Health Services, Attitudes about Children, and Contraceptive Use

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Abstract

The macro-micro link is a fundamental component of sociological theory and empirical research. This paper investigates the relationship between health services and individuals' fertility attitudes and behaviors to help illuminate the mechanisms through which social context influences individuals' behavior. I construct a new theoretical framework that explicitly illustrates how specific dimensions of health services effect behavior. I also provide new information on the social-psychological mechanisms through which social context influences individual behavior by examining the relationship between health services and attitudes. My investigation focuses on a setting in rural Nepal that experienced dramatic social, economic, and demographic changes over the course of current residents' lives. Findings reveal (1) social-psychological mechanisms are a key piece of the social context-individual behavior link; and (2) multiple characteristics of health services exhibit independent effects on fertility attitudes.

Health Services, Attitudes about Children, and Contraceptive Use

A fundamental aspect of sociological inquiry concerns the influence of social context on the individual. A substantial existing body of literature investigating this relationship reveals that health services are one piece of social context related to individuals' fertility behavior. However, the specific mechanisms linking the health services context to individuals have remained elusive. Understanding what these mechanisms are is important for furthering development of theories about the social world and for policy makers who want to design effective programs. By investigating the relationship between specific dimensions of health services, individuals' attitudes regarding children and childbearing, and individuals' contraceptive behavior this paper helps illuminate those mechanisms specific to the link between health context and individual fertility behavior.

Empirical investigations into the macro-micro link have become increasingly common in sociology and social demography, often focusing on family behaviors such as fertility (Alexander 1988; Brewster 1994; Caldwell 1982; Durkheim [1933] 1984; Entwisle and Mason 1985). This research has found that health services are key among the multiple community factors that influence various fertility behaviors (Brauner-Otto et al. Under review; Entwisle et al. 1997). Both the provision of family planning services and maternal and child health services are found to be related to increased contraceptive use (Angeles, Guilkey, and Mroz 1998; Freedman and Takeshita 1969; Sandberg 2006).

Many sociological and social demographic theories are designed to predict changes in family formation resulting from changes in social context, particularly from changes in the health context (Coale 1973; Easterlin and Crimmins 1985; Mason 1987, 1997; Notestein 1953;

Thornton and Lin 1994). However, because of data limitations, efforts to test these theories are often limited to Western countries or other countries with already high levels of non-family opportunities and organizations such as health services, low fertility levels, and widespread use of contraceptives. This lack of empirical tests in settings currently undergoing rapid social change is a notable limitation of the literature on the relationship between social context and individual behavior (Axinn and Barber 2001; Caldwell 1982; Lloyd, Kaufman, and Hewett 2000; Yabiku 2004).

This paper advances our understanding of the mechanisms through which social context influences behavior in four ways. First, I construct a new theoretical framework that explicitly illustrates how specific dimensions of health services effect attitudes and behavior. Second, by empirically examining the relationship between health services and attitudes I provide new information on the social-psychological mechanisms through which social context influences individual behavior. Third, I investigate the relationship between general attitudes about the family and a distant but related behavior, contraceptive use. Although there has been considerable evidence supporting the link between a specific attitude and a closely related behavior (i.e. whether using contraception is acceptable and actual contraceptive use), little evidence has documented the role distal, but theoretical relevant, beliefs may play in an individual's fertility decision making. Fourth, I empirically test this new theoretical framework in an ideal setting currently undergoing dramatic social change; rural Nepal.

Theoretical Significance

The research presented here has three main components: the relationship between health services and behavior; between health services and attitudes; and between attitudes and behavior.

I begin with a discussion of the theoretical link between attitudes and behavior and then discuss the framework for understanding how social context, specifically health services, influences both attitudes and behaviors. I present this framework for examining the effect of social context on attitudes and behaviors together because, as I will demonstrate below, attitudes are a mechanism through which health services may influence behavior.

I rely largely on the theories of planned behavior and reasoned action (Azjen 1985, 1991; Ajzen and Madden 1986), the fertility supply and demand framework (Becker 1960, 1991; Easterlin and Crimmins 1985) and the modes of social organization framework (Thornton and Fricke 1987; Thornton and Lin 1994) in forming my theoretical approach. According to the theory of planned behavior, there are three factors—attitudes, subjective norms, and behavioral control—which affect an individual's intentions and subsequently the individual's behavior (Azjen 1985, 1991; Ajzen and Madden 1986). Both attitudes (an individual's own beliefs about a behavior) and subjective norms (the individual's perceptions of the societal beliefs about the behavior in question) influence intentions. The third predictor of intentions is behavioral control. Behavioral control is the individual's belief about his/her ability to control the behavior or situation and his/her actual ability. Behavioral control influences the individual's intentions towards the behavior and the behavior itself because it serves as a constraint on intentions in addition to influencing intentions; an individual's belief that he can perform a desired behavior may increase his intention to do so.

In the fertility supply and demand framework, the demand for and supply of children jointly determine couples' motivations to control fertility. Motivations, together with fertility regulation costs subsequently determine actual fertility regulation behavior (Easterlin and

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Crimmins 1985). The costs of fertility regulation include psychic costs, such as the couple's attitudes towards contraception, infertility, and children, and monetary costs, such as the actual price of a contraceptive method, the time spent to obtain the method, and the costs of childrearing (Easterlin and Crimmins 1985).

The modes of social organization framework describes a continuum on which populations or societies lie. On one end are the many agrarian, subsistence oriented settings where, historically, most activities were centered on the family and kinship groups. As new non-family organizations and services spread, an important protective activity moves from within the family to outside the family, and more closely resembles populations where all activities are organized outside of the family. In reality, there is no society at either extreme of this continuum, but there most certainly is variation in where they lie and where on the continuum they move to. This change along the continuum is an important part of the fundamental shift in the social organization of daily life that draws individuals out of social networks dominated by family members and into social networks linked to other non-family institutions (Coleman 1990; Thornton and Lin 1994). Once individuals begin to interact with non-family institutions, both their own ideas about certain behaviors and their perceptions of others' ideas about those behaviors begin to change.

Taken together these three theoretical approaches yield two key points relevant for this paper. First, whether referred to as intentions, motivations, or individualism, attitudes play an important role in influencing behavior. Second, the reality of one's environment—the costs of contraception, behavioral control, social norms, and the interactions with non family organizations—also plays an important, influential role in individuals' decision making.

Linking Attitudes to Behavior

A growing body of empirical evidence supports the prediction that attitudes influence behavior (Ajzen 1991; Axinn and Thornton 1992, 1993; Barber 2000; Clarkberg, Stolzenberg, and Waite 1995; Cleland and Hobcraft 1985; Preston 1986). Most of this evidence comes from research in the United States or Western Europe and focuses on the link between an attitude (e.g. marrying at an early age is preferred) and a proximal behavior (e.g. age at marriage) (Jorgensen and Sonstegard 1984; Reineck, Schmidt, and Ajzen 1996). However, the framework described above is not limited to this immediate or proximal attitude-behavior link. In fact, given that societal attitudes, behavioral control, and general attitudes regarding family versus non-family activities are key components, this framework explicitly incorporates more distal or tangential attitudes. Although there have been a few efforts to investigate the relationship between attitudes and more distal behaviors such as the effect of parental attitudes on their children's family formation behavior (Barber 2000; Barber and Axinn 1998) or the effect of attitudes toward women's family roles or competing behaviors on fertility behavior (Barber 2001; Plotnick 1992), this branch of research is far less developed. This paper provides new information for this under-developed body of knowledge by investigating the relationship between attitudes about children and a more distal behavior, contraceptive use.

Attitudes related to contraceptive use. One long-standing theoretical line in demography and economics holds that a major motivating factor behind childbearing is the net benefit couples expect to receive from their children (Easterlin and Crimmins 1985; Cain 1983; Caldwell 1982). Couples weigh the relative costs and benefits of having additional children, and when children are seen as a net cost the couple will use contraception to prevent a pregnancy from occurring

(Becker 1991; Becker and Lewis 1973; Willis 1973). This vein of reasoning is most easily applied to considerations of household production—couples have many children because children decrease the workload for other family members or increase the overall production of the household (Cain 1977). At its most unsophisticated, children's value is their two additional hands of labor. More broadly, couples who do not believe that having additional children will benefit them are more likely to use contraception. For instance, if at a point in time, couples value other goods such as money, education, or even household items more than they value additional children they will likely choose to use contraception to avoid pregnancy (Barber 2001; Edin and Kefalas 2005).

The benefits of children may come from many sources. In addition to immediate economic gains from the children's economic productivity or contribution, parents may gain long-term economic stability or they may see religious or cultural benefits to having children (McGarry and Schoeni 1997; Bennett 1983). Parents may choose to have children to ensure that someone will care for them in their old age. Also, when social norms are highly pro-childbearing, individuals and couples may believe that having children is important, irrespective of the economic value of children. In societies where a woman's social status is determined at least partly by her fertility couples may choose to have children despite it being economically harmful. Couples who believe it is wrong to be childless or who believe that children should care for their aging parents are less likely to use contraception or will use it later to ensure large enough families to obtain these goals.

Other theoretical frameworks also point to the importance of the individual's perception of the relative benefits of children in influencing childbearing behaviors such as contraceptive

use, paying particular attention to the role of individualism in this cost-benefit analysis (Caldwell 1982; Thornton and Fricke 1986; Thornton and Lin 1994). Individuals and couples who are more individualistic are more likely to assess the benefits of other options (the costs of having additional children) as greater than the benefits of additional children. For instance, couples more concerned with their own material gains than with fulfilling religious, cultural, or familial obligations are also more likely to use contraception.

Linking Health Services to Attitudes and Behavior

I now turn to a discussion of how exposure to various dimensions of health services may influence attitudes and behavior related to children and childbearing. Before describing the specifics as they relate to health services, there is one theoretical implication from the framework described above that is important to articulate here: social context may influence individual behavior through both direct and indirect exposure. Direct exposure refers to an individual's active participation in the health service. Indirect exposure refers to formal and informal interactions with children and neighbors who themselves have direct exposure to the health service, interactions with those who work at the health services, and through increased familiarity with the services offered (Caldwell 1982; Mead [1934] 1967; Zajonc 1968). These indirect effects may be particularly strong in a setting where individuals and families have regular contact with one another and intimate knowledge of each other's lives (Brofenbrenner 1970; Smith-Lovin and McPherson 1993; Valente et al. 1997). In such small communities residents are more likely to have the type of formal and informal interactions through which health services indirectly influence behavior.

When thinking about how health services influence behavior, both through direct and

indirect exposure, it is important to remember that health services, like many features of social

context, are generally associated with a specific place, and as they spread and improve, the

distribution of these services across physical space changes. Some evidence clearly points

towards the physical proximity of health services as a key determinant of fertility behavior (Buor

2002, 2003; Entwisle et al. 1997). Nevertheless, research on these topics has not arrived at any

accepted standard for the measurement of the spatial distributions of these services.

Consideration of only the nearest health service may not provide adequate

conceptualization of health services. The nearest provider is not necessarily the only one that is

easily accessible (Brauner-Otto et al. Under Review; Downey 2006). For example, the closest

health service may be a quarter of a mile away, but there may be another health service a third of

a mile away and still another within a half mile—all easily accessible with information about the

services offered at all three locations easily spread within the community. Even more

problematic in terms of data anlysis, there may be multiple health service providers at the same

distance, but in different directions. How is a researcher to know which health service to

consider as influential?

Limiting analysis to only the nearest provider may not fully capture the individual's true

health service context. Instead, consideration of the entire mix of services offered within a

reasonable distance may be more appropriate. Certainly, characteristics of the specific setting

such as the transportation infrastructure will condition this distance, but even then it is difficult,

if not impossible, to determine how far away a health service is before it has no influence on an

individual. In reality, it is likely that the realm of health services' influence does not have a fixed

boundary. Previous research provides evidence that the effect of stationary features of social

context, like health services, has a continuous distribution, much like distance itself, with services in closer proximity having greater influence on the individual than those farther away (Brauner-Otto et al. Under Review; Downey 2006).

Health services, attitudes, and contraceptive use. The protective content of experiences with health services generally affects the lives of individuals by improving their health and well-being. The consequences of the spread of health services are potentially numerous, including increased life expectancy, quality of life, and economic productivity (Berkowitz and Johnson 1974; Entwisle et al. 1997; Muhuri 1995; Orubuloye and Caldwell 1975; Sastry 1996). Thus, new health services constitute a substantial and wide-ranging form of social change. The theoretical framework laid out above illustrates how social change, or specifically increased exposure to non-family organizations, may influence a whole host of attitudes and behaviors. Health services may influence all aspects of the fertility decision-making process—attitudes, desires, social norms, behavioral control, and fertility regulation costs. Therefore, I expect that in addition to the health and well-being improvements that result from a growing health service infrastructure, attitudes about children and childbearing will change as will contraceptive use behavior. Evidence from previous research demonstrates that health services do influence fertility behaviors (Entwisle et al. 1996; Entwisle et al. 1997; Freedman and Takeshita 1969; Knodel et al. 1987). The results presented here will provide new information regarding the specific mechanisms that lead to this observed relationship, notably the degree to which ideational change serves this role.

In the sections below, I discuss the potential mechanisms through which various health services may influence attitudes about children and contraceptive use behavior. The theoretical

framework above illustrates that attitudes may be one of many potential mechanisms at work. As the below discussion will show health services may also influence contraceptive use through other mechanisms such as child mortality or by meeting unmet need for contraception (Casterline and Sinding 2000; Sandberg 2002, 2006).

Family planning services. One mechanism through which health services may influence attitudes about children and contraceptive use behavior is by providing family planning services (contraceptive methods). As early as the 1960s extensive evidence demonstrated that organized family planning programs had substantial influence on couples' childbearing behavior, particularly in terms of contraceptive use and choice of effective methods (Angeles, Guilkey, and Mroz 1998; Entwisle et al. 1996; Freedman and Takeshita 1969; Koenig et al. 1987; Phillips et al. 1982). The provision of contraceptive methods may influence barriers such as lack of information and social pressures to avoid using modern methods. In addition to providing information on effective contraceptive use the provision of family planning services often includes information that may change individual's ideas about children. For instance, family planning motivation programs often include information on the "benefit of small families" and delayed or limited childbearing.

The growth of services in an area may help to spread information about contraceptives, addressing women's concerns about potential side effects from specific methods and reducing social pressure against the use of contraceptives (Mason 1987, 2001; Palmore and Freedman 1969; Stash 1999). Consequently, I expect the increase in the availability of family planning services to influence attitudes about children and childbearing as a result of the provision of methods and through the services that generally accompany method prescription or sale.

Specifically, I expect that women exposed to an increase in the availability of family planning services will be more likely to hold attitudes more favorable to contraceptive use such as placing less importance on childbearing or on the role of children within the family.

   Child health services. A second mechanism through which health services influence attitudes about children and contraceptive use behavior is by providing child health services. Child health services have been promoted as an important influence on fertility related behaviors because they decrease child mortality (Caldwell 1986; Foster 1984; Muhuri 1995; Orubuloye and Caldwell 1975; Pebley 1984). As the research community learned more about individuals' and couples' motivations to have many children, high levels of infant and child mortality were identified as substantial obstacles to the spread of fertility limitation (Bulatao and Lee 1983; Freedman 1987; Lloyd and Ivanov 1988; Mason 1997). In the face of high infant and child mortality, couples wanted many children to insure achievement of their minimum desired family size (Bongaarts and Menken 1983; Chen 1983). If mortality was reduced, couples could achieve their desired family size by having fewer children. These observations led to a proliferation of child health services aimed at keeping young children healthy, lowering infant and child mortality, and thereby reducing the motivation for childbearing and increasing the motivation for contraceptive use. By reducing the need to have many children, child health services were believed to complete the link between lower child mortality and increased fertility limitation. Furthermore, individuals may adjust their attitudes about children and family in response to lowered mortality which would also increase their motivation for contraceptive use. For instance, individuals may change their assessment of the relative value of children versus other goods. When many more children are surviving the additional labor or other benefits they provide to the

household may not be more than their costs.

In fact, the empirical evidence is consistent with the first part of this expectation that child health services do reduce infant and child mortality (Caldwell 1986; Foster 1984; Muhuri 1995; Pebley 1984). Also, it is possible that child health services will influence attitudes about children regardless of their effect on actual child mortality and morbidity. A growing body of evidence indicates that it is parental perceptions of health and mortality risk, not the actual risk, that are a key influence on their childbearing decisions (Mason 1997; Montgomery 2000; Sandberg 2005, 2006).

An increase in the availability of child health services may also influence individual's attitudes about the role of children and of childhood. With the spread of child health services comes an increase in the discourse on investing in children and devoting resources to their health and well-being. Consequently, children may start to be viewed as an opportunity for investment as opposed to being seen for their contributions to the household. This is often referred to as the quantity-quality tradeoff (Becker 1991; Becker and Lewis 1973; Willis 1973). At the same time, health services are one example of the type of non-family institutions referred to in the modes of social organization framework. As child health services spread, individuals, especially mothers, will have more and more interactions occurring outside the family, exposing them to new ideas about children and the family. They are more likely to encounter people with less family oriented beliefs and attitudes such as thinking that the benefits from other options outweigh those of having children, that childbearing is not a necessary option for a fulfilled life, or that children should not be beholden to the family throughout their lives. Consequently, I expect that an increase in the exposure to child health services is related to less family oriented attitudes about

children and increased contraceptive use.

Maternal health services. A third mechanism through which health services may influence attitudes about children and contraceptive use behavior is by providing maternal health services. Just as child health services influence attitudes, fertility, and contraceptive use partly through their effect on child mortality, maternal health services are also important partly due to their effect on maternal health (Koenig et al. 1998; Frankenberg and Thomas 2001). The family unit is less stable when there are high rates and levels of maternal mortality in which case having children may be seen as insurance that there will be surviving family members to carry out the necessary economic, social, cultural, and emotional functions of a family.

Additionally, maternal health services may influence attitudes about women and their roles within the family and society much as child health services influence attitudes about children. Increasing exposure to maternal health services may influence individuals to not limit the roles of women to childbearing and other family functions. The growing investment in women's health may pave the way for new ideas about the importance of childbearing for women—specifically that it is acceptable to remain childless. Health services that convey the risks of childbearing or that provide information regarding the causes of infertility may increase acceptance of childlessness. Increased exposure to maternal health services may also have widespread impact by increasing individualism similar to the effect of the provision of child health services.

With all health services there are two key points. First, health services are one example of the type of non-family institution theoretical and empirically found to be related to more individualistic and less family oriented beliefs and behaviors. Second, because indirect exposure

to health services is important (that is, exposure through paths other than direct participation), and because the realm of influence for health services is not limited to one specific location, when talking about the relationship between the increase in health services and attitudes about children and contraceptive use behavior I am referring to the influcene of the entire health service context an individual is exposed to.

Setting

This research focuses on a setting in rural, south-central Nepal—the Chitwan Valley—where these policy and theoretical applications are exceptionally relevant. Until the 1950s this 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 and implemented malaria eradication efforts. It then instituted a resettlement plan leading to the migration of many different ethnic groups from the more hilly regions. By the late 1970s roughly two-thirds of this valley was cultivated. A small town, Narayanghat, was growing in one corner, but the vast majority of residents were still employed in agriculture and continued to use old, home-centered methods of production.

In 1979 the first all-weather road was completed linking Narayanghat to India and to eastern Nepalese cities. Following that, two other roads were built—one to the west and one north to the capital city, Kathmandu—making Narayanghat the transportation hub for the entire country. This led to the rapid expansion of health services, education, wage labor, markets, and the media (Axinn and Yabiku 2001; Pohkarel and Shivakoti 1986). Between the time the jungle was cleared and 1995, 113 health services were built in Chitwan, in addition to many schools, markets, employment opportunities, and other aspects of social context. Detailed analyses

demonstrate that this spread of non-family institutions occurred at different rates for different areas of Chitwan. So, while access has increased for all residents, the degree to which access has increased varies with time and across geographic space (Axinn and Yabiku 2001; Brauner-Otto et al. Under Review). Important for the research proposed here, these changes in health services did not occur uniformly throughout the study area—different changes in different dimensions of health services occurred at various times for separate segments of the valley. This allows me to examine these changes across time and space.

These physical and community changes were followed by similarly dramatic changes in demographic behavior. For example, the mean age of first marriage rose from approximately 13 for those who married between 1936 and 1945 to approximately 18 for those married in 1966 to 1975 (Yabiku 2004). The total fertility rate (TFR) had been stable around 6 children per woman for as long as records are available (Banister and Thapa 1981; Tuladhar 1989), but has fallen over the 1990s to a TFR of about 4.6 by 2001 (His Majesty's Government 2001; K.C. 2003; Suwal 2001). Because of these concurrent and recent changes in health services and childbearing behavior this setting is ideal for studying the relationship between dimensions of health services, attitudes regarding children, and contraceptive use behavior.

This setting is also ideal because people generally live in small, tightly knit communities so the indirect effects of exposure to health services discussed above are likely to be particularly strong. A typical neighborhood, or *tol*, consists of 5 to 15 households surrounded by farmland. Most activities occur in the outdoor courtyard of each house, in plane view of neighbors, and neighbors will also meet and interact regularly at the common water source and grazing land.

Data

To empirically test my predictions I use data from the Chitwan Valley Family Study (CVFS) conducted in rural Nepal. This study combines survey and ethnographic methods to obtain detailed measures of community context and individual life histories. As argued above, the Chitwan Valley is an ideal setting for this research because the spread of various aspects of health services, changes in the dimensions of these aspects, and changes in attitudes about children and contraceptive use behavior occurred within the lifetimes of the valley's current residents. Also, change in the health services in the Chitwan valley is contained both temporally and geographically making it an ideal setting for evaluating the various aspects of the health context discussed above. It is true that residents would have been able to leave the valley to obtain medical services prior to the building of the first health service provider in the valley. However, those service providers probably had very weak effects on attitudes and behavior because they were so far away.

In 1996, the CVFS collected information from residents of a systematic sample of 171 neighborhoods in Western Chitwan Valley—every resident between the ages of 15 and 59 in the sampled neighborhoods and their spouses were interviewed. Life History Calendar techniques were used to collect reliable retrospective information regarding residents' contraceptive behavior, marital and childbearing behavior, education, and labor force participation (Axinn, Pearce, and Ghimire 1999). The overall response rate of 97 percent yielded 5,271 completed interviews. All interviews were conducted in the most common language in Nepal, Nepali (specific questions appear in their English translation below). Following the 1996 individual interviews the CVFS began collecting monthly prospective data on pregnancies, births, deaths,

marriages, contraceptive use, and changes in living arrangements for all the individuals in the selected households. 151 of the original 171 neighborhoods were selected for this data collection component and 95 percent of respondents were interviewed for 108 months. I analyze data from 1262 women in the CVFS who were under age 45 and had not been sterilized by the 1996 interview. I restrict the sample in this way because women beyond childbearing age or who have been surgically sterilized are not at risk for using contraception to prevent pregnancy.[1] Although contraceptive use is generally a couple level decision, with both husband's and wife's exposure to health services and attitudes playing important roles, this paper focuses on one piece of this complex decision making process—the relationship between wife's exposure to health services, her attitudes about children, and the couples contraceptive use behavior.

The CVFS also collected detailed retrospective accounts of neighborhood resources, including health services. Information regarding changes in health services and other important aspects of community context was collected using the Neighborhood History Calendar (NHC) technique that combines archival, ethnographic, and structured interview methods (Axinn, Barber and Ghimire 1997). The NHC technique was also used to collect Health Service History Calendars on all 113 health service providers that have existed in the Chitwan Valley, regardless of whether that health service provider was active. It is important to emphasize that this data collection technique resulted in measures of community level characteristics that are not constrained by any physical boundaries.

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[1] Although sexually transmitted diseases and infections are becoming more widespread 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 pregnancy prevention so I only examine women at risk of pregnancy occurring.

Measures

Contraceptive use. The dependent variable I use in the models of contraceptive use behavior is

the timing of contraceptive use. I treat this as a transition from not currently using contraceptives

to using contraceptives and code a time-varying, dichotomous variable equal to 1 the month the

respondent uses contraception, and 0 in months prior (but after the 1996 interview). This variable

comes from information collected during the monthly, prospective data collection so it refers to

the time from the 1996 survey forward till 2005. As I describe below, this variable is used to

estimate the hazard of contraceptive use. Forty-eight percent of women in this sample used

contraceptives at some point during prospective data collection period (see Table 1). Table 1

presents descriptive statistics for all individual level measures used in these analyses. The

distributions presented refer to the respondent's last person-month contributed to the analysis; for

women who used contraceptives during the prospective data collection period this is the first

month they used contraception, for women who have not used contraceptives during this period

this is the last month of data collection.

(Table 1, about here)

Attitudes. I look at three measures that capture different aspects of attitudes about children that

may be relevant for an individual's contraceptive use decision making. The first measure

attempts to capture the respondent's assessment of the immediate benefits of children.

Respondents were asked: "Some people think that having many children would help parents do

their work. Do you strongly agree, somewhat agree, or don't agree at all?" I recoded this

measure into a dichotomous measure equal to 0 if respondents strongly agree and 1 otherwise so

that this variable equals one if the respondent thinks that children are not helpful to their parents

and 0 if they strongly agree that children are helpful.[2] Sixty-seven percent of women in my

sample felt that having many children would *not* help parents do their work (Table 1).

The second attitude measure attempts to capture the respondent's assessment of the long-

term benefits of children. Respondents were asked: "Some people think that a married son

should live with his parents in their older age. Do you strongly agree, agree, disagree, or strongly

disagree?" I recoded this measure such that respondents who said they strongly agree or agree

are coded as 0 and those who disagree or strongly disagree are coded as 1.

The third attitude measure attempts to capture the respondent's general attitude regarding

the importance of children and childbearing. Respondents were asked whether they strongly

agree, agree, disagree, or strongly disagree with the following statement: "To be an infertile

woman is the same as not having a life." I recoded this measure such that those who strongly

agree, agree, or disagree are coded as 0 and only those who strongly disagree are coded as 1.

Health services. As discussed above, when considering the effect of health services on

individual behavior it is important to consider all the health services that may influence an

individual. Consequently, the measures of health services I use in these analyses incorporate

information from all the health services that ever existed in this study area capturing the spatial

variation in the distribution of health services. Also important, because the theoretical framework

discussed above refers to change in availability as a key component of the effect of health

services on the individual, these measures also incorporate temporal variation in the distribution

of health services.

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[2] I code this and the other attitude measures such that a positive coefficient in models with attitudes as the dependent or independent variable implies more individualistic or less family oriented attitudes—attitudes resulting from exposure to health services or causing increasing contraceptive use.

I created three measures to capture separate aspects of the health service context: family planning services (the provision of contraceptive methods), child health services (the provision of oral rehydration therapy), and maternal health services (the provision of prenatal services). All three measures capture both the provision of medical services, treatments, or medications and the dispersal of information.[3] For all three aspects I create geographically weighted measures of the change in health service availability which can be represented as:

$$S_{cn}^* = \sum_{h=1}^{113} \left(\frac{S_{ch1994}}{W_{hn}} - \frac{S_{ch1970}}{W_{hn}} \right)$$

where S_{cn}^* is the geographically-weighted service c (e.g. oral rehydration therapy) for neighborhood n, S_{ch1994} is service c offered by provider h in the year 1994, S_{ch1970} is service c offered by provider h in 1970, and W_{hn} is the weight for provider h and neighborhood n. Because previous research and the theoretical framework described above predict that health services farther away will have less of an influence than those closer to the individual, I define W_{hn} as the natural log of the distance between provider h and neighborhood n (Buor 2002, 2003; Downey 2006). Previous research with these data found this specification of the distance decay function to best fit the data (Brauner-Otto et al. Under Review). The summation over 113 health service providers is because that is the total number of health service providers that ever existed in Chitwan.

The choice of reference year, 1970, is to some degree arbitrary. Theoretically, it seemed important to incorporate as much change over the individuals lives into the measures as possible. I chose 1970 as the base year of reference because it was the first year that all three of the health services were available within the study area. This would allow for the measures to incorporate

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[3] It is not possible to separate the effects of information versus service provision in these data.

the greatest amount of change or variation in the geoweighted values (a detailed description of

the pace of change in the availability of health services is beyond the scope of this paper. See

Brauner-Otto et al. Under Review for a such a description.). I tested the sensitivity of the results

presented below to alternative base years and found similar results. The second year, 1994, was

the year before the individual survey was collected—that is, before the measures of respondents'

attitudes were ascertained and before the prospective contraceptive use data was collected.[4] This

change measure allows me to investigate the relationship between a change in health services

over the course of an individual's life on her later contraceptive use behavior. The distributions

at the health service level for these measures are presented in Table 2.

(Table 2, about here)

Controls. I also include measures of characteristics that may influence the likelihood of living

near certain health services, attitudes, and contraceptive use. These controls are all reported in

Table 1.

I include four measures of previous childbearing and contraceptive experiences in these

models. The first measure is a count of the number of children that the respondent gave birth to

before the 1996 interview. This measure is time-invariant and comes from the retrospective Life

History Calendar data. The second measure is time varying, referring to the previous month, and

increments by one for every live birth after 1996. These data come from the prospective data

collection. I created two separate measures of childbearing because the childbearing that occurs

after 1996 also follows the collection of the attitude measures. To ensure proper temporal and

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[4] There is some complication when ensuring temporal ordering because these Nepalese calendar starts in mid-April and some information in the data refers to the Nepalese year and some to the U.S. year. To ensure that the correct temporal ordering is accounted for I include an extra year in the lag between variables.

causal ordering in the models it was important to exclude this behavior from models of the effect

of health services on attitudes. Separating childbearing into two measures will then allow for

greater comparability across the multiple models presented in this paper.

I also include a time invariant measure for the number of the respondent's children who

died before 1996 and another time invariant measure equal to one if the respondent had ever used

a contraceptive method before 1996.[5]

Individual's early non-family experiences may also influence the individual's choice in

community later in life, attitudes, and contraceptive use behavior (i.e. individual's who had used

health services early in life may be more likely to seek out communities with health services

nearby). I use information gathered on the Life History Calendars to create two dichotomous

measures of the individual's experiences with living away from home (alone, in dormitories,

with unrelated individuals, and other non-family possibilities) and non-family work for pay

(wage employment, salaried employment, or owning a business outside the home). Both these

measures are time invariant and equal 1 if the respondent had experienced it before 1992 and

zero otherwise. I use 1992 as the reference year to ensure that these non-family experiences came

before the final year of the health services measures.

Health services are often built in conjunction or in close proximity to other community

services that may have similar influence on attitudes and behavior (Axinn and Yabiku 2001;

Casterline 1985; Gertler and Molyneaux 1994; Hernandez 1981). Schools are of particular

concern because there is some reason to believe that the spread of schools actually produces the

increased availability of health services (Caldwell 1986). If this is true, then access to school

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[5] It is not possible to determine the number of children who died after 1996 for each respondent.

may in fact lead to subsequent changes in health services. Consequently, I include a measure of access to schools in all the models presented here. This measure equals 1 if the respondent had a school within a five minute walk in 1992. Previous research has found a 5 minute walking radius to be the appropriate measure in this setting (Axinn and Yabiku 2001).

I include a measure of childhood community context in the analysis because it is strongly associated with contraceptive use in this setting (Axinn and Yabiku 2001). Respondent's reported whether there was a school, employer, market, or bus transportation within an hours walk from the respondent's neighborhood before age 12. Following previous research I created five separate dummy variables for each of the five services. Each dummy is equal to one if the service was available within an hours walk. I then summed the five measures to create an index of childhood community context. This measure is created from information in the retrospective individual survey interview and it is explicitly designed to capture the strongest possible effect of childhood community context documented in previous research using these data (Axinn and Yabiku 2001).

Parents with education or work experience may choose to move to neighborhoods with greater access to health service providers and other institutions. Therefore, I control for several aspects of family background: father's and mother's education (ever went to school), father's employment (ever had non-family employment before respondent's age 12), mother's children ever born, and parents ever used a contraceptive. Mother's children ever born is included as a count measure and the other four measures are dichotomous indicators.

In all the models I also control for the respondent's ethnicity. Ethnicity in Nepal is complex, multifaceted, and interrelated with religion. A full description of the ethnic groups in

this setting is beyond the scope of this article (see Acharya and Bennett 1981; Bista 1972; Fricke 1986; and Gurung 1980 for detailed descriptions). 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. Each group has different propensities to use contraceptives to stop childbearing and different access to health services. High-caste Hindu is the reference group in the analyses.

To control for previous migration I create a dichotomous measure equal to 1 if the respondent had moved before 1992 and zero otherwise.

Because the prevalence of health services has increased over time I control for birth cohort. I create dichotomous variables for three birth cohorts: 1981-1972 (ages 14-24 at the 1996 survey), 1971-1962 (ages 25-34 at the 1996 survey), and 1961-1951 (ages 35-45). The 1981-1972 birth cohort is the reference group for the analysis.

Analytic Strategy

This paper has four analytic goals: 1) to investigate the relationship between attitudes about children and contraceptive use behavior; 2) to investigate the effect of health services on attitudes about children; 3) to investigate the effect of health services on contraceptive use behavior; and 4) to examine the degree to which attitudes about children are a mechanism through which health services effect contraceptive use behavior. I use the life-course and social organization of the family perspectives to guide the analysis for all four analytic components. I begin with models of the effect of health services on attitudes about children because I use these attitudes to predict later life contraceptive use behavior in the second set of models. The third set of models reintroduces the measures of health services and estimates the effect of health services

on contraceptive use behavior. I then estimate the fourth set of models, adding the measures of

attitudes back into the models to examine the degree to which attitudes about children can be a

mechanism through which health services influence contraceptive behavior. Because the third

and fourth sets of models build directly on the second set I use a nested-model strategy—that is, I

use the same analysis sample in all models (Axinn and Barber 2001; Axinn and Yabiku 2001;

Entwisle, Casterline, and Sayed 1989). This allows me to do two important things. First, I can

assess the extent to which beliefs add to the overall fit of the model. Second, I can observe

changes in the estimated effects of health services and can attribute those changes to the addition

of the attitude measures.

These four separate goals require two different analytic approaches, based on whether the

dependent variable is attitudes or contraceptive use. I describe both methods separately below,

detailing first the strategy for analyzing models of the effects of health services on attitudes and

then the strategy for models with contraceptive use behavior as the outcome. For consistency, I

also present my results in the same order.

Models with attitudes about children as the dependent variable. The analyses of the effect of

health services on attitudes about children focuses on one attitude measure at a time. Because I

have recoded the attitude measures into dichotomous indicators I use multilevel logistic

regression of the form:

$$\ln\left(\frac{p_a}{1-p_a}\right) = \beta_0 X_{jn} + \beta_1 S_n \qquad \text{(equation 1)}$$

where p_a is the probability of holding less family oriented attitudes about children, and p_a /1-

p_a is the odds of holding that attitude. Specifically, it is the odds that the respondent *does not*

think having many children helps parents with their work, that a married son should live with his

parents in their older age, and that being infertile is the same as not having a life. X_{jn} represents

the individual level explanatory variables for individual j in neighborhood n, β_0 represents the

effects parameters of the individual explanatory variables, S_n represents the geoweighted health

service variables for neighborhood n, and β_1 represents effects parameters for these health service

variables.

As I mentioned above, the individuals in our study area are clustered with several living

in the same community who all have the same community characteristics. Consequently, I use

the *GLIMMIX* macro for SAS to estimate all multilevel random-effects logistic regressions in

this paper. This modeling strategy has the added benefit of also addressing the non-random

family planning program placement issue of unobserved heterogeneity. The procedure has been

used in previous research as an attempt to account for this potential problem (Angeles, Guilkey

and Mroz 1998; Brauner-Otto et al. Under Review).

Of course no amount of care in the estimation will create random assignment of health

services to places where it did not exist. Therefore the results I present below should be

interpreted with reasonable caution regarding the nature of the true causal effects our estimates

are designed to reflect. Nevertheless, the estimates are robust to a range of alternative

specifications. In the context of this specific setting this is not surprising—in this part of Nepal

the location of health services was generally determined by the central government and

international assistance organizations with relatively little consideration of local community

differences.

Models with contraceptive use as the dependent variable. I use event history methods to model the risk of using contraception. Because the data are precise to the month, I use discrete-time methods to estimate these models (Allison 1982, 1984; Petersen 1991). Person-months of exposure are the unit of analysis and I consider women to be at risk after they marry for the first time. To account for the clustered nature of the data I follow previous research using these data and estimate multilevel random-effects discrete-time hazard models (Axinn and Yabiku 2001; Barber et al. 2000). Because that specific estimation strategy is explained in detail by Barber et al. 2000, and I follow their technique closely, I do not repeat that description here.

The first set of models I analyze with this technique estimate the effect of attitudes about children on the hazard of contraceptive use. I use logistic regression of the form:

$$\ln\left(\frac{p_c}{1-p_c}\right) = \beta_0 X_{tjn} + \beta_1 A_{jn} \qquad \text{(equation 2)}$$

where p_c is the monthly probability of using a contraceptive method, $p_c/1\text{-}p_c$ is the odds of using a contraceptive method in a month, X_{tjn} represents the individual level explanatory variables at time t for individual j in neighborhood n, β_0 represents the effects parameters of the individual explanatory variables, A_{jn} represents the individual level attitude variables for individual j in neighborhood n, and β_1 represents the effect parameters of the attitude variables in the model. Individual level time-varying measures of characteristics of the respondents are measured in the month *prior* to the current month of contraceptive use.

The second set of models using event history methods I present estimate the effect of health services on the hazard of contraceptive use. This model is similar to equation 2 above except that instead of the term $\beta_1 A_{jn}$ it includes $\beta_1 S_n$ from equation 1:

$$\ln\left(\frac{p_c}{1-p_c}\right) = \beta_0 X_{tjn} + \beta_1 S_n \qquad\qquad \text{(equation 3)}$$

The final set of models I present are the full models that allow me to estimate the degree

to which attitudes may be a mechanism through which health services influence the hazard of

contraceptive use:

$$\ln\left(\frac{p_c}{1-p_c}\right) = \beta_0 X_{tjn} + \beta_1 A_{jn} + \beta_1' S_n \qquad\qquad \text{(equation 4)}.$$

By comparing β_1 and β_1' in equations 3 and 4 I am able to discern the amount of the effect of

health services on the hazard of contraceptive use that is due to the inclusion of the specific

attitude measures in A_{jn}.

Results

Health services and attitudes

Table 3 presents the estimates for models of the relationship between health services and

attitudes about children. The coefficients displayed are the multiplicative effects on the odds of

holding that attitude. 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.

For each attitude measure I present the separate effects of the three geoweighted health

service change measures—family planning methods, oral rehydration therapy, and prenatal care.

All of the measures of health services are positively related to all three attitude measures. That is,

a greater change in the geoweighted distribution of health services corresponds with more

individualistic or less family oriented attitudes. Models 1-3 present the models for the

relationship between health services and the respondent's attitude regarding whether children

help their parents with their work. All three measures of the change in the geoweighted

distribution of health services are positively related to the attitude that having many children would *not* help parents to their work. Specifically, respondents who experienced a one unit increase in the geoweighted distribution of family planning services, oral rehydration therapy, or prenatal care had almost 200 percent higher odds of saying that having many children is not helpful to their parents. I found similarly large effects for the other attitude measures. A one unit increase in the geoweighted distribution of health services corresponded with a 245-260 percent higher odds of reporting that a married son should live with for his parents in their old age (Models 4-6) and a roughly 320-355 percent higher odds of reporting that being infertile is not the same as not having a life (Models 7-9).

(Table 3, about here)

I do not believe we should be wary of the large odds ratios in these models because these measures represent a new way of conceptualizing the health service context and their scale is different from how we typically measure health services. These measures of health services are geoweighted measures of the change in the distribution of all the health services in the study area over time. A one unit increase in the measure of the change in the geoweighted health services distribution corresponds with a dramatic change in the health service context. For instance, if one additional health service located at either end of the study area provided family planning methods in 1995, the mean change in the geoweighted distribution of family planning methods would only increase from 7.56 to 7.67. If the additional health service was located roughly one-third of the way into the study area the mean would increase to 7.68. If all of the health services located in one-third of the study area that were not offering family planning methods in 1995 began to offer them, the mean for this variable would increase to 8.12. Consequently, it may be

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more realistic to think of the consequences of a .10 or .20 unit increase in the geoweighted

change in exposure to family planning services, which is associated with a roughly 10 to 20

percent higher odds of reporting that having many children would not help parents do their work.

So, even when considering only a small increase in the geoweighted exposure to health services,

these results show that increased exposure to multiple types of health services is related to

significantly less family oriented attitudes for a range of attitudes about children.

It is worth noting that the controls included in Table 3 do not perform similarly across the

models. Nor do they necessarily perform consistently in the other tables. However, I include

them in the models because of solid theoretical and empirical evidence that they are important to

the question at hand. A full discussion of their effects is beyond the scope of this paper and for

parsimony I do not discuss them in the paper.

Attitudes and behavior

In Table 4 I present the odds ratios from the multilevel hazard models of the relationship

between attitudes about children and later contraceptive use behavior. 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. Models 1 through 3 show

the separate effects of each attitude on the hazard of contraceptive use. All three attitudes were

positively related to the hazard of contraceptive use—women who reported more individualistic

or less family oriented attitudes about children had higher rates of contraceptive use. The

measure of respondent's attitudes about infertility had the largest effect on contraceptive use—

women who strongly disagreed with the statement that to be infertile is the same as not having a

life had rates of contraceptive use 61 percent higher than other women. This may be because

attitudes about infertility may be more directly related to contraceptive use than attitudes about children's roles within the family.

(Table 4, about here)

Model 4 shows the independent effects when all three measures of attitudes are included in the same model. All three measures of attitudes maintain statistically independent effects in this model. That is, all three of these attitudes simultaneously and independently influence contraceptive use.

Health services and behavior

In Table 5 I reintroduce the measures of change in the geoweighted distribution of health services to the hazard models of contraceptive use and remove the attitude measures. As with their relationship to attitudes about children, all three of the measures of health services were positively and significantly related to the hazard of contraceptive use. Women who experienced more change in their geoweighted distribution of health services had higher rates of contraceptive use than women who experienced less change.

(Table 5, about here)

Health services, attitudes, and behavior

Table 6 presents the models described by equation 4 above and includes both the attitude measures from Table 4 and the health service measures from Table 5. The estimates shown are odds ratios from multilevel hazard models of the relationship between health services, attitudes about children, and the hazard of contraceptive use. Before interpreting these results it is important to clarify that I am not able to determine when a specific attitude was formed, only what it was at the time of the interview in 1996. Consequently, I am not able to empirically

determine whether attitudes are an intervening mechanism through which health services influence contraceptive use, or whether health services are the intervening mechanism through which attitudes influence behavior. However, my theoretical framework guides me to believe that attitudes are the intervening mechanism and I use the temporal ordering embedded in my multilevel event history and prospective panel data to more correctly specify and guide my interpretation of these models.

(Table 6, about here)

The important conclusion from the three models presented in this table is that attitudes about children do appear to be a mechanism through which health services influence contraceptive use behavior. The estimated effects of all three measures of the change in the geoweighted distribution of health services on the hazard of contraceptive use decreases when the measures of attitudes about children are included in the model (Table 6, Models 1-3 compared with Table 5, Models 1-3 respectively). Specifically, the odds ratio for all three measures of the geoweighted distribution of health services are lowered by roughly 6 percent by including these three attitudes in the models.

While this may seem like a small percentage of the total effect that is explained by the inclusion of attitudes, researchers should not be disheartened by these findings for at least three reason. First, the three attitude measures presented in these analyses are simply examples of ways to capture these attitudes among individuals. There may be many other questions and statements that could be used to capture these same attitudes. Second, the theoretical framework I discuss above points to *many* different attitudes that may be relevant to contraceptive use. This paper only examines attitudes about children, and only about very specific aspects of children.

Third, these attitude measures only capture the wife's attitudes. It is likely that husband's, parents', and even neighbors' attitudes also influence behavior and including them in the model would likely yield a larger decrease in the effect estimates for the measures of health services.

Discussion

Demographic research has long focused on the role health services play in influencing individual behavior. Substantial bodies of literature exist documenting the effect that provision of contraceptive services has on individual's contraceptive behavior (Freedman and Takeshita 1969; Knodel et al. 1987). Related research has addressed how access to those services may moderate their effect on individuals (Brauner-Otto et al. Under review; Entwisle et al. 1996; Entwisle et al. 1997). However, far less research has gone beyond studying the direct relationship between contraceptive provision and use or a simple definition of access as being a straight line distance.

Social psychological theories show that numerous factors influence individual behavior. Individuals' and community held beliefs and behaviors all influence individuals' motivations and intentions. Additionally, beliefs and experiences not directly comparable to a specific behavior may influence it. Yet, demographic research has not expanded to investigate these multiple causal pathways (see Barber 2001 and Plotnick 1992 for notable exceptions). The research presented here is an important contribution to both demographic and social psychological literatures because it expands previous demographic models to incorporate the numerous alternative causal influences predicted by social psychological frameworks. The results shown above provide important evidence regarding both the need to expand our previous conceptualizations of common demographic topics and the importance in looking to multiple

theoretical frameworks in demographic research.

The analyses presented in this paper provide evidence that social psychological frameworks may be particularly fruitful in demographic research. Several different measures of individual's attitudes were significantly related to their contraceptive behavior. There are at least three important points to highlight here. First, these findings show that multiple attitudes are simultaneously and independently related to individual's contraceptive use. Second, these results constitute new evidence that attitudes are not just related to their most proximal behavior. These results show that ideas about childlessness, infertility, the relative value of children, and children's roles within the household all influence the rate of contraceptive use. Third, these results directly support both the social psychological and social change aspects of my theoretical framework. As women are increasingly exposed to important non-family organizations, their attitudes become less focused on the family and more individualistic, and they have higher rates of modern contraceptive method use.

Perhaps the most important conclusion from the final set of analyses I present refers to my theoretical framework. Social theories of how macro-level characteristics influence the individual generally detail two potential pathways. On the one hand, changes in social context may allow individuals to act on previously held beliefs and change their behavior. For example, when contraceptives become more readily available people who previously wanted to use contraceptives but could not obtain them are now able to do so. On the other hand, changes in social context may change individual's ideas thereby resulting in observed behavioral changes (Caldwell 1982; Casterline 2001; Lesthaeghe and Surkyn 1988). The research presented here allows us the unique opportunity to differentiate between these two mechanisms. By explicitly

testing the relationship between health services, attitudes that are known to influence

contraceptive use, and actual contraceptive use rates I provide evidence that these pathways are

working simultaneously. By showing that the small selection of attitude measures presented here

decreases the effect of the change in the exposure to health services by 6 percent these findings

illustrate that change in social context allows individual to act on previously held beliefs *and* is

related to ideational change. Of course, the results presented here at not conclusive in anyway.

But they do provide evidence of an ideological effect of social change.

There are also important conclusions regarding the influence of health services. The

analyses presented here represent a new way of thinking about health services, access to services,

and the effect of services on the individual. Theories of how social context influences the

individual point to a range of pathways through which health services influence individuals—

specifically to both direct and indirect exposure. However, empirical research has often been

limited by data in its ability to expand its analyses of indirect exposure. This paper makes an

important contribution by conceptualizing and analyzing the role of health services in terms of

the overall health context an individual is exposed to, and not limiting it to one specific provider.

The dramatic and consistent findings regarding the effect of this inclusive conceptualization of

health services on both attitudes and behaviors should be seen as positive evidence regarding this

more expansive approach to understanding access to health services specifically and social

context in general. Although contextual features are almost always physically confined to one

place, their influence is not similarly limited and as researchers we should explore new ways to

measure and model access and the relationship between context and the individual.

The implications of this research for understanding how access to health services

influences individuals is worth elaborating on briefly. A small, but growing, body of existing research looks at alternative measures of access to health services than simple distance to the nearest provider (Buor 2002; 2003; Entwisle et al. 1996; Entwisle et al. 1997; Frankenberg and Thomas 2001). That work is most certainly informative, but we should not think it is sufficient. The findings I present here remind the researcher that effect of services extends far beyond their walls. Investigations into how these effects spread throughout space may be a fruitful avenue of future research. Research in the fields of network and spatial analysis are likely to be especially informing in this area.

Finally, I would like to remind the reader that the analyses presented here focused on only a few measures of health services and of one domain of wife's attitudes. Our understanding of extent to which health services directly influences contraceptive use as opposed to indirectly through ideational change will be greatly improved by additional research that investigates other aspects of health services, other measures of these attitudes, and measures of other attitudes held by wives, husbands, and other people who may influence the couple's decision to use contraception. Additional research may provide valuable information on how attitudes are shaped in general and more specifically on how social context shapes them.

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Table 1. Individual Level Descriptive Statistics

	Mean	SD	Min	Max
Contraceptive use				
Used any contraceptive method	0.48		0	1
Attitudes				
Having many children would help parents do their work. (reverse coded)	0.67		0	1
A married son should live with his parents in their old age. (reverse coded)	0.13		0	1
To be an infertile woman is the same as not having a life. (reverse coded)	0.03		0	1
Controls				
Total number of children born before 1996	1.83	2.16	0	10
Total number of children born since 1996	0.75	0.87	0	5
Total number of children died before 1996	0.18	0.53	0	4
Ever used contraception before 1996	0.21		0	1
Non family experiences before 1992				
Lived outside of family household before 1992	0.04		0	1
Worked for pay outside the household before 1992	0.34		0	1
Had school within 5 minute walk in 1992	0.49		0	1
Number of non-family organizations in childhood (age 12) community	3.11	1.15	0	4
Family Background				
Father's education (ever went to school)	0.38		0	1
Father's employment (ever had paid employment)	0.45		0	1
Mother's education (ever went to school)	0.10		0	1
Mother's children ever born	5.80	2.46	1	19
Parental contraceptive use (parents ever use)	0.36		0	1
Ethnicity				
High caste Hindu	0.45		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
Moved before 1992	0.80		0	1
Birth cohort				
Born 1981-1972 (Age 14-24 in 1996)	0.58		0	1
Born 1971-1962 (Age 25-34 in 1996)	0.25		0	1
Born 1961-1952 (Age 35-44 in 1996)	0.16		0	1

Note: Descriptive statistics are for 1,262 women and for time-varying measures refer to the last person month of data contributed to the analyses.

Table 2. Neighborhood Level Health Services Descriptive Statistics, Geographically Weighted Distributions

	Mean	SD	Min	Max
Family planning methods				
1969	0.23	0.02	0.20	0.30
1993	7.56	0.23	6.84	8.10
Difference	7.33	0.22	6.64	7.88
Oral rehydration therapy				
1969	1.92	0.08	1.72	2.21
1993	9.03	0.30	8.14	9.71
Difference	7.10	0.22	6.42	7.58
Prenatal services				
1969	1.81	0.06	1.63	2.02
1993	8.69	0.28	7.84	9.38
Difference	6.87	0.22	6.21	7.40

N=171 neighborhoods.

Table 3. Multilevel Logistic Regression Estimates: Relationship between Health Services and Attitudes

	Having many children would help parents do their work. (reverse coded)			A married son should live with his parents in their old age. (reverse coded)			To be an infertile woman is the same as not having a life. (reverse coded)		
	1	2	3	4	5	6	7	8	9
Health Services (geoweighted log of difference between 1994 and 1970)									
Family planning methods	2.92*** (3.40)			2.45* (2.05)			4.19+ (1.33)		
Oral rehydration therapy		2.87*** (3.43)			2.47* (2.11)			4.55+ (1.40)	
Prenatal care			2.95*** (3.43)			2.58* (2.18)			4.41+ (1.38)
Controls									
Total number of children born before 1996	1.01 (0.24)	1.01 (0.26)	1.01 (0.25)	1.13* (1.83)	1.13* (1.85)	1.13* (1.85)	0.97 (-0.35)	0.97 (-0.34)	0.97 (-0.34)
Total number of children died before 1996	0.98 (-0.11)	0.98 (-0.13)	0.98 (-0.12)	0.79 (-1.22)	0.79 (-1.23)	0.79 (-1.23)	1.31 (1.22)	1.31 (1.22)	1.31 (1.22)
Ever used contraception before 1996	1.28+ (1.43)	1.28+ (1.42)	1.28+ (1.41)	0.85 (-0.70)	0.85 (-0.72)	0.85 (-0.73)	0.91 (-0.35)	0.90 (-0.36)	0.91 (-0.36)
Non family experiences before 1992									
Lived outside of family household before 1992	1.85* (1.82)	1.85* (1.83)	1.85* (1.82)	1.33 (0.71)	1.32 (0.71)	1.32 (0.70)	4.49*** (3.36)	4.48*** (3.35)	4.49*** (3.35)
Worked for pay outside the household before 1992	0.78 (-1.72)	0.78 (-1.73)	0.78 (-1.71)	0.76 (-1.36)	0.76 (-1.38)	0.76 (-1.36)	0.87 (-0.56)	0.87 (-0.56)	0.87 (-0.56)
School within 5 minute walk in 1992	0.79 (-1.76)	0.79 (-1.72)	0.80 (-1.69)	1.02 (0.14)	1.03 (0.16)	1.03 (0.19)	0.92 (-0.17)	0.92 (-0.17)	0.94 (-0.14)
Number of non-family organizations in childhood (age 12) community	1.03 (0.41)	1.03 (0.43)	1.03 (0.42)	1.02 (0.22)	1.02 (0.23)	1.02 (0.22)	0.91 (-0.99)	0.91 (-0.99)	0.91 (-0.99)
Family Background									
Father's education (ever went to school)	1.08 (0.51)	1.08 (0.50)	1.08 (0.51)	1.22 (1.00)	1.21 (0.99)	1.21 (0.99)	0.89 (-0.44)	0.89 (-0.44)	0.89 (-0.44)
Father's employment (ever had paid employment)	0.77 (-1.99)	0.77 (-1.98)	0.76 (-2.00)	0.87 (-0.75)	0.87 (-0.75)	0.87 (-0.77)	0.57 (-2.53)	0.57 (-2.52)	0.57 (-2.53)
Mother's education (ever went to school)	0.68 (-1.74)	0.68 (-1.72)	0.68 (-1.73)	0.79 (-0.72)	0.80 (-0.72)	0.79 (-0.73)	2.21** (2.56)	2.21** (2.56)	2.21** (2.56)
Mother's children ever born	0.99 (-0.44)	0.99 (-0.46)	0.99 (-0.46)	1.05 (1.30)	1.05 (1.29)	1.05 (1.29)	0.90** (-2.34)	0.90** (-2.34)	0.90** (-2.34)
Parental contraceptive use (parents ever use)	1.13 (0.84)	1.14 (0.85)	1.13 (0.84)	1.42* (1.73)	1.42* (1.74)	1.42* (1.72)	1.17 (0.61)	1.18 (0.62)	1.17 (0.61)
Ethnicity[a]									
Low caste Hindu	0.69+ (-1.64)	0.69+ (-1.62)	0.69+ (-1.63)	0.56+ (-1.62)	0.56+ (-1.60)	0.56+ (-1.61)	0.72 (-0.66)	0.72 (-0.65)	0.72 (-0.65)
Newar	0.67 (-1.52)	0.69 (-1.44)	0.68 (-1.47)	0.93 (-0.21)	0.95 (-0.15)	0.94 (-0.19)	2.67** (2.56)	2.68** (2.58)	2.67** (2.56)
Hill Tibeto-Burmese	0.80 (-1.08)	0.80 (-1.11)	0.80 (-1.10)	0.99 (-0.04)	0.99 (-0.05)	0.99 (-0.04)	0.56+ (-1.32)	0.56+ (-1.32)	0.56+ (-1.32)
Terai Tibeto-Burmese	0.41*** (-4.81)	0.41*** (-4.80)	0.41*** (-4.82)	1.12 (0.47)	1.13 (0.49)	1.13 (0.49)	0.42* (-1.91)	0.42* (-1.90)	0.42* (-1.91)
Ever moved before 1992	1.66** (2.99)	1.66** (2.97)	1.66** (2.97)	0.91 (-0.37)	0.91 (-0.39)	0.91 (-0.39)	0.78 (-0.84)	0.78 (-0.85)	0.78 (-0.85)
Birth cohort[b]									
Age 25-34 (born 1962-1971)	1.09 (0.46)	1.09 (0.48)	1.09 (0.46)	1.12 (0.45)	1.12 (0.46)	1.12 (0.43)	1.96 (1.99)	1.96 (1.99)	1.95 (1.98)
Age 35-44 (born 1952-1961)	0.67+ (-1.49)	0.68+ (-1.47)	0.68+ (-1.48)	1.44 (1.02)	1.44 (1.03)	1.43 (1.02)	1.95 (1.44)	1.95 (1.44)	1.95 (1.44)
ICC	0.06	0.06	0.06	0.00	0.00	0.00	0.94	0.94	0.94
N	1262	1262	1262	1262	1262	1262	1262	1262	1262
Deviance	1480	1482	1482	941	941	941	196	196	196

[a]Reference category is Upper caste Hindu.

[b]Reference catergory is born 1972-1981.

+ P < .10, one tailed test; * P < .05, one tailed test; ** P < .01, one tailed test; *** P < .001, one tailed test

Table 4. Multilevel Hazard Model Estimates: Relationship between Attitudes and Contraceptive Use [a]

	1	2	3	4
Attitudes				
Having many children would help parents do their work. (reverse coded)	1.13+ (1.30)			1.14+ (1.43)
A married son should live with his parents in their old age. (reverse coded)		1.33* (2.32)		1.33* (2.31)
To be an infertile woman is the same as not having a life. (reverse coded)			1.61* (1.89)	1.63* (1.92)
Controls				
Total number of children born before 1996	1.25*** (5.37)	1.25*** (5.30)	1.25*** (5.35)	1.25*** (5.30)
Total number of children born since 1996	2.78*** (18.15)	2.81*** (18.25)	2.80*** (18.26)	2.81*** (18.17)
Total number of children died before 1996	0.79* (-2.23)	0.79* (-2.12)	0.79* (-2.21)	0.79* (-2.21)
Ever used contraception before 1996	1.36** (2.74)	1.34** (2.62)	1.37** (2.83)	1.33** (2.54)
Non family experiences before 1992				
Lived outside of family household before 1992	1.34+ (1.36)	1.37+ (1.44)	1.36+ (1.42)	1.33+ (1.31)
Worked for pay outside the household before 1992	0.81 (-2.14)	0.82 (-2.06)	0.80 (-2.26)	0.82 (-2.03)
School within 5 minute walk in 1992	0.95 (-0.51)	0.94 (-0.59)	0.94 (-0.59)	0.94 (-0.58)
Number of non-family organizations in childhood community	1.11** (2.48)	1.12** (2.54)	1.11** (2.52)	1.12** (2.57)
Family Background				
Father's education (ever went to school)	0.94 (-0.65)	0.93 (-0.73)	0.94 (-0.62)	0.93 (-0.83)
Father's employment (ever had paid employment)	1.02 (0.25)	1.02 (0.18)	1.01 (0.07)	1.03 (0.38)
Mother's education (ever went to school)	1.00 (0.00)	1.00 (-0.01)	0.99 (-0.08)	0.99 (-0.08)
Mother's children ever born	0.97 (-1.55)	0.97 (-1.53)	0.97 (-1.55)	0.97 (-1.53)
Parental contraceptive use (parents ever use)	1.13+ (1.31)	1.13+ (1.34)	1.13+ (1.29)	1.12 (1.26)
Ethnicity [b]				
Low caste Hindu	1.07 (0.46)	1.08 (0.52)	1.07 (0.44)	1.10 (0.58)
Newar	1.12 (0.60)	1.10 (0.51)	1.11 (0.55)	1.12 (0.59)
Hill Tibeto-Burmese	1.42** (2.48)	1.45** (2.61)	1.41** (2.43)	1.45** (2.58)
Terai Tibeto-Burmese	0.79* (-1.69)	0.78* (-1.78)	0.77* (-1.84)	0.80+ (-1.57)
Ever moved before 1992	1.09 (0.68)	1.11 (0.86)	1.11 (0.81)	1.10 (0.75)
Birth cohort [c]				
Age 25-34 (born 1962-1971)	0.72** (-2.65)	0.72** (-2.63)	0.71** (-2.70)	0.71** (-2.72)
Age 35-44 (born 1952-1961)	0.11*** (-8.04)	0.11*** (-8.10)	0.11*** (-8.14)	0.11*** (-8.11)
ICC	0.17	0.17	0.18	0.18
Person months	66978	66978	66978	66978
Deviance	5932	5930	5930	5923

[a]Includes dummies variables for month since 1996.

[b]Reference category is Upper caste Hindu.

[c]Reference catergory is born 1972-1981.

+ P < .10, one tailed test; * P < .05, one tailed test; ** P < .01, one tailed test; *** P < .001, one tailed test

Table 5. Multilevel Hazard Model Estimates: Relationship between Health Services and Contraceptive Use [a]

	1	2	3
Health Services (geoweighted log of difference between 1994 and 1970)			
Family planning methods	1.85**		
	(2.55)		
Oral rehydration therapy		1.88**	
		(2.65)	
Prenatal services			1.96**
			(2.79)
Controls			
Total number of children born before 1996	1.26***	1.26***	1.26***
	(5.49)	(5.50)	(5.50)
Total number of children born since 1996	2.81***	2.81***	2.81***
	(18.27)	(18.27)	(18.28)
Total number of children died before 1996	0.79*	0.79*	0.79*
	(-2.14)	(-2.14)	(-2.13)
Ever used contraception before 1996	1.34**	1.34**	1.33**
	(2.58)	(2.57)	(2.54)
Non family experiences before 1992			
Lived outside of family household before 1992	1.34+	1.34+	1.34+
	(1.37)	(1.35)	(1.35)
Worked for pay outside the household before 1992	0.80	0.80	0.80
	(-2.28)	(-2.29)	(-2.28)
School within 5 minute walk in 1992	0.90	0.90	0.90
	(-1.01)	(-1.00)	(-0.98)
Number of non-family organizations in childhood community	1.12**	1.12**	1.12**
	(2.54)	(2.55)	(2.57)
Family Background			
Father's education (ever went to school)	0.93	0.93	0.93
	(-0.73)	(-0.74)	(-0.74)
Father's employment (ever had paid employment)	1.00	1.00	1.00
	(-0.05)	(-0.05)	(-0.06)
Mother's education (ever went to school)	0.99	0.99	0.99
	(-0.06)	(-0.05)	(-0.07)
Mother's children ever born	0.97	0.97	0.97
	(-1.52)	(-1.51)	(-1.51)
Parental contraceptive use (parents ever use)	1.13+	1.13+	1.13+
	(1.33)	(1.35)	(1.34)
Ethnicity [b]			
Low caste Hindu	1.07	1.08	1.08
	(0.44)	(0.47)	(0.48)
Newar	1.05	1.05	1.04
	(0.23)	(0.27)	(0.22)
Hill Tibeto-Burmese	1.47**	1.47**	1.47**
	(2.73)	(2.73)	(2.75)
Terai Tibeto-Burmese	0.82+	0.82+	0.82+
	(-1.43)	(-1.39)	(-1.38)
Ever moved before 1992	1.09	1.09	1.09
	(0.73)	(0.70)	(0.70)
Birth cohort [c]			
Age 25-34 (born 1962-1971)	0.71**	0.71**	0.71**
	(-2.75)	(-2.74)	(-2.75)
Age 35-44 (born 1952-1961)	0.11***	0.11***	0.11***
	(-8.19)	(-8.18)	(-8.18)
ICC	0.16	0.16	0.15
Person months	66978	66978	66978
Deviance	5936	5937	5937

[a]Includes dummies variables for month since 1996.

[b]Reference category is Upper caste Hindu.

[c]Reference catergory is born 1972-1981.

+ P < .10, one tailed test; * P < .05, one tailed test; ** P < .01, one tailed test; *** P < .001, one tailed test

Table 6. Multilevel Hazard Model Estimates: Relationship between Health Services, Attitudes, and Contraceptive Use [a]

	1	2	3
Health Services (geoweighted log of difference between 1994 and 1970)			
Family planning methods	1.74*		
	(2.24)		
Oral rehydration therapy		1.77**	
		(2.34)	
Prenatal services			1.84**
			(2.47)
Attitudes			
Having many children would help parents do their work. (reverse coded)	1.12	1.11	1.11
	(1.20)	(1.18)	(1.17)
A married son should live with his parents in their old age. (reverse coded)	1.31*	1.31*	1.30*
	(2.20)	(2.18)	(2.17)
To be an infertile woman is the same as not having a life. (reverse coded)	1.59*	1.59*	1.58*
	(1.81)	(1.81)	(1.80)
Controls			
Total number of children born before 1996	1.26***	1.26***	1.26***
	(5.42)	(5.43)	(5.42)
Total number of children born since 1996	2.82***	2.82***	2.83***
	(18.2)	(18.2)	(18.21)
Total number of children died before 1996	0.79*	0.79*	0.79*
	(-2.18)	(-2.18)	(-2.17)
Ever used contraception before 1996	1.31**	1.31**	1.30**
	(2.36)	(2.35)	(2.33)
Non family experiences before 1992			
Lived outside of family household before 1992	1.31	1.31	1.30
	(1.24)	(1.23)	(1.23)
Worked for pay outside the household before 1992	0.81	0.81	0.81
	(-2.11)	(-2.12)	(-2.12)
School within 5 minute walk in 1992	0.90	0.90	0.90
	(-1.00)	(-0.99)	(-0.98)
Number of non-family organizations in childhood (age 12) community	1.12**	1.12**	1.12**
	(2.62)	(2.64)	(2.65)
Family Background			
Father's education (ever went to school)	0.92	0.92	0.92
	(-0.94)	(-0.95)	(-0.95)
Father's employment (ever had paid employment)	1.02	1.02	1.02
	(0.24)	(0.24)	(0.24)
Mother's education (ever went to school)	0.98	0.99	0.98
	(-0.11)	(-0.10)	(-0.12)
Mother's children ever born	0.97	0.97	0.97
	(-1.50)	(-1.50)	(-1.50)
Parental contraceptive use (parents ever use)	1.12	1.12	1.12
	(1.26)	(1.27)	(1.26)

(cont.)

Table 6. Multilevel Hazard Model Estimates: Relationship between Health Services, Attitudes, and Contraceptive Use (continued)[a]

	1	2	3
Ethnicity[b]			
Low caste Hindu	1.10	1.10	1.10
	(0.58)	(0.61)	(0.61)
Newar	1.07	1.07	1.06
	(0.32)	(0.35)	(0.32)
Hill Tibeto-Burmese	1.50**	1.50**	1.50**
	(2.81)	(2.81)	(2.83)
Terai Tibeto-Burmese	0.84	0.84	0.85
	(-1.21)	(-1.18)	(-1.17)
Ever moved before 1992	1.09	1.09	1.09
	(0.70)	(0.68)	(0.68)
Birth cohort[c]			
Age 25-34 (born 1962-1971)	0.70**	0.70**	0.70**
	(-2.81)	(-2.80)	(-2.81)
Age 35-44 (born 1952-1961)	0.11***	0.11***	0.11***
	(-8.20)	(-8.19)	(-8.19)
ICC	0.17	0.17	0.16
Person months	66978	66978	66978
Deviance	5924	5924	5925

[a]Includes dummies variables for month since 1996.

[b]Reference category is Upper caste Hindu.

[c]Reference catergory is born 1972-1981.

+ P < .10, one tailed test; * P < .05, one tailed test; ** P < .01, one tailed test; *** P < .001, one tailed test