.20 (1.29)	1.19 (1.24)	1.17 (1.13)	1.21 (1.33)	1.22 (1.38)
Mother's work	1.12 (0.64)	1.09 (0.44)	1.09 (0.50)	1.12 (0.65)	1.11 (0.58)	1.11 (0.60)

Adult Non-family Services	1	2	3	4	5	6
Mother's education	1.41 (1.83)	1.44 (1.96)	1.43 (1.94)	1.42 (1.96)	1.45 (1.98)	1.43 (1.94)
Mother's number of children	0.95 (1.53)	0.95 (1.54)	0.95 (1.49)	0.96 (1.35)	0.96 (1.40)	0.95 (1.44)
Duration (c)						
1–6 months	1.81** (1.80)	1.81** (1.81)	1.85** (1.86)	1.86** (1.88)	1.86** (1.88)	1.82** (1.82)
7–12 months	1.58 [†] (1.35)	1.59 [†] (1.36)	1.60 [†] (1.38)	1.60 [†] (1.38)	1.62 [†] (1.42)	1.59 [†] (1.36)
13–18 months	1.77 [†] (1.64)	1.78** (1.65)	1.78** (1.66)	1.78** (1.65)	1.81** (1.69)	1.77* (1.64)
19–24 months	1.05 (0.13)	1.07 (0.17)	1.06 (0.14)	1.07 (0.16)	1.08 (0.20)	1.07 (0.17)
25–30 months	0.73 (0.67)	0.73 (0.67)	0.74 (0.65)	0.74 (0.65)	0.74 (0.65)	0.73 (0.67)
31–36 months	1.24 (0.50)	1.26 (0.53)	1.26 (0.53)	1.26 (0.53)	1.26 (0.52)	1.26 (0.52)
37–42 months	0.64 (0.84)	0.65 (0.81)	0.65 (0.80)	0.64 (0.83)	0.64 (0.81)	0.64 (0.82)
–2 Res Log L	35149	35145	35064	35190	35203	35202
Deviance	2150	2146	2151	2159	2153	2151
Person Months	5767	5767	5767	5767	5767	5767

Note:

[†] $P < .1$,** $P < .05$,*** $P < .01$;

all probabilities are one-tailed. Odds ratios are reported on the first line, with Z statistics in the parentheses on second line. All models were estimated using multivariate logistic regression. (a) High Caste Hindus as reference group. (b) 0–3 years of schooling as reference group (c) More than 42 months as reference group.

Table 4

Multi-level Discrete-Time Hazard Model Estimates of Influence of Non-family Services and Neighborhood land area devoted to Agriculture on First Birth

Land Area devoted to Agriculture	1	2
Percent land area devoted to Agriculture	1.01** (1.77)	1.00 (0.75)
Adult hood Non-family Services		
Average number of years of non-family services		0.98** (1.92)
Childhood Non-family services		
School within one-hour walk	0.71 (0.81)	0.66 (0.97)
Health service within one-hour walk	1.17 (0.78)	1.24 (1.09)
Bus stop within one-hour walk	0.64** (2.28)	0.66** (2.15)
Employer within one-hour walk	1.10 (0.52)	1.07 (0.37)
Controls		
R's 1996 Neighborhood Characteristics		
Distance to urban center	0.99 (0.34)	0.98 (0.66)
Neighborhood electrification	1.01 (0.03)	1.05 (0.29)
Neighborhood wealth index	1.01 (1.19)	1.01 (1.17)
Respondent's Marital Experiences		
Age at first marriage	1.02 (0.93)	1.03 (1.21)
Marriage duration before 1997	0.97*** (4.42)	0.98*** (4.18)
Respondent's Ethnicity(a)		
Lower caste Hindus	0.99 (0.02)	1.08 (0.30)
Hill Tibeto-burmese	0.89 (0.54)	0.92 (0.37)
Newar	1.06 (0.20)	1.08 (0.27)
Terai Tibeto-burmese	1.37† (1.37)	1.33 (1.23)
Respondent's Educational Experience (b)		
4 to 7 years of schooling	1.46	1.44

Land Area devoted to Agriculture	1	2
	(1.29)	(1.25)
8 to 11 years of schooling	2.01***	2.11***
	(2.84)	(3.01)
More than 11 years of schooling	2.06***	2.07***
	(2.85)	(2.86)
Respondent's Parents's Characteristics		
Parents' contraceptive use	0.69***	0.69***
	(2.53)	(2.50)
Father's work	0.73**	0.71***
	(2.19)	(2.33)
Father's education	1.22	1.23
	(1.40)	(1.44)
Mother's work	1.11	1.11
	(0.61)	(0.62)
Mother's education	1.46	1.45
	(2.04)	(1.98)
Mother's number of children	0.95	0.95
	(1.44)	(1.43)
Duration (b)		
1–6 months	2.81**	1.79**
	(1.80)	(1.77)
7–12 months	1.58 [†]	1.57 [†]
	(1.35)	(1.32)
13–18 months	1.76 [†]	1.76 [†]
	(1.63)	(1.61)
19–24 months	1.05	1.06
	(0.13)	(0.16)
25–30 months	0.73	0.73
	(0.67)	(0.68)
31–36 months	1.25	1.25
	(0.52)	(0.51)
37–42 months	0.64	0.64
	(0.81)	(0.82)
–2 Res Log L	35139	35225
Deviance	2152	2149
Person Months	5767	5767

Note:

[†] $P < .1$,

** $P < .05$,

*** $P < .01$;

all probabilities are one-tailed. Odds ratios are reported on the first line, with Z statistics in the parentheses on second line. All models were estimated using multivariate logistic regression. *(a)* High Caste Hindus as reference group. *(b)* 0–3 years of schooling as reference group *(c)* More than 42 months as reference group.