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School Characteristics and Transitions in Childbearing Behavior*

By

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Abstract

This paper investigates the complex relationship between the spread of mass education and transitions in childbearing behavior by modeling the effect of school characteristics on childbearing behavior (specifically, contraceptive use). Using data from rural Nepal, I create geographically weighted measures of school characteristics—such as teacher and peer characteristics, curriculum, and financial costs—that capture exposure during childhood and investigate the direct relationship between these dimensions of school characteristics and childbearing behavior. These analyses provide new information on the broader issue of how social context influences the adoption of innovative behaviors by exploring the wide reaching effects of educational context on individuals. Findings show that: increased exposure to these aspects of school characteristics throughout the study area, but not necessarily at the closest school, is related to higher rates of contraceptive use and that school characteristics early in the life course can have long-term consequences for individual behavior.

School Characteristics and Transitions in Childbearing Behavior

Sociological research on education spans a diverse set of substantive foci including its effects on employment, demographic behaviors, and ideas or attitudes (Becker 1991; Coleman 1990; Thornton and Lin 1994). This study aims to increase our understanding of the relationship between the spread of mass education and demographic change. To do so, I combine two separate, but equally substantial literatures: that on the effects of school characteristics on students' academic outcomes (Card and Krueger 1996; Heyneman and Loxley 1983; Lloyd et al. 2003) and that on the effects of educational attainment on family related behaviors (e.g. childbearing, fertility limitation, contraceptive use) (Blossfeld and Huinink 1991; Caldwell 1980; Lloyd, Kaufman, and Hewett 2000). Using this foundation, this study examines the links between changing dimensions of school characteristics and fundamental transitions in childbearing behaviors, illuminating the breadth of educational influences on social change and the extent of educational effects on family and demographic outcomes.

This paper adds to the research literatures on social change, education, and childbearing behavior in three ways. First, it presents a clear synthesis of multiple theoretical approaches and delineates the complex relationship between school characteristics and individuals' childbearing behavior. This framework explains how the characteristics of all schools in the community—not necessarily that of the schools individuals attend—are related to individuals' behavior. Second, the paper investigates various dimensions of school characteristics (specifically teacher and peer characteristics and school resources) to understand more fully the process through which the presence of a school in a community influences individuals. Third, by considering the effects on childbearing behavior and of exposure to school characteristics on a broad population of women rather than only on students, this research provides new information on the range of the

consequences of variations in school characteristics.

This research focuses on rural Nepal—an appropriate setting for investigating these complex relationships for both theoretical and empirical reasons. Many of the sociological and social demographic theories regarding the effects of changing social context on childbearing behaviors were designed to describe settings like Nepal—places that only recently experienced a rapid expansion of educational opportunities and dramatic changes in demographic behaviors (Caldwell 1982; Easterlin and Crimmins 1985; Thornton and Lin 1994). Additionally, this setting offers unique longitudinal data documenting the local population and school characteristics which enables empirical tests of these complex relationships. This study links detailed measures of the variation in schools and school characteristics over space and time with individuals' subsequent childbearing behavior, also measured over time. The result is new empirical detail regarding the consequences of multiple dimensions of school characteristics for non-academic behaviors.

THEORETICAL BACKGROUND

SCHOOLS AND CHILDBEARING BEHAVIOR.

The transition from high fertility and no contraceptive use to low fertility and the widespread use of contraception is a fundamental shift in social demographic behavior and is the focus of this study. A long history of research from multiple disciplines has pointed to education as one catalyst for this transition (Becker 1991???; Coleman 1990; Lesthaeghe and Surkyn 19??; Notestein 1953) and has largely demonstrated that the spread of mass education is related to the increased presence of smaller families and increased contraceptive use (Axinn and Barber 2001; Caldwell 1982; Lam and Dureya 1999). Much of this literature looks at the relationship between an individual's (or parent's) education and his or her own childbearing behaviors. Researchers

with an economics based perspective in this area often posit that education increases the opportunity costs for having children because of women's newfound opportunities outside of the home (Easterlin and Crimmins 1985; Notestein 1953). Alternatively, those with ideational perspectives emphasize the introduction of new ideas as the means through which education influences childbearing behavior. These may be Western values from imported educational systems (Caldwell 1982; Caldwell et al. 1985), knowledge about contraceptive methods (Hermalin 1983), knowledge of and desire for consumption goods (Freedman 1979), or the decreasing or changing connection to one's family (Caldwell 1976; Thornton and Lin 1994).

Regardless of the theoretical perspective, empirical research generally finds that when basic education is fairly widespread there is an inverse relationship between educational attainment and fertility and contraceptive use (Cochrane 1979; Singh and Casterline 1985). However, this is not the case in all situations. In the extremes, where education is only just becoming available and where education is quite high and fertility already very low, increased education is related to increased fertility (Axinn 1993; Axinn and Barber 2001; Rindfuss, Morgan, and Offutt 1996).

Like the research stemming from the ideational perspective, research that links to the literature on neighborhood effects further demonstrates that the spread of mass education influences individuals through more than simply teaching them the skills or providing the credentials necessary to succeed in a non-family based employment system. These sociologists have considered education at a more macro-level and investigated the effects of neighbors' and other family members' education or the presence of a school on individuals' childbearing behaviors (Axinn and Barber 2001; Axinn and Yabiku 2001). They find that having more educated neighbors and living near a school, both in childhood and later in life, are all related to

lower fertility and more contraceptive use. Furthermore, proximity, or exposure, to schools during childhood has a lasting effect on women's adult childbearing behaviors independently of her and her husbands' own education, their exposure to schools later in life, and their children's education (Axinn and Barber 2001).

Previous research has provided information that the spread of mass education, and in particular proximity to schools, influences individuals' family related behaviors. This study asks a different question—one fundamental to understanding this relationship: what is it about schools and proximity, or exposure, to them that influences individuals' childbearing behavior? To address this question I incorporate the literature on school quality effects and investigate the relationship between school characteristics and individuals' childbearing behavior. Additionally, I explicitly examine the spatial component of schools and its relationship to individuals' childbearing behaviors. In the following sections I first describe the theoretical linkages between exposure to schools and individuals' actions. I then turn to a more specific discussion of how exposure to specific school characteristics may be related to transitions in childbearing behavior.

Exposure to schools. A key to understanding why proximity to schools is related to childbearing behavior is, what I term, exposure effects. Individuals can have exposure to something—like a school—without ever having direct interaction or engagement with it—that is without ever having attended the school. While people live their daily lives they move around to different physical spaces and interact with others who come from different places or have had different life experiences. As a result, individuals can have interactions with children and neighbors who themselves attended school, interactions with those who work at the schools, and through increased familiarity with the services offered via passive contact such as walking by the building on the way to the market or while taking animals out to grazing lands, or by being

exposed to school recruiting campaigns (Bongaarts and Watkins 1996; Casterline 2001; Mead [1934]1967). Through these formal and informal interactions individuals are exposed to new, non-family ideas and experiences, and as a result their ideas, their perceptions of others' ideas, and their behaviors begin to change (Casterline 2001; Montgomery and Casterline 1996; Thornton and Lin 1994). Exposure effects may be particularly strong in a setting where communities are small and consist of individuals and families who have regular contact with one another and intimate knowledge of each other's lives—that is, where the local channels of social interactions are high (Bongaarts and Watkins 1996; Brofenbrenner 1970; Smith-Lovin and McPherson 1993; Valente, Watkins, and Jato 1997). Because the effect of exposure to schools occurs through these multiple, varied interactions or pathways, that effect is not limited to individuals who attended schools themselves—schools can influence the behavior of all community members, not only students' behavior (Axinn and Barber 2001; Kravdal 2002; McNay, Arokiasamy, and Cassen 2003).

Spatial distribution of schools. By focusing on the effects of exposure to schools on individual behavior, there are additional issues to consider regarding the spatial distribution and geographic access to schools. Neighborhood focused research has shown us that the spatial distribution of resources and organizations matters (Brauner-Otto, Axinn, and Ghimire 2007; Downey 2006; Hipp 2007). Also, exposure effects incorporate a spatial component by definition. So, when focusing on the exposure effects of schools we must conceptualize schools in a more spatially sensitive manner.

Schools are generally associated with a specific place. As the number of schools increases and their services expand, the distribution of their characteristics across physical space changes. Some evidence points towards the physical proximity of community services as a key

determinant of fertility behavior (Buor 2002, 2003; Entwisle et al. 1997). However, recent research demonstrates that limiting analysis to only the nearest building may not fully capture the individual's true social context (Brauner-Otto et al. 2007; Downey 2006). For instance, one can have exposure (as defined above) to multiple schools in a community. Consider a young woman responsible for taking the livestock to communal grazing lands. She may be accompanied by a woman from a different neighborhood. If both women went to school, it is likely they attended different ones, which may or may not have been the ones closest to their neighborhood. They may also pass by other schools throughout the day. All of these activities then expose the women to a wide array of schools.

From a more methodological perspective, consider the situation where two schools are equidistant from an individual but in opposite directions. How does the researcher decide which school has the most influence? In these cases consideration of the entire mix of schools and school qualities within a reasonable distance may be more appropriate. It is difficult, if not impossible, to determine the maximum distance at which a school may influence an individual. Previous research does provide some evidence that the effects of stationary features of social context, like schools, have a continuous distribution, much like distance itself, with schools in closer proximity having greater influence on the individual than those farther away (Brauner-Otto et al. 2007; Downey 2006).

School characteristics. I now turn to a discussion of how exposure to various aspects of school characteristics may influence childbearing behavior. Schools and education are not uniform—schools vary in their structural characteristics and resources. As mass education spreads, its institutional characteristics are likely to change yielding tremendous variation in community level educational contexts. Understanding which specific school characteristics are

related to childbearing behaviors will provide valuable new information regarding the processes through which the spread of mass education leads to dramatic social and demographic change.

Based on the above discussions of exposure and education effects there are two broad pathways through which specific school characteristics may be related to individuals' childbearing behavior. First, consider that a portion of exposure effects on childbearing behavior occur through the interactions individuals have with others, such as neighbors or children, who themselves went to school. In this instance, school characteristics that influence that school experience—perhaps by increasing attendance, lengthening enrollment, or increasing or changing the material learned while in school—may have exposure effects. Even when discussing exposure effects, the amount and length of student enrollment may be an important consideration. When larger proportions of children are enrolled in school others in the community have more opportunities to interact with them, thereby increasing the exposure effects of schools. When children attend school for more years they, and consequently their families and neighbors (who may not attend school themselves), are likely to be influenced more by that experience than children who attend for only short periods. Additionally, exposure over a longer time period may result in a stronger effect on the students (Zajonc 1968) and subsequently on those who interact with them. Also, the concept of childhood—and as a result women's childbearing behavior—is likely to be different in communities where children attend school only through second grade and then return to working in the household, as opposed to communities where they remain in school through 10th grade (the official last year of high school in Nepal). Finally, longer enrollment, or higher attainment, may result in more non-family work opportunities. These opportunities themselves may further change individuals', and therefore the parents' or neighbors, behavior.

The specific material learned in school may also influence individual behavior. Certain material, such as reproductive health classes, may more directly influence childbearing behavior. But other, more academic material may also be influential if it exposes students, and those who they interact with, to new ideas which shape their own attitudes, desires, expectations, and life goals. What is learned in school may itself be influenced by length of enrollment if certain topics are only covered in later grades or if certain ideas become more strongly ingrained in students' after repeated exposure.

In Nepal there are several school characteristics that may be particularly important with respect to attendance, enrollment, and the material covered: teachers' education and gender, the specific curriculum taught, supplemental fees, and students' gender. Previous research has linked teachers' education to educational attainment and enrollment (Card and Krueger 1992; Heyneman and Loxely 1983). Highly educated teachers may be better able to convey the material to their students and to keep students enrolled for longer (Heyneman and Loxley 1983; Lloyd, Mensch, and Clark 2000).

In Nepal, student fees may also be important through their effect on the material learned while in school. Student fees typically provide additional educational services such as science laboratories, libraries, or computer training and schools that do not charge supplemental fees cannot offer these services. Nepalese typically see fees as a signal of school quality; a common sentiment is that fees benefit students and women are often distrustful of free services—doubting their value or characteristics.[1] Additionally, fees are a tool schools can use to show community members the value of education. Fees signal that education has worth. Consequently, schools that require fee payments are likely seen as "better" than free schools, and women with more

[1] Information gathered from focus groups of mothers conducted in study area by author during winter 2006.

exposure to these schools will use contraception before women with less exposure.[2]

Also of particular importance in Nepal when considering the effects of school characteristics on childbearing behaviors may be teachers' and students' gender. Life in Nepal is highly segregated by gender. Nepalese women are far more likely to engage in social networks with other women and girls than with men and boys; men and women do not usually have close relationships outside their immediate families. Additionally, the typical work structure allows women to interact frequently with other women, but not necessarily with men. Since these networks and interactions are the mechanism through which exposure to schools influences individual behavior, it follows that women are more likely to be influenced by schools when more girls are enrolled in school and stay in school longer. Female teachers may be better able enroll girl students, keep them enrolled for longer periods of time, and teach them more effectively. Girls students, specifically a larger proportion of girl peers, may similarly effect enrollment and attainment. Single-sex schooling has been linked to higher educational outcomes for girls (Jimenez and Lockheed 1989). Importantly, previous research has also found that girls who attend single-sex schools also hold more equitable attitudes about gender roles and more liberal, or Western, attitudes about women's roles in society (Lee and Lockheed 1990; Mael 1998).

To reiterate—teachers' education, supplemental fees, teachers' gender, and students' gender are all characteristics of schools that may lead to more and longer enrollment in schools, higher attainment, and increased or different learning, especially for girl students. In turn, these

[2] Fees are separate from tuition requirements and schools with tuition requirements may or may not also require extra fees. Tuition revenues are typically used for basic operating costs, not for extra services. Also, the predicted effect of fees is opposite from how fees may or may not be related to access to schools. Schools that require extra fees are, by definition, not as accessible as schools without fees. However, this paper is not focused on individuals' ability to attend school, but rather on how the schools in the community influence individuals outside of this direct interaction. Consequently, this paper conceptualizes fees as a sign of its prestige and resources.

students will then influence others in their communities through formal and informal interactions and it is in this way that exposure to specific school characteristics may influence the childbearing behaviors of all community members, not just students.

A second broad pathway through which specific school characteristics may be related to individuals' childbearing behavior relies on the more removed exposure effects such as walking by the school or seeing and being aware of the school, teachers, and students. As mentioned above, the spread of mass education can change the meaning of childhood, even for those who are not directly interacting with the school. Also, the presence of female teachers in the community when they are coming and going to work may influence other women in the community. Their presence may reveal the possibility of working outside the home, or make this possibility seem more obtainable. In both cases, this may change women's family ideals and desires, for themselves or their own children, which would also influence their childbearing behavior.

Other community characteristics. The spread of mass education does not occur in isolation. Other community organizations, such as markets, employment opportunities, health services, and transportation infrastructure, are likely changing at the same time as more schools are built and as their characteristics change. Consequently, it's possible that any observed relationship between exposure to schools with specific characteristics and childbearing behavior is merely spurious. However, in this setting, it is more likely that such an observed relationship is real and not spurious. Schools are the first of these non-family, community organizations to have been built throughout this study area in Nepal (Axinn and Yabiku 2001). Their presence predates, and may even cause the later establishment and growth of markets, health services, employers, and the like (Caldwell 1992). More educated communities may attract other services

more or be better able to acquire those community services. Despite this pattern it will be important to account for other community characteristics in the analyses.

THE TIMING OF EXPOSURE.

When investigating the relationship between exposure to schools and individual behavior it is important to consider when this exposure occurs (Elder 1977, 1983). Previous theoretical and empirical research demonstrates that early life experiences and social context influence later life behaviors (Axinn and Yabiku 2001; Axinn and Barber 2001; Cherlin, Kiernan, and Chase-Lansdale 1995; Garces, Duncan, and Currie 2002; McLanahan and Sandefur 1994). Accordingly, exposure to schools during childhood should have long-term impacts on childbearing behavior.

Investigating the effects of exposure to school characteristics early in the life course may be especially important when investigating a broad conceptualization of exposure that is more likely to influence attitudes, subjective norms, and one's perceptions of those norms as opposed to influencing the immediate opportunity structure. By immediate opportunity structure I refer to the choices women face at the time of contraceptive use, such as those between working and having more children, that also play a role in their decision making. More contemporary measures of school characteristics may directly influence these factors. For instance, if the proportion of female students is relatively high when your own daughter approaches school age you may determine that she will not be able to help with childcare or other household tasks and, as a result, you decide to use contraception to limit further childbearing. However, if girls' enrollment in school was prevalent when you were young, that early exposure may influence and start to form the aspects of your personality, your preferences or attitudes, that shape your ultimate childbearing goals and behaviors (Becker 1996; Yabiku, Axinn, and Thornton 1999). Although the former situation certainly is important, it has been documented elsewhere (Axinn

and Barber 2001) and it is the latter situation that is the focus of this paper.

DATA AND METHODS

To empirically test my predictions I use data from the Chitwan Valley Family Study (CVFS) conducted in rural Nepal. Until the 1950s, Chitwan Valley was covered with virgin jungle and thinly inhabited by indigenous ethnic groups (Guneratne 1994). In the 1950s, the government began clearing parts of the jungle, implemented malaria eradication efforts, and instituted a resettlement plan leading to the in-migration of many different ethnic groups. The first school opened in 1954. By the late 1970s, roughly two-thirds of this valley was cultivated and the first all-weather road was completed, linking Narayanghat (the main town in one corner of the study area) to India and eastern Nepalese cities. Subsequently, other major highways were constructed making Narayanghat the transportation hub for the entire country. This led to the rapid expansion of schools, health services, wage labor, markets, and the media. (Axinn and Yabiku 2001; Pohkarel and Shivakoti 1986). As these structural and community level changes were happening, individual childbearing behaviors were also changing. The Total Fertility Rate dropped from over 6 in the 1960s to around 4 by the mid 1990s and contraceptive use has similarly become more widespread. The study area is bounded by jungle on one side, one of the largest rivers in Nepal on another side, and the major highway running from India to Kathmandu on the third side. Because these changes in the community context are contained both temporally and geographically, and dramatic changes in individuals' childbearing behavior occurred within the lifetimes of the valley's current residents, Chitwan Valley is a fitting setting for evaluating the various effects of school characteristics.[3]

In 1996, the CVFS collected information from residents of a systematic sample of 171

[3] Residents would have been able to leave the valley to attend school prior to the building of the first school in the valley. However, those schools probably had very weak effects on the behavior of community members because they were so far away.

neighborhoods in Western Chitwan Valley—every resident between the ages of 15 and 59 in the sampled neighborhoods and their spouses were interviewed. This survey interview included Life History Calendars both of which covered a wide array of topics such as parental characteristics, educational experiences, and other family and non-family experiences. All interviews were conducted in the most common language in Nepal, Nepali.

Following the 1996 individual interviews, the CVFS began collecting monthly data on contraceptive use for all the individuals in the selected households. Due to budget cuts, only 151 of the original 171 neighborhoods were selected for this data collection. Ninety-five percent of respondents have been interviewed, yielding 4,646 individuals aged 13-80 with both 1996 interviews and contraceptive method records.[4] Information for these individuals has been collected for 108 months.

I analyze data gathered from 1,227 women in the CVFS who were between the ages of 15 and 44 in 1996, were married at some point in the data collection period, and were not sterilized by the time of the 1996 interview.[5] I restrict the sample to these younger, non-sterilized women because analysis of childbearing behavior is not relevant for women beyond childbearing age or who have been surgically sterilized. I also limit the sample to married women because, in this setting, premarital sex is extremely rare. As a result, I limit my sample to women who marry at some point prior to the end of the 108-month prospective data collection period.[6,7]

[4] Households that move out of the study area are tracked and interviewed.
[5] This sample also excludes women who were missing data on any of the variables included in these analyses.
[6] Limiting the sample to non-sterilized women raises the possibility of left censoring. However, when I reduce the sample to include only women under age 25, for whom sterilization rates are extremely low, the substantive conclusions drawn from the analyses do not change.
[7] While the vast majority of research on fertility has focused on women only, a small and growing body of research conceptualizes childbearing behavior at the couple level (Thomson 1997, Axinn and Barber 2001). The empirical evidence from this work demonstrates that both husband's and wives' characteristics, including education, have separate, independent effects on the couples' fertility and contraceptive use. Because wives characteristics maintain separate and independent effects, I follow the majority of the literature on the transition from high fertility and little contraceptive use to low fertility and widespread contraceptive use and focus on women only.

The CVFS also collected detailed accounts of neighborhood resources such as schools with health services, and markets. In this rural setting, a neighborhood defines a cluster of approximately 5 to 15 households—a group of individuals who have face-to-face contact daily. These neighborhoods are typically located at the junction of unpaved, rough roads and are surrounded by farmland. To carry out the necessary daily work such as gathering firewood or water, tending animals, or farming, individuals often walk several kilometers, passing different neighborhoods, schools, and community services along the way. Schools, shops, and other resources also tend to be clustered at crossroads. Additionally, activities that occur within the household, such as helping children get ready for school, take place in the open courtyards in front of the house in plain view of neighbors and those who pass by. This setting, with its close living and open display of behaviors, makes it ideal for examining exposure effects.

In 1995, the CVFS collected School History Calendars (SHC) for all 145 schools ever operating in the study area from 1945 to 1995, regardless of operating status at the time of data collection. The SHCs were collected using the Neighborhood History Calendar (NHC) technique (Axinn, Barber, and Ghimire 1997)—a data collection technique that combines archival, ethnographic, and structured interview methods and yields measures of community level characteristics not constrained by physical boundaries or dependent on the memory of one individual. These calendars included information on teachers' education, number and gender of students and teachers, and student fees.

MEASURES

Childbearing behavior: Contraceptive use. To investigate the transition in childbearing behavior, I focus on individuals' contraceptive use. I treat contraceptive use as a transition from not currently using contraceptives to using contraceptives and consider eight possible

contraceptive methods—own sterilization, spouse's sterilization, Depo-Provera, IUDs, Norplant, oral contraceptive pills, condoms, or any other method. When contraceptive methods first began to be widely used, Nepalese, like many other South Asian populations, generally used long-term methods such as sterilization, Depo-Provera, IUDs, or Norplant and used these methods to stop childbearing rather than to space births (Axinn 1992, 1993; Axinn and Yabiku 2001). Analyses of the monthly contraceptive data reveal that recently other, more temporary methods have become more common. However, the vast majority of women who use temporary methods such as pills and condoms eventually go on to use a permanent method. In fact, 80% of women who used any type of contraceptive method eventually become sterilized or used Depo-Provera, IUDs, or Norplant. Because contraceptive use is typically used to terminate childbearing discontinuation is low even for more temporary methods. As a result, it is the initiation of contraceptive use that is a pivotal life event in this setting and I focus on this initiation (i.e. the first use of any contraceptive method) as the dependent variable to illustrate the relationship between social context and the transition in childbearing behavior.[8],[9]

I create a time-varying, dichotomous variable equal to 1 the month the respondent first uses any contraceptive method and 0 in months prior. Table 1 shows the frequencies for this and all of the individual level variables I use in this paper. In this sample, 59% of women used contraceptives between 1997 and 2006. This measure is then used in event history models described below.

(Table 1, about here)

[8] I also estimated models using more restrictive measures of contraceptive use (women's own sterilization, women's or husband's sterilization, any long term method (sterilization, Depo-Provera, IUD, Norplant), and female only methods (women's own sterilization, Depo-Provera, IUD, Norplant, pills, foam). In all cases the effects of school characteristics were stronger than those shown here. I present this broad measure of contraceptive use as a conservative estimate of the effect of exposure to schools on childbearing behavior.

[9] Although sexually transmitted diseases and infections are becoming more prevalent in Nepal, and condom use to prevent their transmission is of obvious social importance, the research presented here is concerned with contraceptive use as it relates to childbearing behavior.

School characteristics. To investigate the long term effects of individuals' exposure to schools during childhood the measures of school characteristics I investigate refer to exposure when the respondent was 13 years old.[10] To capture multiple aspects of schools that may influence individual behavior through the pathways described above (i.e. increasing enrollment and attainment, changing the meaning of childhood, and role modeling) I create five measures of school characteristics: (1) the percent of teachers in each school in that year who had at least a college education, (2) the percent of teachers in each school in that year who were female, (3) the percent of students enrolled in each school in that year who are female, (4) a dichotomous variable equal to 1 if the school had a family planning component to its curriculum, and (5) a dichotomous variable equal to 1 if the school required students to pay fees in order to attend first grade that year and 0 otherwise. These measures are all based on the SHCs described above.

Changes in schools over time. Figure 1 shows how the number of schools and their characteristics have changed over time in Chitwan. Years are along the x-axis and number of schools is along the left-hand y-axis. The line with the triangles shows the number of schools open in a given year and clearly shows an increase over time demonstrating the spread of mass education. The line with the diamonds shows the number of schools that required additional fees for first grade. Although always common, this practice has become increasingly so in recent years. The line with the circles shows the number of schools with a family planning component to their curriculum—although they have become more common over time, they are still quite rare. The remaining lines show the mean, across open schools, for the other characteristics mentioned above and refer to the right-hand y-axis. The percent of teachers at each school who

[10] Methodologically, age 13 is a crucial point because it allows me to include measures of the respondent's community during childhood (age 12 and younger) as controls. The CVFS asked a series of questions regarding the respondent's neighborhood during childhood directing the respondent to think of the neighborhood she lived in before age 12 when answering. In order to incorporate these additional controls, and maintain proper temporal ordering, the key independent variables refer to the schools following this early childhood period.

are female and who are college educated has generally been quite low with the mean never rising over a quarter. Female students are far more common with the mean of the percent at each school at almost half in the last year of data. It is worth noting that only two schools were ever completely single-sex schools—they had only male students and it was only for a short time period. No schools are designed to be single-sex schools. The upward slope of most of the lines on this graph demonstrate that the number of schools, and the prevalence of some dimensions of school quality, as measured here, have been increasing over time.

(Figure 1, about here)

School characteristics: geographically weighted. To understand more about the spatial dimension of school effects, given the problems described above with limiting analyses to only one school, and with recent research pointing to the simultaneous importance of multiple community organizations, I create measures that incorporate information on all the schools that ever existed in the study area capturing the wide spatial distribution of schools and school characteristics. For all five measures of school characteristics I create geographically weighted measures which can be represented as:

$$S_{cnt}^{**} = \left(\sum_{l=1}^{145} \frac{S_{clt}}{W_{\ln}} \right) \Big/ \sum_{l=1}^{145} W_{\ln} \qquad \text{(equation 1)}$$

where S_{cnt}^{**} is the geographically weighted average of school characteristics for characteristic *c* (e.g., proportion of female teachers) and neighborhood *n* in the year *t* (the year the respondent turned 13). S_{clt} is the characteristic *c* offered by school *l* in the year *t*, and W_{ln} is the weight for school *l* and neighborhood *n*. Because previous research and the theoretical framework employed here predict that aspects of social context farther away will have less

influence than those closer to the individual, I define W_{ln} as the distance between school *l* and the center of the neighborhood *n*.[11] Distance was calculated "as the crow flies" using latitude and longitude coordinates for the neighborhood and the school and is in kilometers. Because households in neighborhoods are clustered closely together the geographic location of the center of the neighborhood very closely approximates the geographic location for all households.[12] The summation over 145 schools is because that is the total number of schools that ever existed in Chitwan.[13] Importantly, the metric for these geoweighted measures is complex and not necessarily intuitive. Table 2 presents descriptive statistics for these geographically weighted measures at the individual level for the year the respondent turned 13 years old.

(Table 2, about here)

As Figure 1 demonstrated the number of schools and prevalence of these school characteristics has been changing over time. However they have not been changing at the same rate in the same substantive way. That is, these school characteristics are not highly correlated with one another or with the number of schools open. Table 3 presents the Pearson Correlation Coefficients for the school measures at the school level for 1980 (the middle year women in the analysis sample would have turn 13). I do not present the correlations for the geoweighted measures because, as we would expect given the construction of these variables, they are all highly correlated with one another—the same geo-weights play a large role in the determining

[11] Previous research in this setting has found this weight to be the most appropriate (Brauner-Otto et al. 2007).
[12] I do not have geographic coordinates for individual households.
[13] To clarify, consider the measure of female teachers as an example. In the first step, for each school-neighborhood pair in a year (specifically the year the respondent turned 13 years old) I divide the proportion of teachers who were female (S_{clt}) by the distance between that school and that neighborhood (W_{ln}) to create a weighted measure of female teachers. Next, I sum all of these weighted measures for one entire neighborhood—that is, I add up the weighted measure of female teachers for each of the 145 schools that were open that year. Finally, I divide this by the sum of the distances between that specific neighborhood and all of the open schools and then multiply this final result by 10 to scale the effect estimates. In the end, I have a neighborhood level variable that refers to the individual's current neighborhood when she was 13 years old. Note, not all 145 schools were open in every year; only schools that were open in that specific year were included in these calculations.

the value of all of these measures. Looking at the raw measures for each school we see far more differentiation. The most highly correlated characteristics were the percent of students who are girls and the percent of teachers with college degrees which are inversely correlated with a Pearson coefficient of -0.5. None of the other measures are correlated above 0.3, and most are less than .1. Only the correlation between teachers' education and having a family planning curriculum was statistically significant. This may be because family planning is more likely taught at higher grades and more educated teachers are more likely to teach those grades. The degree of correlation does change over time. For instance, the correlation between female students and female teachers is positive in 1980 but negative in 1995, but the reverse is true for teachers' gender and education (but not statistically significant in either year). Of course, these correlation coefficients are not perfect measures, but they do offer support that these characteristics are not very closely tied to one another and that these measures are in fact capturing different aspects of schools.

School characteristics: other. Of course, even though the entire educational climate, or school context, is the focus of this paper, the characteristics of the closest school may still be relevant so I include several measures to control for its potential influence. In all the models I include a measure of how long it takes to walk from the respondent's neighborhood to the closest school (measured in minutes by foot) and a count of the number of schools open that year. The first measure is based on information from the NHC and has been widely used in other published research (Axinn and Yabiku 2001; Ghimire 2003) and the second measure uses information from the SHC. I also examine the effect of the characteristics of the closest school. So in each model I include two measures of school characteristics—a geographically weighted measure as described above and a measure for the closest school. The descriptive statistics for these measures are also

contained in Table 2.

Controls. As with all studies of the effect of social context on individuals, these analyses face threats to the validity of conclusions about causal connections between macro-level characteristics and micro-level outcomes. Of particular concern here is that (1) the school characteristics may be produced through non-random processes such that the processes producing contextual change create spurious associations between school characteristics and individual outcomes, and (2) individuals may choose to live in specific communities so that selective migration decisions produce spurious associations between school characteristics and individual outcomes. Both of these threats can be considered a problem of missing data (Holland 1986; Rosenbaum 2002). For the first problem, the missing data are the process through which the school characteristics came to be. For the second, the missing data are the unobserved characteristics of individuals that influence both the choice of neighborhood and their individual behavior.

The data used here provide me with an opportunity to address these potential threats, although certainly not to erase them. Because of the highly detailed and comprehensive nature of these data I have at my disposal many more measures than researchers typically have. In particular, I have extensive detail about the neighborhood, individual characteristics and experiences, and individual's migration histories that may influence school characteristics, neighborhood choice, and individual's childbearing behavior. All the control measures refer to the period from when the respondent was 12 years old or earlier—that is, before the exposure to schools.

Neighborhood characteristics. The first point above, that the measures of schools and school characteristics merely capture other neighborhood characteristics, is of particular concern

here because, as I mentioned earlier, schools do not change in isolation. To address this issue I include multiple measures of the individual's neighborhood. These measures also control for the general economic situation of the community, an often cited correlate of contraceptive use.

When investigating contraceptive use the availability of health services is of particular concern because we know that access to contraceptive methods is related to actual contraceptive use. I include a continuous measure of the distance between the respondent's neighborhood and the nearest health services (measured in minutes by foot).[14]

I also create a measure of the respondent's childhood community. Following previous research, I create four dichotomous variables equal to 1 if the respondent had a school, health service, employer, market, or bus stop within an hour's walk of her neighborhood before she was 12 years old and 0 otherwise (Axinn and Yabiku 2001; Brauner-Otto et al. 2007). I then summed these measures to create an index measure of the number of services available. In separate models I also tested an index that included the presence of police stations, temples, dairies, co-ops, and movie halls within 1 hour. The results were essentially identical to those shown below, but there was slightly more missing data with this larger measure so I only present the results for the more concise one.

Individual characteristics. Substantial bodies of literature provide evidence that education, work, living experiences, media exposure, participation in groups, parental characteristics, and receipt of health services all influence childbearing behaviors (Axinn and Yabiku 2001; Barber 2004; Barber et al. 2002; Lloyd, Kaufman, and Hewett 2000). As a result I include multiple measures of these experiences and characteristics.

I create two measures of experiences. One's own education and experiences with schools

[14] I also explored a measure of the number of health services open when the respondent was 12, but this measure was too highly correlated with the number of schools open to include both in the model.

is certainly important—women who went to school early in life may be more likely to live near schools with certain characteristics later on and to use contraception. As a result, I include a continuous variable for the number of years of schooling a woman obtained before age 13. The mean number of years was just under 4 years. Other non-family experiences are also important so I create an index of the number of other non-family experiences the respondent had. For this measure I create a series of six dichotomous variables equal to 1 if the respondent had worked for pay outside the home, lived away from her family, visited a health post, seen a movie, or participated in a club or group[15] by age 12 and 0 otherwise. I then sum these dichotomous measures to create a single index.[16] The mean number of non-family experiences women in this sample had by age 12 was less than 1. Most of these experiences were quite rare, and in fact, no one had experienced all six. However, theoretically they are important and creating an index allows me to include these experiences in the model without creating estimation problems due to the low frequencies.

Previous research has found that parental characteristics are important predictors of family related behaviors (Axinn and Thornton 1992, 1993; Barber 2000, 2001; Thornton and Camburn 1987). Consequently, I use dichotomous measures to control for father's and mother's education (ever went to school), father's employment (ever had non-family employment before respondent's age 12), and whether parents ever used a contraceptive. I also include a count measure of the respondent's mother's number of children ever born.

Additionally, because ethnicity in Nepal is complex and likely related to an individual's

[15] Groups refers to social groups and community based groups focusing on issues including women's issues, seed dispersion, and micro-loans.

[16] I also estimated models with these measures entered as separate dichotomous variables and models with an index of only the most common experiences. Only visiting a health service was positively and significantly related to the hazard of contraceptive use. Importantly, since these are included only as control measures, the different model specifications did not change the substantive results regarding the relationship between attitudes and the hazard of contraceptive use. Also, because of colinearity among these measures and with the measures of childhood community context I elected to include these measures as an index and not as separate measures.

behaviors (Acharya and Bennet 1981; Bista 1972; Fricke 1994; Gurung 1980), I use dichotomous variables to control for five classifications of ethnicity: high caste Hindu, low caste Hindu, Newar, hill Tibeto-Burmese, and Terai Tibeto-Burmese. High-caste Hindu is the reference group in my analyses.

I also control for birth cohort. I create dichotomous variables for four birth cohorts: 1981-1977 (age 15–19 at the 1996 survey), 1976-1972 (age 20–24 at the survey), 1971-1967 (age 25–29 at the survey), and 1966-1952 (age 30–44 at the survey). The 1981-77 birth cohort is the reference group for all the analyses.

Finally, I control for migration. Because the measures of school characteristics refer to the respondent's current neighborhood when she was 13 years old, it is imperative to control for whether the respondent lived in the same neighborhood during her childhood as she did at the time of the interview. I create a dichotomous measure equal to 1 if the respondent ever lived in the neighborhood before she was 13 years old. Since migration was common in this sample, I also took several additional steps to assess the sensitivity of my results to varying assumptions regarding migration. I tested multiple alternative migration controls in these models including the age at which the respondent first lived in the selected neighborhood and whether she moved into the selected neighborhood before she married (marriage is a major reason Nepalese women migrate). Neither measure yielded results substantively different from those presented here. However, even with these controls, migration (or rather the reason for moving) may still be creating a spurious observed relationship between school characteristics and contraceptive use. Therefore, I also estimate models with only non-migrants and discuss results from this alternative specification below in the results section.

ANALYTIC STRATEGY

The breadth of the CVFS allows me to estimate complex models of the relationship between schools, school characteristics, and contraceptive use. I treat contraceptive use as the transition occurring over time from not using any contraceptive method to using contraception and use discrete-time event history techniques to estimate the models (Allison 1982, 1984; Petersen 1986, 1991). Person-months of exposure are the unit of analysis, and I consider women to be at risk of contraceptive use after they marry for the first time. For women who marry before February 1997, I start the hazard in the first month of the prospective data collection. Otherwise, I start the hazard the month after the respondent marries.[17, 18]

Because the individuals in the CVFS are clustered, with several individuals living in the same community sharing the same school characteristics, I estimate multilevel models to account for this data structure (Barber et al. 2000; Mason et al. 1983). Techniques for multilevel modeling are well developed and have been widely applied in fertility and school research (Entwisle, Casterline, and Sayed 1989; Mason et al. 1983; Raudenbush and Bryk 2002). I use the multilevel hazard analysis proposed in Barber et al. (2000) and estimate discrete-time hazard models with random neighborhood level effects.[19] Because the outcome in question has only one destination state and is measured as a dichotomous variable, logistic regression is an appropriate estimation technique (Allison 1982; Guilkey and Rindfuss 1987).

In addition to the control variables described above, I also include two series of dummy variables for the time since the start of the hazard that control for the baseline hazard. Because

[17] Because the first month of the prospective data collection includes information regarding women's contraceptive use between the date of their individual interview, which occurred sometime between July and December 1996, and February 1997 I include an additional control for whether the specific person-month was this irregular, potentially long month. This variable equals 1 if the person-month was this first month and 0 otherwise.

[18] I also estimated models that included a time varying covariate for time since marriage. Including this control had no effect on the models and I exclude it here for parsimony.

[19] Due to data limitations I am not able to estimate fixed-effects models with these data. This is unfortunate because a fixed-effects approach is a relatively conservative strategy. However, previous studies with data from this study area use random effects and have found similar estimates from models with fixed and random effects (Axinn and Yabiku 2001; Brauner et al. 2007).

the ability to obtain contraceptive methods is highly influenced by time of year—roads are often impassable during the rainy season and farmers work very long hours during harvest and planting times—I created twelve dummy variables, one for each month of the year. In each month of exposure one of these variables equals 1 and the remaining eleven equal 0. January is the excluded variable in the models. Because length of the period of risk is important I also include nine dummy variables for the specific year. For every month one variable is equal to 1 and the remaining variables equal 0; every 12 months the year variable that equals 1 changes. I exclude the last year from the analyses.

RESULTS

Table 4 shows the effects of the geographically weighted average of school characteristics of the entire study area at age 13 on the hazard of contraceptive use. The coefficients displayed are the multiplicative effects on the odds of contraceptive use. An exponentiated coefficient greater than 1.00 represents a positive effect, less than 1.00 a negative effect, and equal to 1.00 no effect. Because the frequency of events, contraceptive use, in any one-month interval is quite small, the odds of contraceptive use are very similar to the rate, and I discuss the results in terms of rates.

Looking at columns 1 through 3 we see evidence that teacher and student characteristics have a long-term influence on individuals' childbearing behaviors. Women with more exposure to schools with higher proportions of college educated and female teachers, and higher proportions of female students had higher rates of contraceptive use than women with less exposure. These findings provide evidence that the specific people connected to the schools, the teachers and students, are important aspects of school context in terms of long-term and widespread effects on childbearing behaviors.

(Table 4, about here)

Technically, a one-unit increase in the geographically weighted average of the percent of teachers who are college educated corresponds with an 8 percent higher rate of contraceptive use (Model 1). But what does a 1 percent increase in your geographically weighted average mean? The answer depends on the specific year and neighborhood in question. In the 1950s, when schools were first being built in the study area, obtaining a 1 percent increase in the geoweighted average of any one school characteristic was fairly easy. For instance, the geoweighted average of the percent of teachers who are college educated could have increased by 1 percent simply by employing one more teacher with a college degree. Considering a school that initially had no college educated teachers, this additional college educated teacher would raise the percent of teachers in that school with higher degrees from 0 to 12.5%. At another school, that already employed college educated teachers the addition of one more may increase the percent for that school from a quarter to one-third and the geoweighted average by over 40 percent. This large increase occurs partly because there were so few teachers, especially highly educated ones, at so few schools. Over time, each increase requires more of an investment. For instance by the mid 1980s you would need to add two or three college educated teachers to the school with no college educated teachers to see a similar increase in the geoweighted average. Despite the variation in how one can achieve a 1 percent increase in the geoweighted school characteristics, it is fair to say that such an increase requires a substantial, but certainly realistic, change in the school context or climate.

I do not find evidence that the specific material taught, specifically exposure to lessons on family planning, is influential (column 4). In light of previous research on this setting about the influence of specific health services on contraceptive use this is not surprising. Previous work

has demonstrated that the availability of contraceptive methods per se is less influential on women's contraceptive use than the availability of other health services such as child vaccinations or prenatal care (Brauner-Otto et al. 2007). It appears that knowledge about and access to contraception is no longer a barrier to contraceptive use in this area. Rather, women's decisions to use or not to use contraception are more influenced by the other aspects of family life that continue to change.

In column 5 we see that women who are exposed to more schools that require supplemental fees to attend first grade have substantially higher rates of contraceptive use. This finding is an interesting comparison to the lack of significant effects regarding curriculum. Supplemental fees are used to provide additional services or activities to students, beyond the normal curriculum. Unfortunately, we do not know what each school uses their fees for specifically—it ranges from from science laboratories to after-school sports. In light of this variety it is best to make a more general interpretation of this result. That is, these supplemental fees can be a sign of overall quality of the school so women exposed to better quality schools have higher rates of contraceptive use than women exposed to more basic schooling environments.

In contrast to the findings regarding the geoweighted average measures, none of the characteristics of the closest school during childhood were significantly related to women's later childbearing behaviors.[20] This may seem surprising at first thought, but it should not be because the broad conceptualization and resulting geoweighted measures of school context more closely match the theory which is about exposure and exposure doesn't necessarily only occur at your closest school. Because these exposure effects influence individuals through a range of social

[20] In models without the geoweighted average measures the effect estimates for the closest school were similar to those shown here.

channels physical proximity is less important. Not unimportant, remember these measures do incorporate distance so it is not that proximity is unimportant, rather that it is not the most important component of exposure to school characteristics in terms of their influence on contraceptive use. Also, the closest school is not necessarily one that the respondent attended—many of these women never went to school and, because enrollment is not determined through residential zoning, those who did go may not have gone to the school closest to their neighborhood. Additionally, consider the outcome in question here: later life contraceptive use. It may very well be the case that characteristics of the closest school influence academic outcomes. Perhaps most importantly, we should remember that the lack of statistical significance cannot be interpreted as having no influence, only that I have not shown a significant effect.

Regarding the control measures, none of the measures of the respondent's neighborhood at age 12 were statistically significant. Also, women's own education and her parents' education were not related to her rate of contraceptive use. These education findings are in fact similar to those in other studies using these same data, and offer support that both the spread of mass education and the transition in childbearing behaviors are still in their early stages (Axinn and Barber 2001; Axinn and Yabiku 2001). There is a complex interaction between cohort and education in these data because education has become increasingly widespread for the younger cohorts. When I remove the controls for birth cohort from the models own and parents' schooling were positively related to contraceptive use. These models also show that women in older birth cohorts had lower rates of contraceptive use than women in the youngest birth cohorts. Nevertheless, because the main focus of these analyses is not own or parents' schooling, the models include the full array of controls.[21]

[21] I also tested models that used a continuous measure of respondent's age in 1996 as control. Models with only age and with both age and the four birth cohort measures shown here yield virtually identical results to those shown

To further explore the relationship between schools, education, and contraceptive use I estimated models with interaction terms between the school characteristics and the women's own education. The effects of exposure to schools, the geoweighted measures, were substantially larger for non-students than for students. Women's own education serves to mute the effects of exposure to the broader school context on childbearing behaviors, although the exposure effects still had strong, statistically significant effects on contraceptive use even for students.

Women's other non-family experiences are positively related to contraceptive use as was father's work experience. Women who had more non-family experiences or who had father's with work experience had higher rates of contraceptive use.

Because some women were living in a different neighborhood when they were 13 years old I also estimated models similar to those presented in Table 4 but with only the non-migrants (women who were living in their sample neighborhood when they were 13). Effect estimates from analyses of only non-migrants were similar to those presented here, although the standard errors were much larger making the estimates not statistically significant.

DISCUSSION

This paper aims to increase our understanding of fundamental sociological questions regarding social change, the spread of mass education, and the relationship between education and fertility. By examining new conceptualizations of school context and their relationship to the transition from high to low fertility this work informs both our understanding of the processes of widespread social change and of the specific mechanisms through which the spread of mass education influences individuals' behavior. Models of the relationship between specific aspects of school characteristics and actual contraceptive use yield important, new insight into the

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here. A dichotomous measure of whether the respondent had ever attended school was also not statistically related to the hazard of contraceptive use.

specific programmatic mechanisms through which individuals are influenced by their educational surroundings and provide new information about the complex relationship between school context across space and individual behavior.

The results in this paper indicate that increased exposure to college-educated teachers, female teachers and students, and required student fees are associated with increased contraceptive use to limit childbearing. Although these effects of school characteristics are what we would expect given previous findings that (1) these dimensions of school characteristics increase students' academic outcomes and (2) higher academic outcomes are associated with lower fertility and increased contraceptive use they have not been previously documented. Furthermore, this study provides evidence that school characteristics influence all of the women in the community, not only students, dramatically expanding what researchers typically consider the realm of influence for schools to be.

Substantively these findings reveal important pathways for schools, and potentially other community organizations, to influence individuals. First, these findings are evidence of the importance in having women at the forefront. That the proportion of female teachers and students were significant shows that as role models and as members of the community women are incredibly influential and can be catalysts for social change—like the transition to low fertility—and adoption of innovative behaviors—like the widespread use of contraception to limit childbearing. Research and community work on women's businesses and networks demonstrated this in other settings. The work presented here adds to this knowledge by showing that there are multiple arenas within a community, not only small business ventures, where women can be the influential actors.

Second, I find evidence that teacher's education can have significant, lasting impacts on

individuals' futures. Highly educated teachers have long been seen as crucial when discussing education in the United States or other wealthy countries. However, when we turn our attention to places where education is still spreading, the tendency appears to be to think that a high level of education may not be as important in a setting like Nepal. These findings are evidence that there is something fundamentally different about having specifically trained, well-educated teachers in the community and that when we build and support schools we need to be cognizant of that.

Since the theoretical framework used here relies heavily on inter-personal interactions for these exposure effects to occur it is encouraging that I find that the characteristics of teachers and students are related to women's later life contraceptive use. Future data collection efforts designed to capture these interactions more directly is necessary to fully understand the mechanisms through which social context influences individuals behaviors.

By investigating the effects of school context in childhood this paper also touches on important life course dynamics, revealing that one's childhood context is crucial in shaping lifes' trajectories and future behaviors. I operationalize school characteristics early in the life course to capture the long term effects that exposure to schools has on individuals' decision-making frameworks. Consequently, these findings are evidence that, as life course theory predicts, exposure to certain school characteristics early in life influences the formation and assessment of attitudes, preferences, and social norms that guide later life childbearing and contraceptive use decisions (Elder 1998). This is in contrast to the relationship between current social context and individual behavior where behavior may be more closely tied to a more immediate opportunity cost analysis.

It may be that some of the long-term effect occurs by influencing later life exposure to

these same or other aspects of school and community context (Caldwell 1986). Early exposure to specific school characteristics may motivate women to live near similar schools later in life or even to change the schools in their later life communities. In this situation, the relationships presented here represent the overall effects of school characteristics early in the life course and later exposure could be a mechanism through which the effect occurs. Additional research is necessary to fully explore this complex relationship. However, it is worth noting that previous research in this setting has found that childhood exposure to schools and other aspects of social context maintain strong effects on later contraceptive use, even after controlling for later life exposure and education (Axinn and Barber 2001; Axinn and Yabiku 2001).

Perhaps most relevant to a broader sociology audience are the findings regarding the geoweighted measures of school context. Recall that the geoweighted measures were statistically significant but those of the closest school were not. This is not surprising given the specific theoretical model applied here—one which places multiple types of interactions (those with children, neighbors, teachers, and the building itself) at the crux of how school context influences the individual. These geographically weighted measures better capture a physically wide ranging aspect of social context—the appropriate level of operationalization for this hypothesized relationship. Simply put, the geoweighted measures better match the theory than the measures of the closest school.

The significant relationship between geographically weighted measures of the entire school context has important implications for future conceptualizations of social context more broadly. To understand the full range of effects that changes in social context have on individual behavior we need to incorporate individuals' entire context into our theories and models. The analyses presented in this paper document that when looking at the effects of dimensions of

social context it is not enough to examine individuals' own experiences or exposure to only the closest aspect of each dimension. These models show that measures that capture the full range of school characteristics have strong, statistically significant effects on contraceptive use, even when measures of school enrollment or of the closest school failed to have such effects. Unfortunately, our sociological theories have not developed to incorporate how context over space is related to individual behavior. Several recent studies have shown the importance in carefully conceptualizing context and have provided examples, much as this paper does, that this conceptualization must incorporate specific features of the setting and of the social problem being studied (Brauner-Otto et al. 2007; Downey 2006; Hipp 2007). However, we are still a long way from having clear guidelines or frameworks for how to theoretically conceptualize and empirically examine spatial dynamics of multilevel problems. Future theoretical work should address this weakness to provide guidance for empirical models.

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Table 1. Descriptive Statistics

	Mean	SD	Min	Max
Contraceptive use				
Used any contraception	0.59		0	1
Controls				
Neighborhood characteristics, age 12				
Distance to nearest health service (minutes by foot)	33.11		0	240
Index of number of non-family organization within 1 hour before age 12	3.85	1.44	0	5
Individual experiences				
Years of schooling before age 13	3.86		0	10
Index of non-family experiences before age 13	0.98	0.86	0	4
Parental characteristics				
Father ever went to school	0.39		0	1
Father ever worked for pay outside the family	0.46		0	1
Mother ever went to school	0.10		0	1
Mother's children ever born	5.82	2.43	1	19
Parents ever used contraceptives	0.37		0	1
Ethnicity				
High caste Hindu	0.46		0	1
Low caste Hindu	0.10		0	1
Newar	0.07		0	1
Hill Tibeto-Burmese	0.15		0	1
Terai Tibeto-Burmese	0.21		0	1
Birth cohort (age in 1996)				
1981-1977 (ages 15-19)	0.35		0	1
1976-1972 (ages 20-24)	0.25		0	1
1971-1967 (ages 25-29)	0.16		0	1
1966-1952 (ages 30-44)	0.24		0	1
Lived in 1996 neighborhood when aged 13	0.38		0	1

N=1,227 women.

Table 2. Descriptive Statistics Measures of School Characteristics, Individual Level at Age 13

	Mean	SD	Min*	Max
Geoweighted average				
Percent of teachers with college degrees	0.37	1.27	0.01	19.75
Percent of teachers who are women	0.30	1.19	0.01	15.87
Percent of students who are girls	1.32	3.82	0.06	47.86
Number of schools with family planning curriculum	0.01	0.03	0	0.35
Number of schools with supplemental fees for 1st grade	0.29	0.08	0.00	0.98
Closest school				
Distance to the closest school	10.99	8.75	0	90
Number of schools open	89.98	19.79	37	123
Percent of teachers with college degrees	10.47	17.47	0	100
Percent of teachers who are women	10.81	15.80	0	100
Percent of students who are girls	36.65	16.24	0	81.58
School has family planning curriculum	0.18	0.38	0	1
School has supplemental fees for 1st grade	0.77	0.42	0	1

N=1,227

*When zero has two decimal places minimum values are not exactly zero, they are numbers slightly larger than zero that become zero when only two significant digits are shown.

Table 3. Peason Correlation Coefficients for School Variables, School Level for 1980

	Percent of teachers with degrees	Percent of female teachers	Percent of students female	School has family planning curriculum	School has supplemental fees for 1st grade
Percent of teachers with college degrees	1				
Percent of teachers who are women	-0.073	1			
Percent of students who are girls	-0.486	0.280	1		
School has family planning curriculum	0.282	0.134	-0.154	1	
School has supplemental fees for 1st grade	0.107	0.230	0.018	0.083	1

Table 4. Multilevel Hazard Model Estimates: School Characteristics at Age 13 and Contraceptive Use

	1	2	3	4	5
School characteristics--geoweighted average					
Percent of teachers with college degrees	1.08**				
	(2.33)				
Percent of teachers who are women		1.07*			
		(1.68)			
Percent of students who are girls			1.03**		
			(2.33)		
Number of schools with family planning curriculum				8.91	
				(1.18)	
Number of schools with supplemental fees for 1st grade					4.28**
					(2.40)
School controls					
School characteristics--closest school					
Percent of teachers with college degrees	1.00				
	(1.43)				
Percent of teachers who are women		1.00			
		(0.26)			
Percent of students who are girls			1.00		
			(1.52)		
Number of schools with family planning curriculum				1.18	
				(1.41)	
Number of schools with supplemental fees for 1st grade					0.96
					(-0.41)
Distance to closest school age 13	0.98**	0.98**	0.98**	0.98**	0.98**
	(-2.79)	(-2.68)	(-2.51)	(-2.77)	(-2.68)
Number of schools open (not geoweighted)	1.02***	1.02***	1.02***	1.02***	1.02***
	(3.90)	(3.74)	(3.98)	(3.79)	(3.57)
Controls[a]					
Neighborhood characteristics, age 12					
Distance to nearest health service	1.00	1.00	1.00	1.00	1.00
	(0.81)	(0.64)	(0.68)	(0.73)	(0.72)
Index of non-family organizations within 1 hour before age 12	1.02	1.02	1.02	1.02	1.02
	(0.55)	(0.57)	(0.49)	(0.61)	(0.58)
Individual experiences					
Years of schooling before age 13	0.98	0.98	0.98	0.98	0.98
	(-0.93)	(-0.94)	(-0.95)	(-1.06)	(-0.95)
Index of non-family experiences before age 13	1.10*	1.10*	1.10*	1.10*	1.10*
	(1.86)	(1.97)	(1.98)	(1.85)	(1.95)

(cont).

Table 4. Multilevel Hazard Model Estimates: School Characteristics at Age 13 and Contraceptive Use

	1	2	3	4	5
Parental characteristics					
Father ever went to school	0.82*	0.82*	0.82*	0.82*	0.82*
	(-2.15)	(-2.17)	(-2.24)	(-2.19)	(-2.19)
Father ever worked for pay outside the family before respondent age 12	1.14	1.15*	1.14	1.14*	1.14*
	(1.62)	(1.72)	(1.62)	(1.66)	(1.67)
Mother ever went to school	0.89	0.88	0.89	0.89	0.89
	(-0.88)	(-0.91)	(-0.87)	(-0.90)	(-0.88)
Mother's children ever born	0.98	0.98	0.97	0.97	0.98
	(-1.47)	(-1.50)	(-1.59)	(-1.51)	(-1.50)
Parents ever used contraceptives	0.99	0.99	0.98	1.00	0.99
	(-0.12)	(-0.11)	(-0.21)	(-0.02)	(-0.09)
Ethnicity[b]					
Low caste Hindu	1.03	1.03	1.04	1.01	1.03
	(0.22)	(0.17)	(0.24)	(0.05)	(0.20)
Newar	1.20	1.20	1.21	1.17	1.20
	(1.12)	(1.10)	(1.15)	(0.95)	(1.12)
Hill Tibeto-Burmese	1.32*	1.32*	1.35*	1.32*	1.32*
	(2.12)	(2.10)	(2.29)	(2.09)	(2.12)
Terai Tibeto-Burmese	0.78*	0.76*	0.77*	0.76*	0.77*
	(-1.79)	(-1.95)	(-1.81)	(-1.91)	(-1.87)
Birth cohort[c]					
Born 1976-1972 (age 20-24 in 1996)	1.84***	1.81***	1.84***	1.80***	1.79***
	(4.26)	(4.15)	(4.25)	(4.10)	(4.02)
Born 1971-1967 (age 25-29 in 1996)	1.75**	1.68**	1.77**	1.67**	1.63**
	(2.73)	(2.55)	(2.75)	(2.54)	(2.36)
Born 1966-1952 (age 30-44 in 1996)	1.03	0.95	1.08	0.98	0.91
	(0.10)	(-0.20)	(0.28)	(-0.09)	(-0.34)
Lived in this neighborhood before age 13	0.76**	0.76**	0.76**	0.76**	0.77**
	(-2.45)	(-2.43)	(-2.42)	(-2.50)	(-2.41)
ICC	0.19	0.19	0.19	0.19	0.19
Person months	66274	66274	66274	66274	66274

[a]Includes dummies for calendar month and year and for first month of prospective data collection.

[b]Reference category is Upper caste Hindu.

[c]Reference group is born 1981-1977 (age 15-29 in 1996).

* P < .05, one tailed test; ** P < .01, one tailed test; *** P < .001, one tailed test

Figure 1. Description of Change Over Time in Number of Schools and Their Characteristics, Chitwan, Nepal