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Determinants of induced abortion: An analysis of individual, household and contextual factors in Rajasthan, India

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Abstract

Background: Most analyses of the determinants of induced abortion in developing countries have considered only a small set of household and individual socio-demographic factors and have treated abortion as an isolated outcome, ignoring its relationship with prior reproductive health and family planning behaviors and experiences.

Objectives: To examine the contextual-, household- and individual-level determinants of induced abortion using data from a large community-based abortion knowledge, attitudes and practice survey in Rajasthan, India and to decompose the probability of abortion into two sequential but interrelated behaviors and events.

Methods: Robust bivariate probit models are used to jointly model the probability of pregnancy and the conditional probability of abortion. Geographic-area stratified models are constructed to examine whether the importance of contextual-level variables differ in urban and rural areas.

Results: We found increased socio-economic status and life cycle factors to be associated both with the probability of pregnancy and with the conditional likelihood of abortion for our total sample. Women reporting personal networks were also more likely to terminate pregnancies, particularly if their network members were purported to have abortion experience. Community knowledge of sex-selective behaviors among others also exerted a significant positive effect on the propensity to terminate a pregnancy. In our rural sub-

sample, community beliefs regarding requirements for husband's consent pre-abortion was also significantly associated with abortion among pregnant women and demonstrated the largest effect estimate of all our covariates.

Conclusion: Individual- and household-level characteristics appear to be the predominant determinants of pregnancy and abortion. The large effect estimate of one of our contextual-level variables, however, underscores the need for further efforts to identify relevant community-level variables, particularly as they may point to factors most amenable to information, education and communication campaigns.

Introduction

The demographic, social and service-delivery determinants of induced abortion are well documented for the United States and many other developed countries. In the developing world, however, where community-based surveys on abortion are rare, little is known about the risk and precipitating factors for abortion. By and large, the data on women seeking abortions in developing countries have come from clinic-based studies (Binkin et al, 1984; Lema et al, 1996; Strickler et al, 2001; Thapa and Padhye, 2001; Nguyen et al, 2002), precluding comparisons between women who obtain abortions with those who do not. While several community-based studies have investigated the determinants of abortion in developing-country settings in recent years (Nair and Kurup, 1985; Shapiro and Tambashe, 1994; Ping and Smith, 1995; Agadjanian and Qian, 1997; Ahmed et al, 1998; Babu et al, 1998; Okonofua et al, 1999; Ahiadeke, 2001; Bairagi, 2001; Calves, 2002; Geelhoed et al, 2002; Guillaume and Desgrees du Lou, 2002; Razzaque et al, 2002; Bose and Trent, 2003; Malhotra et al, 2003; DaVanzo et al, 2004a; DaVanzo et al, 2004b), for the most part, they have considered only a small set of household and individual socio-demographic factors and have treated abortion as an isolated outcome, ignoring its relationship with prior reproductive health and family planning behaviors and experiences.

A more thorough understanding of the determinants of induced abortion in developing countries is important for demographic, programmatic and policy reasons. Indeed, information on socio-demographic differentials in abortion risk can improve our understanding of how this method of fertility control is used by sub-populations at

different stages of the demographic transition. At the programmatic level, identifying the individual factors associated with an increased risk of pregnancy termination can facilitate targeted family planning interventions. Equally important, from a policy perspective, highlighting the contextual factors that deter women from terminating pregnancies, when unintended, can bolster the case for improving access to or the quality of abortion services.

In this paper, we build on the limited body of community-based research on the determinants of induced abortion in developing countries. Using data from a large cross-sectional abortion knowledge, attitudes and practices survey of reproductive-aged women in Rajasthan, India, our study makes two new and important contributions to the existing literature. First, we model jointly the probability of a woman having a pregnancy and the conditional probability of that pregnancy ending in induced abortion, thus better reflecting abortion as the result of a series of sequential and interrelated behaviors and events. Second, our study expands existing analytical frameworks by incorporating contextual-level, in addition to household- and individual-level determinants of induced abortion.

Conceptual framework

There are no known conceptual frameworks for the determinants of induced abortion in developing countries. Adapting a framework developed recently to explore the determinants of abortion in a developed country (Rossier et al, 2003), Figure 1 depicts a broad conceptual model of the determinants of induced abortion in developing countries.

Three elements of this model merit particular attention. First, abortion is portrayed as the result of several conditional and interrelated behaviors and events – namely, sexual intercourse, contraceptive use and pregnancy – each with its own risk and precipitating factors. While these risk and precipitating factors may overlap across behaviors and events, the importance or direction of their effects may differ at the various stages of the process leading to abortion. Explicitly acknowledging the relationship between them provides a more nuanced and comprehensive assessment of the determinants of induced abortion. Indeed, a high likelihood of abortion among a sub-group of women may be explained by a variety of factors. For example, many women in that group may be exposed to sexual intercourse; those who are exposed to sexual intercourse may be unlikely to use contraception; those who use contraception, as well as those who do not, may be especially likely to become pregnant; or those who do become pregnant may be especially likely to have abortions. To distinguish between these possibilities, our model decomposes the probability of abortion into a chain of interrelated and sequential events and behaviors that should be analyzed simultaneously. In doing so, the model posits that these events and behaviors are jointly determined with the decision to have an abortion.[1] Second, both pregnancies reported by women as intended and those reported as unintended may end in induced abortion. One reason for this is that pregnancies that were originally intended may be terminated if subsequently the fetus is found to be malformed, or otherwise non-desirable for socio-cultural reasons. As an example, in the Asian context, an ultrasound revealing a female fetus may lead to what was initially an intended pregnancy being terminated. Additionally, in countries where women have little

[1] Kane and Staiger (1996) demonstrated empirically that pregnancy and abortion are endogenous. Other researchers have suggested that contraceptive use may be jointly determined with decisions about pregnancy and abortion (DaVanzo et al, 2004a).

autonomy, the decision to terminate a pregnancy may be made by other family members, including husbands and mother-in-laws, and thus women may report pregnancies as intended but may also report terminating them. Third, our model depicts abortion and its antecedent events as a function of the interrelated effects of community, contextual, household and individual characteristics. Included under contextual- and community-level factors are norms concerning sexuality, family size, contraception and induced abortion, as well as access to and quality of care, not only of abortion services, but also family planning services. At the household and individual levels, the primary constellations of determinants are socio-economic status and life-cycle factors. Below, we summarize the developing-country, community-based literature, and when relevant the developed-country literature, on the impact of each of these factors on induced abortion.

Community- and contextual-level effects

The literature on the effects of community factors on induced abortion comes almost exclusively from developed countries and mainly from the United States, where policy analysts have long been concerned with the impact of state legislation (including mandatory delay and parental involvement laws), government reimbursement of abortion, government prenatal and pediatric benefits, and the availability of abortion services on pregnancy resolution, particularly among adolescents. Community-based studies examining the effect of legislative restrictions and government funding on abortion have found mixed results. The majority have documented decreased odds of abortion when state legislative restrictions are in place (Joyce and Kaestner, 1996), as government

funding for abortion is restricted (Lundberg and Plotnick, 1990; Currie et al, 1996; Levine et al, 1996; Argys et al, 2000), or as government funding of prenatal and pediatric care is expanded (Joyce and Kaestner, 1996). A few, however, have found no effects at all (Averett et al, 2002), or effects only in sub-populations (Currie et al, 1996). In contrast, studies examining the relationship between access to abortion services and pregnancy termination have shown a uniformly positive association: Whether measured by the percentage of the population living in counties with high-volume providers of abortion, the ratio of obstetrician-gynecologists to births per county or the distance to an abortion provider, increased access to services has been positively correlated with the likelihood that a pregnancy will end in abortion (Joyce, 1988; Lundberg and Plotnick, 1990; Currie et al, 1996; Brown et al, 2000).

Only two studies have examined the impact of community factors on pregnancy termination in developing countries (Ping and Smith, 1995; Rahman et al, 2001). Survey data from a large sample of married women in rural China were used to examine the effect of regional differences in the enforcement of national family size policies on the likelihood of a given pregnancy ending in abortion. Pregnancies to women residing in counties where implementation of the policies had been relaxed were significantly less likely to be terminated than those to women residing in counties were the policies where strictly enforced, even after controlling for individual and household socio-demographic factors (Ping and Smith, 1995). Rahman and colleagues (2001) combined data from a longitudinal demographic surveillance system and a cross-sectional survey in Matlab, Bangladesh, where a controlled, large-scale family planning experiment has been in place

since 1977, to examine the effect of improved access to family planning services on abortion. While abortion rates were significantly lower in the area with better family planning services than in the area with the standard government services, this was attributed to a decrease in unintended pregnancy rates in the treatment area, rather than to any difference in the propensity to abort unintended pregnancies.

With regard to contextual factors – norms regarding abortion at the community level – the literature is particularly scant and pertains exclusively to developed countries (Currie et al, 1996; Brown et al, 2000; Averett et al, 2002). Moreover, the contextual measures used to date have been somewhat distally related to abortion and, not surprisingly, have shown weak effects. For example, a recent study of the determinants of abortion in the United States, which used the predominance of Catholicism in the respondent's county of residence as a proxy for conservative attitudes towards abortion, found no empirical support for an association between community norms regarding abortion and the likelihood of pregnancy termination (Averett et al, 2002).

Household- and individual-level effects

Relative to community and contextual factors, an extensive body of literature exists on the effects of household and individual factors on induced abortion in developing countries, largely from studies conducted in Asia and Sub-Saharan Africa. Regardless of the wide geographic variation in settings, these studies have repeatedly highlighted socio-

economic factors as important determinants of induced abortion.[2] Indeed, higher socio-economic status – whether measured by household standard of living, literacy, educational attainment, employment status or caste – has shown a consistently positive relationship with the likelihood of abortion (Nair and Kurup, 1985; Shapiro and Tambashe, 1994; Agadjanian and Qian, 1997; Ahmed et al, 1998; Babu et al, 1998; Okonofua et al, 1999; Ahiadeke, 2001; Calves, 2002; Geelhoed et al, 2002; Guillaume and Desgrees du Lou, 2002; Razzaque et al, 2002; Bose and Trent, 2003; Malhotra et al, 2003; DaVanzo et al, 2004a; DaVanzo et al, 2004b). Another measure of socio-economic status – urban residence – has shown a positive relationship with abortion in four of the six studies that included both rural and urban respondents and no relationship in the other two, raising the question of whether urbanization is a proxy for improved socio-economic status or other unmeasured and unobservable factors, including differences in access to services (Babu et al, 1998; Okonofua et al, 1999; Ahiadeke, 2001; Geelhoed et al, 2002; Bose and Trent, 2003; Malhotra et al, 2003).

Life cycle factors have also emerged as important individual-level predictors of abortion in developing countries. Most studies have reported an increase in the odds of abortion with increasing age of the woman or an increase followed by a decrease in the late reproductive years, with exceptions coming from studies of adolescents or those conducted in settings where pre-marital intercourse is believed to occur more frequently (Shapiro and Tambashe, 1994; Alvarez et al, 1999; Ahiadeke, 2001; Calves, 2002; Guillaume and Degrees du Lou, 2002; Razzaque et al, 2002; Bose and Trent, 2003;

[2] The only exception appears to be China, where strongly enforced government policies regarding childbearing have been found to negate the effect of household and individual socio-economic status on the probability of abortion (Ping and Smith, 1995).

DaVanzo et al, 2004a; DaVanzo et al, 2004b). In those cases, the woman's age has been inversely related to her probability of having an abortion and, similarly, unmarried women or those in less formal/shorter unions have been found to have significantly higher odds of termination (Shapiro and Tambashe, 1994; Alvarez et al, 1999; Ahiadeke, 2001; Calves, 2002; Guillaume and Degrees du Lou, 2002). Studies have also linked increased parity to pregnancy termination (Ping and Smith, 1995; Ahmed et al, 1998; Ahiadeke, 2001; Bairagi, 2001; Calves, 2002; Malhotra et al, 2003; DaVanzo et al, 2004a), and in the Asian context, son preference (Ping and Smith, 1995; Bairagi, 2001; Malhotra et al, 2003). The desire to space or limit family size and short pregnancy intervals have also been associated with increased odds of abortion (Ahmed et al, 1998; Razzaque et al, 2002; Malhotra et al, 2003; DaVanzo et al, 2004a; DaVanzo et al, 2004b).

The effect of women's autonomy – a construct based on the interaction of socio-economic status and life cycle factors – on the propensity to terminate a pregnancy has received surprisingly little attention in the developing-country literature. Two recent studies in developing countries which did include measures of women's autonomy, however, found it to be an important individual-level predictor of abortion. Indeed, in Turkey and in India, higher levels of emotional autonomy and mobility, respectively, were associated with increased odds of abortion (Akin, 1999; Malhotra et al, 2003).

While our conceptual framework posits that contraceptive use is jointly determined together with sexual activity, pregnancy and abortion, many researchers examining the determinants of induced abortion in developing countries have treated it as an exogenous

variable. Not surprisingly, when included as an individual-level covariate, contraceptive use has shown a consistent and strong relationship with induced abortion in developing countries. For example, in Bangladesh, Cuba and Nigeria, current use of family planning was associated with increased odds of abortion, while in India, ever use of contraception was found to increase the likelihood of abortion (Alvarez et al, 1999; Okonofua et al, 1999; Razzaque et al, 2002; Bose and Trent, 2003). As the measurement of contraceptive use did not necessarily precede pregnancy in those studies, however, it is unclear whether the observed association resulted from increased pre-pregnancy family planning among women who obtain abortions or rather more family planning use post-abortion among those women. Results from the two studies which relied on time-varying measures of contraceptive use suggest that the relationship may in fact reflect a strong desire to control fertility among certain women: Use of contraception in a given pregnancy interval was associated with increased odds of that pregnancy ending in abortion in both studies (Malhotra et al, 2003; DaVanzo et al, 2004a).

Setting and data

Our study is situated in the northwestern Indian state of Rajasthan. A largely rural and desert state, Rajasthan is among the least developed in India and characterized by strong gender disparities. According to the latest National Family Health Survey, only one-third of females aged six and above are literate. Marriage is nearly universal and occurs at a very early age, with almost half of females aged 15-19 already married. Fertility has shown little decrease in the past ten years, with the latest total fertility rate of 3.8 children per women roughly 30% higher than the national average (IIPS and ORC Macro, 2001).

Like many other states in northern India, son preference is believed to be pervasive, resulting in the selective abortion of female fetuses and the latest child sex ratio of 909 females per 1000 males (Census of India, 2002).

In Rajasthan, like elsewhere in India, women have been entitled to legal abortion services for over 30 years, following the enactment of the Medical Termination of Pregnancy (MTP) Act of 1971 (Government of India, 1971). In addition to the medical indications permitted in many other countries, including physical danger to the mother's health, rape and fetal malformations, the MTP Act permits abortion in cases of potential injury to the mother's mental health and, among married women, for contraceptive failure. Abortions must be performed within the first 20 weeks of pregnancy at a facility approved by the government and by a licensed medical practitioner, who has received training in abortion provision from a government hospital or an approved training facility (Government of India, 1971).

Despite the existence of a seemingly liberal abortion policy, important deficiencies in its implementation have contributed to the continued predominance of illegal abortions in India. Access to registered facilities is poor, particularly in rural areas (Khan et al, 1999). Quality of care of legal services is hindered by inadequately trained providers, pervasive infrastructure problems, poor treatment of clients and a lack of counseling (Gupta, 1993; Singh et al, 1997; Barge et al, 1998; Khan et al, 1999; Ramachandar and Pelto, 2002). Additionally, misperceptions regarding the legality of abortion are widespread among women, men and even providers (Gupte et al, 1997; Ganatra, 2000a; Sheriar, 2001;

Malhotra et al, 2003; Elul, 2004). Ultimately, 90% of the estimated 6 million abortions that occur in India each year are believed to be illegal, and unsafe abortion is thought to account for 3% to 18% of all maternal deaths and extensive morbidity (Chhabra and Nuna, 1994; Sood et al, 1995; Ganatra, 2000a; Ganatra, 2000b; Johnston, 2002; Elul, 2004).

Our data come from a 2001 Population Council Abortion Knowledge, Attitudes and Practices survey intended to provide benchmark indicators for a large-scale intervention project to improve safe and legal abortion services in Rajasthan (Elul, 2004). Multi-stage stratified cluster sampling was used to select a sample of 3266 ever-married women between 15 and 44 years of age across six districts of Rajasthan. Due to the geographically focused nature of the intervention, the study districts were purposively selected and the sample was limited to district headquarters and villages and towns lying within a 25 kilometer radius of the district headquarters, as well as one pre-selected town per district and villages lying within a five kilometer radius of those towns. Additionally, urban areas were over-sampled to improve the reliability of estimates for those heterogeneous localities. Separate sampling strategies were followed for urban and rural areas, with wards and villages serving as primary sampling units (PSUs) in each of those geographic areas, respectively. As census maps were unavailable, a listing of 200 consecutive households, beginning at a randomly selected spot, was completed in each randomly selected PSU and served as the sampling frame. In urban areas, 30 households were then randomly selected from the frame, while in rural areas, 20 households were randomly selected. For every selected household, which agreed to participate in the

survey, a list of all members was completed and information was collected on the socio-economic characteristics of the household. Finally, all ever-married women residing in a selected household were invited to participate in a face-to-face interview. Ultimately, 3266 of the 3682 eligible women identified participated, yielding a response rate of 88.7%. As the study districts were purposively sampled, the data cannot be weighted to project the results to the entire state of Rajasthan, and thus generalizations are limited to the sampled areas.

In addition to collecting socio-demographic information, the survey included a detailed pregnancy history designed to capture information on all pregnancies, regardless of their outcomes. To this end, women were first asked to enumerate each pregnancy that resulted in a live birth. For each reported birth, respondents were queried about the intendedness of that child at the time of conception. Using the information on live births, the interviewer constructed birth intervals and asked about pregnancies that did not result in live births in each interval. For example, starting with the interval closest to the survey, the interviewer asked, "Did you have any pregnancies that lasted only a short time between now and the birth of [name], your last child?" For each such reported pregnancy, women were asked if the pregnancy had been intended and the outcome of the pregnancy. Women were asked the same set of questions for each birth interval. We believe that this approach reduced, to some degree, the under-reporting of induced abortions that is common in self-reported survey data (Baretto et al, 1992; Rossier et al, 2003). The survey also included a series of very specific questions on respondents' knowledge about various aspects of abortion legislation in India. Respondents were asked

if abortion was legal and whether husband's consent prior to abortion was mandated by law. They were also asked whether they knew someone who had undergone a sex selective abortion. Data on contraceptive use at the time of the survey were also collected.

In this paper, we combine woman- and pregnancy-based data from the 2571 currently-married women at risk of pregnancy during the five years preceding the survey, and thus at risk of abortion then as well.[3,4] To this end, women appear in the dataset once if they had no pregnancies or only a single pregnancy in the five-year reference period, while those who had more than one pregnancy in that period appear in the dataset multiple times, corresponding to the total number of pregnancies they reported in the reference period. Women who were sterilized (n=576) or whose husbands were sterilized (n=13) more than five years before the survey are excluded entirely from our analysis, as they were not at risk of pregnancy at the start of the reference period. The 347 women who reported being sterilized and the four women who reported that their husbands were sterilized sometime during the five-year reference period contribute events up to the point of sterilization and then self-select out of the dataset. Similarly, as we do not have monthly or yearly data on infecundity or sexual activity, we assume that infecund women or those with no exposure to intercourse also self-select out of the dataset. Thus, in total, our sample consists of 3861 observations, combining woman- and pregnancy-based data.

[3] We use a five-year reference period to minimize the effects of recall bias.
[4] We exclude the 106 divorced, separated or widowed women from our analysis; given the social stigma associated with non-martial pregnancy in India, they would be far more likely to under-report pregnancies and abortions than currently married women. We note, however, that 18 of these women reported at least one pregnancy during the reference period, and one reported an abortion during that period as well.

Methods

Analytical approach

By combining woman- and pregnancy-based data we are able to simultaneously model two of the four principal antecedent events or behaviors depicted in our conceptual framework: pregnancy and the decision to have an abortion.[5,6] To this end, we use a maximum likelihood bivariate probit model with selection (the dichotomous analogue to the Heckman selection model) to jointly identify the determinants of whether or not a woman has a pregnancy, and then whether those pregnancies end in induced abortion or any other outcome (i.e. live birth, spontaneous abortion or stillbirth). This model follows from our conceptual framework by allowing for explicit correlation between the two dependent variables, as well as for the censoring process, thus accounting for potentially significant endogeneity between them (Greene, 2003). As the model fits two equations simultaneously, it permits the parameters that govern the determination of whether a woman has a pregnancy or not to differ from those that govern whether the pregnancy ends in abortion, thus accommodating a key aspect of our conceptual framework. In other words:

(1) $y_{1j} = (x_{1j}'\beta_1 + \mu_{1j} > 0)$, which is the pregnancy selection model;

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[5] While we would also be able to jointly examine the probability of pregnancy and abortion with a woman-based dataset, linking women and pregnancies allows us to examine a larger sample of pregnancies and thus abortions than if each woman appeared only once in the dataset. Additionally, a combined woman- and pregnancy-based dataset permits us to examine the effect of time-varying measures on pregnancy resolution.

[6] We do not have accurate information on sexual activity or time-varying information on contraceptive use, and thus cannot include those pre-pregnancy events and behaviors as dependent variables in our analysis. As described below, we include a measure of contraceptive use at the community level among our independent variables, although it may be endogenous with our dependent variables. Additionally, while our conceptual framework suggests that abortions may result from both unintended and intended pregnancies, due to the small number of abortions in our sample, we are unable to model each of these probabilities separately. Instead, we simplify this model in our analysis by conditioning abortion on all pregnancies, regardless of intentions. In other words: P(induced abortion) = P(pregnancy) * P(induced abortion|pregnancy).

(2) $y_{2j} = (x_{2j}'\beta_2 + \mu_{2j} > 0)$, which is the abortion model;

where: $\mu_{1j} \sim N(0,\sigma)$;
$\mu_{2j} \sim N(0, 1)$;
$corr(\mu_{1j}, \mu_{2j}) = \rho$; and
y_{2j} is only observed if and only if $y_{1j} > 0$.

Independent variables

The independent variables included in our analysis are shown in Table 1. The woman and household variables include both time-varying and fixed measures. Included among the time-varying measures are the woman's age, as well as her reported number of living children and living sons. These variables were measured at the start of the five-year period, and, if the woman had one or more pregnancies during the five-year reference period, prior to each of those pregnancies. The fixed variables, which were measured at the time of the survey, include the type of personal network the respondent had, her religion, the household standard of living and urban-rural residence of the household.[7] We measured respondents' personal networks by combining responses to two different questions: Respondents were first asked to list (but not name) up to five ever-married women aged 15-44 with whom they discuss important matters and share secrets. If they listed at least one such network member, they were then asked whether each woman in their network had attempted abortion in the five years preceding the survey. As numerous studies have documented a link between both social interaction generally and social interaction regarding family planning specifically, on the one hand, and fertility regulation, on the other hand (Entwisle et al, 1996; Montgomery and Casterline, 1996; Kohler, 1997; Kohler et al, 2001; Madhavan et al, 2003; Feyisetan et al, 2003), we

[7] Caste and employment status, two other important fixed variables, were initially included in our analysis, but as they were collinear with individual-level education and geographic residence, they were ultimately excluded.

categorized this variable to reflect both whether respondents had personal networks comprised of ever-married females of reproductive age, and if so, whether they reported that those networks included women who had attempted abortion in the five years preceding the survey. We hypothesized that the presence of a personal network in itself would be positively associated with the likelihood of abortion even if those network members had purportedly not attempted abortion in the five years preceding the survey, and that an even stronger relationship would exist if those networks included women with abortion experience. The household standard of living index was calculated following the approach used in the National Family Health Survey in India and incorporated information on the construction of the house, as well as ownership of land and household goods (IIPS and ORC Macro, 2000).

To develop our contextual variables, we aggregated responses to questions regarding individual education, modern temporary contraceptive use, knowledge of the legality of and restrictions on abortion in India, and familiarity with sex-selective abortion to the PSU level. In doing so, we are able to examine the effect of community education, as well as local norms regarding family planning and abortion on the likelihood of a given pregnancy ending in abortion. In some cases, measuring these variables at the community level also allows us to bypass potentially significant endogeneity problems that would occur if these variables were measured at the individual level. As an example, if knowledge of the legality of abortion in India was measured at the individual level and demonstrated a positive relationship with induced abortion, we would be unable to ascertain whether this relationship resulted from women who are more knowledgeable of

abortion legality having more abortions or from women who have had abortions being more likely to learn about the legality of abortion in India. In calculating these contextual measures, we used our entire survey sample of 3266 women across the total 150 PSUs to better capture community norms and removed the index case of individual *i* when aggregating responses, commonly known as the jackknife method.

The five contextual variables we consider in our analysis are as follows: (1) *community-level education* is the mean years of schooling completed per PSU; (2) *community-level use of spacing methods of contraception* is the percentage of respondents in a PSU who were using a modern spacing method of family planning at the time of the survey; (3) *community-level knowledge of abortion legality* is the percentage of respondents in a PSU who responded correctly that abortion is legal in India in either of two questions, the first asking if abortion was legal in India, and the second querying if there was a law on abortion in India; (4) *community-level beliefs regarding husband's consent* is the percentage of respondents in a PSU who incorrectly believed that husband's consent pre-abortion is mandated by law; (5) *community-level knowledge of sex-selective abortions by others* is the percentage of respondents in a PSU who reported that they knew someone who had a sex selective abortion in the past. As community education level has been associated with lower fertility and increased use of contraception, net of individual education and other individual-level factors (Kravdal, 2002; Moursund and Kravdal, 2003), we expect that it may be positively correlated with use of abortion.[8] As noted

[8] Community education is believed to impact individual fertility through social learning (i.e. knowledge and attitudes are transmitted directly from others by communication and observation), social influence (i.e. more passive imitation of behavior, driven by a desire to gain other people's approval or to avoid sanctions) or more indirect effects (i.e. others' ideas, resources or behaviors can influence society and social

earlier, as we do not have a time-varying measure of contraceptive use at the individual level,[9] we are unable to include it among our dependent variables. Thus, despite potential endogeneity, we include community-level prevalence of spacing methods at the time of the survey among our independent variables to examine the relationship between contraceptive use and abortion. In order to best gauge family planning use among those at risk of pregnancy, we focus solely on use of spacing methods when calculating this variable. This measure provides an indication of the community's desire to control fertility, and also, as community-level contraceptive prevalence is arguably more stable over time than individual use, serves as a proxy for contraceptive use at the start of the reference period. Community-level knowledge of abortion legality and community-level beliefs regarding whether husband's consent is required pre-abortion each tap different aspects of perceptions of abortion access that have been hypothesized to deter women in India from obtaining pregnancy terminations. Indeed, several qualitative and descriptive studies have suggested that women who misperceive abortion to be illegal in India or incorrectly believe that husband's consent is required for abortion may not obtain abortions when faced with unwanted pregnancies (Ganatra et al, 2000b; Duggal and Barge, 2003; Malhotra et al, 2003; Visaria et al, 2003; Elul, 2004). Since widely publicized legislative proscriptions on sex determination tests are likely to lead to severe under-reporting of sex-selective abortions, we use the variable community-level

institutions and therefore behavior more generally) (Bongaarts and Watkins, 1996; Montgomery and Casterline, 1996; Kohler et al, 2001).

[9] The only available individual-level variable was contraceptive use at the time of the survey. In India, as abortion is frequently followed by (voluntary or non-voluntary) adoption of contraception, generally sterilization, including current-use information would distort the relationship between contraceptive use before the index pregnancy and abortion.

knowledge of sex-selective abortions by others as a proxy for the prevalence of such abortions in a given community.

All analyses account for clustering at the PSU, household and respondent levels using the Taylor Linearization Method, and were performed using STATA 7.0.

Results

Table 2 describes the background characteristics of the 2571 women who were at risk of pregnancy (and hence abortion) during the five years preceding the survey, the 1809 who had at least one pregnancy during the reference period, and the 202 who reported at least one abortion in that period. While there are small differences in the background characteristics of women based on their reproductive experiences in the reference period, particularly with regard to those who had at least one abortion, by and large, women in our study were young, uneducated, and Hindu.

Table 3 provides the results of the bivariate probit selection model for our entire sample in the form of coefficients. Model 1 shows the effects of household and individual variables on the risk of pregnancy and, conditional on pregnancy, the risk of abortion. Model 2 adds the community-level measures of education and contraceptive use to the pregnancy equation and all five community-level variables to the abortion equation.

From Model 1, we see that life cycle factors are significantly related to the probability of pregnancy, as well as to the likelihood that a pregnancy will be terminated, albeit the

latter to a lesser degree. While the probability of pregnancy peaks for women in the middle of their childbearing years (i.e. aged 25-34), age is linearly and positively related to pregnancy termination. Increasing parity is negatively correlated with the likelihood of pregnancy and positively correlated with the probability of a pregnancy being terminated. While the number of living sons a woman has is also negatively associated with pregnancy, it has no significant relationship with the likelihood of a pregnancy being terminated. We also see the expected effects of socio-economic status on pregnancy and abortion. Women of high socio-economic status and those who live in urban areas are less likely than their low and middle socio-economic status and rural counterparts, respectively, to get pregnant; once pregnant, though, these woman are more likely to have an abortion. Higher individual educational attainment, however, is associated with a decreased probability of pregnancy but has no significant relationship with a pregnancy being terminated. While personal networks have no effect on the likelihood of pregnancy, as hypothesized, women who report personal networks are significantly more likely to terminate their pregnancies; the effect is particularly strong if those networks include women who reportedly attempted abortion themselves.

In Model 2, the community-level education and contraceptive use variables have been added to the pregnancy equation and all five community-level variables have been to the abortion equation. No community effects emerge in the pregnancy model and only a single marginally significant effect is observed in the abortion model: Pregnancies are more likely to be terminated as a higher percentage of women in the community know someone who has had a sex-selective abortion. Inclusion of the community-level

variables, however, reduces the rural-urban differential in both the pregnancy and abortion models, so much so that residence area is no longer significantly related to either outcome variable. Similarly, individual-level educational differences in the propensity to get pregnant disappear once the community-level variables are included in the analysis.

In Table 4, we explore whether the effects of our individual, household and contextual variables on induced abortion differ in urban and rural areas. As described earlier, in India, rural areas are characterized by poor access to abortion services and low levels of familiarity with abortion legislation. We thus hypothesize that the meaning of the contextual factors may vary by geographic residence area. Using the same variables as in our final model for the total sample, we see that with regard to household and individual factors, some of the previously observed relationships persist in both the urban and rural sub-samples. Women aged 25-34 remain the most likely to get pregnant, and increasing age is still strongly positively associated with a pregnancy being terminated in both geographic areas. Religion continues to have non-significant effects on both pregnancy and abortion across the urban and rural sub-samples.

The effects of other variables differ across the urban and rural sub-samples. For example, in the urban sub-sample, increased parity and number of living sons are both inversely related to pregnancy and not significantly associated with the termination of a pregnancy. In contrast, in the rural sub-sample, increased parity negatively affects the propensity to get pregnant and positively affects the likelihood of a woman having an abortion once pregnant, while the number of living sons has no significant relationship with either

outcome variable. Similarly, household standard of living now shows a strong inverse relationship with the risk of pregnancy in the urban sample and no relationship with that outcome variable in the rural sample. Its effect on the likelihood of a pregnancy ending in abortion, however, is stronger among rural women than among urban women. Additionally, the effect of respondents' personal networks on the likelihood of a pregnancy ending in abortion is now evident only for the rural sub-sample and, among that sub-sample, is particularly strong when the networks include women with abortion experience.

The contextual variables remain largely non-significant in both the pregnancy and abortion models once the data are disaggregated by geographic area. Indeed, the previously observed association between community knowledge of sex-selective abortion behaviors among others and pregnancy termination is not significant in either the urban or rural sub-sample. Among rural women, however, community-level beliefs regarding whether husband's consent is required to obtain an abortion emerges as the strongest predictor of a pregnancy being aborted of all our covariates: The higher the proportion of women in the community who incorrectly believe that husband's consent is required pre-abortion, the less likely rural women are to terminate their pregnancies.

Discussion

We examined the contextual-, household- and individual-level determinants of induced abortion using data from a large community-based abortion knowledge, attitudes and practice survey. Using a model that accounts for endogeneity between abortion and

pregnancy, we decomposed the probability of abortion into two sequential but interrelated behaviors and events. In doing so, we provided a more methodologically rigorous analysis of the determinants of this important method of fertility control.

Our results reaffirm the role of individual-level socio-economic status and life cycle factors in predicting abortion behavior and provide important additional evidence of exactly where in the conditional chain of events leading to abortion these factors exert their influence. Indeed, several of our socio-economic status and life cycle measures were found to operate through effects on both the likelihood of pregnancy and on the conditional decision to terminate a pregnancy, while others had effects on only one stage of the process. In particular, women's age, parity and household standard of living all appear to be strongly related to fertility regulation, impacting both women's propensity to get pregnant and to end a pregnancy. Surprisingly, given the distortion in the child sex ratios documented recently in Rajasthan (Census of India, 2002), we did not find a significant relationship between the number of living sons a woman had and the likelihood of her pregnancies ending in abortion; instead, we found son preference to impact fertility solely by decreasing the likelihood of pregnancy. As several other analyses of the determinants of induced abortion in India have documented a direct relationship between son preference (measured either by the ratio of the desired number of boys to girls or by reports of ultrasound tests indicating female fetuses) and abortion (Bose and Trent; 2003; Malhotra et al, 2003), we believe that women in our survey may have under-reported pregnancies of female fetuses. Additionally, while we find evidence of rural-urban differentials in the propensity to have an abortion in our initial analysis,

once we control for community-level factors, these differences disappear altogether, suggesting that geographic residence serves as a proxy for increased access to services rather than a direct measures of socio-economic status.

Also of particular significance is our finding that rural women who report that they share important and private matters with other ever-married women of reproductive age are more likely to terminate pregnancies and that this effect is particularly strong if those networks include women who reportedly attempted abortion themselves. While there is much evidence supporting the role of social interaction in facilitating contraceptive use in developing countries (Entwisle et al, 1996; Montgomery and Casterline, 1996; Kohler, 1997; Kohler et al, 2001; Madhavan et al, 2003; Feyisetan et al, 2003), to our knowledge, this is the first study to document the effect of such interaction on abortion. While several studies designed to estimate abortion levels have focused on women's networks as a source of prevalence information (Renne, 1997; Rossier, 2002; Rossier et al, 2003; Elul, 2004), our findings suggest that more attention should be given to how social interaction effects the likelihood of abortion.

Unlike previous studies exploring determinants of induced abortion in developing countries, we included several community-level variables in our analysis. In contrast to the literature on the importance of community effects on other health outcomes and behaviors (von Korff et al, 1992; Diez-Roux, 1998) and particularly other reproductive health outcomes and behaviors (Entwisle et al, 1984; Entwisle et al, 1989; Degraff et al, 1997; Mroz et al, 1999; Katende et al, 2003; Kravdal, 2002; Stephenson and Tsui, 2002;

Koenig et al, 2003; Moursund and Kravdal, 2003; Stephenson and Tsui, 2003; Koenig et al, 2004), we found little support for community effects on either pregnancy or abortion. Indeed, only two of our five community-level variables attained statistical significance, and one only marginally: Increased community knowledge of sex-selective behaviors among others was positively associated with abortion among pregnant women for our total sample, and increased community misperceptions regarding husband's consent pre-abortion was negatively related to termination of a pregnancy among our rural sub-sample. In the latter case, however, the effect estimate was highly significant and was by far the largest we observed among all of our covariates, underscoring the importance of community-level beliefs regarding consent requirements in deterring women from terminating their pregnancies. As access to abortion services is already poor in rural India, this finding is particularly worrisome: Indeed, information, education and communication programs are direly needed to clarify the consent requirements for abortion at the community level.

As we found few community-level effects on abortion, it appears that abortion may be determined largely at the individual level in India. Indeed, a previous analysis of the determinants of abortion in several north Indian states, including Rajasthan, concluded that abortion behavior in those states, as compared to in several southern Indian states, was largely a reflection of women's individual characteristics (Bose and Trent, 2003). Before supporting this conclusion, however, further efforts are needed to develop relevant community- and contextual-level variables. As direct measures of access to and quality of services have been shown to impact pregnancy resolution in the United States

(Joyce, 1988; Lundberg and Plotnick, 1990; Currie et al, 1996; Joyce and Kaestner, 1996; Levine et al, 1996; Argys et al, 2000; Brown et al, 2000), and to determine other reproductive health outcomes in developing countries (Entwisle et al, 1984; Entwisle et al, 1989; Degraff et al, 1997; Mroz et al, 1999; Katende et al, 2003; Stephenson and Tsui, 2002; Stephenson and Tsui, 2003; Tuoane et al, 2003), future analyses of the determinants of induced abortion should include such information whenever possible. While abortion providers may be reluctant to share the requisite information in facility surveys, community-based studies can be used to ask women about the available abortion providers and facilities.

Finally, several limitations of our study should be noted. First, despite efforts to elicit complete pregnancy histories, our data may suffer from under-reporting of pregnancies and induced abortions, and mis-reporting of induced abortions as spontaneous abortions or still births. If this is the case, we cannot rule out the possibility that the observed positive association between socio-economic status and abortion may be a function of the greater willingness of women of higher socio-economic status to report abortions, rather than true differences in levels of abortion across status levels, or that several underlying associations were obscured. Second, given the cross-sectional nature of our data, we are unable to definitively sort out several key issues of causal and temporal ordering, particularly among the individual-level variables that we assumed to be fixed across time. Additionally, our data do not permit us to explore several of the key steps in the chain to abortion as depicted in our conceptual framework, most notably sexual activity and individual-level contraceptive use before the pregnancy. Due to the small numbers of

abortions in our data, we were also unable to model the probabilities of unintended pregnancies and intended pregnancies separately and had to condition abortion on all pregnancies. Finally, we were constrained by our lack of information on several key covariates, including fertility desires, expressed son preference, duration of pregnancy intervals and women's autonomy.

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Figure 1. Conceptual framework for the determinants of induced abortion and its antecedent events.

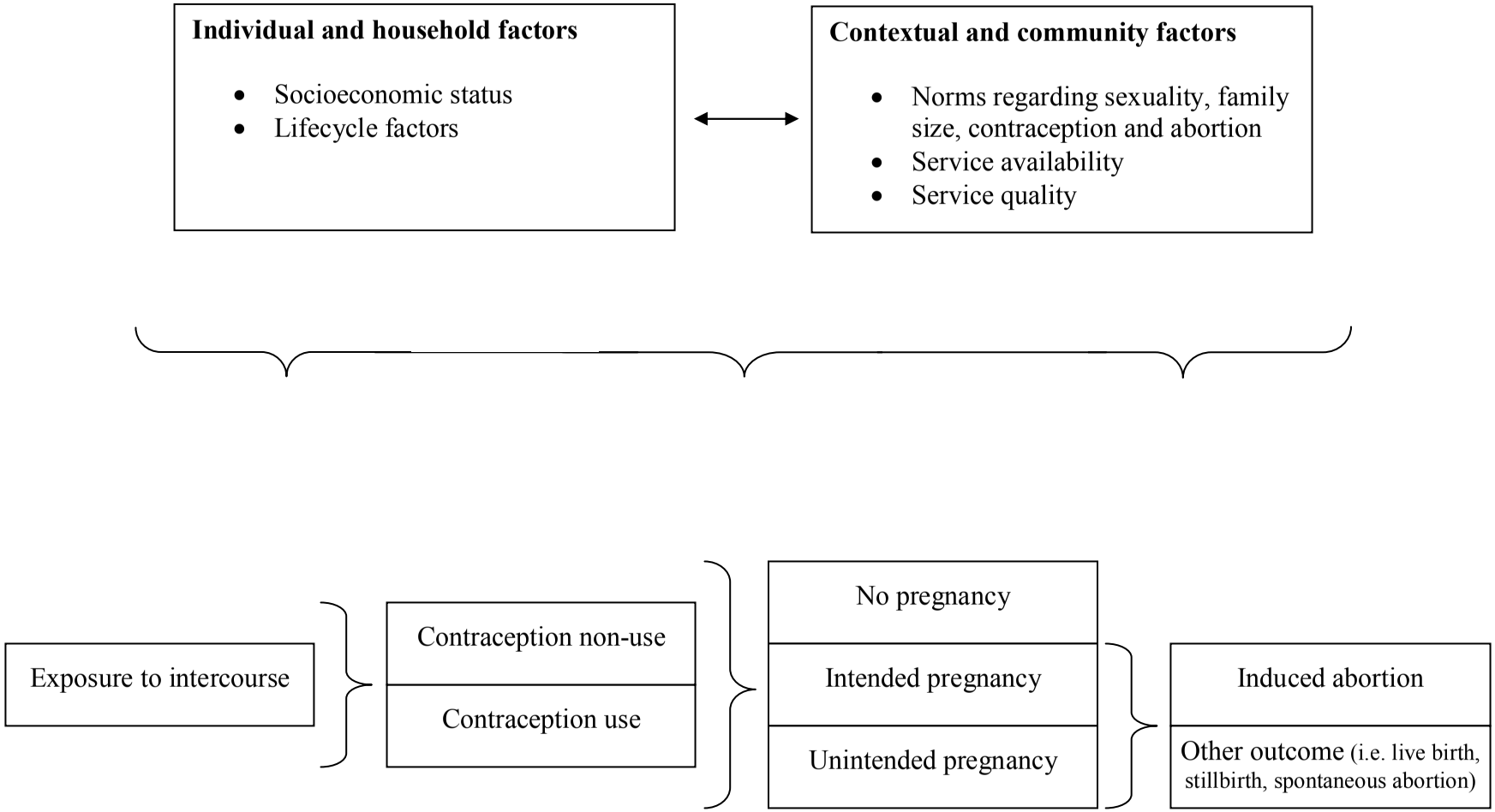

Table 1. Summary of independent variables for analysis.

Variables	Type	Codes / Range (SD)
Woman and household variables		
Age at start of reference period, or at index pregnancy if ≥1 pregnancy in reference period	Categorical	≤ 24 years 25-34 years 35-44 years
Number of living children at start of reference period, or at index pregnancy if ≥1 pregnancy in reference period	Continuous	0-10 (1.25)
Number of living sons at start of reference period, or at index pregnancy if ≥1 pregnancy in reference period	Continuous	0-6 (0.73)
Personal network	Categorical	No personal network Has personal network with no abortion experience Has personal network with abortion experience
Religion	Categorical	Hindu Non-Hindu
Household standard of living index	Categorical	Low Medium High
Household residence area	Categorical	Rural Urban
Contextual variables		
Mean years of completed education	Continuous	0.0 - 13.3 (3.13)
Percent of women currently using modern contraception	Continuous	0.0 - 80.0 (16.74)
Percent of women who know that abortion is legal	Continuous	0.0 - 61.1 (12.46)
Percent of women who believe husband's consent is mandated by law	Continuous	75.0 - 100.0 (3.57)
Percent of women who know someone who has had a sex selective abortion	Continuous	0.0 - 96.3 (21.87)

Table 2. Distribution of respondents at risk of pregnancy, reporting at least one pregnancy, and reporting at least one abortion in the five years preceding the survey.

	At risk of pregnancy	At least one pregnancy	At least one abortion
Percentage of all women at risk of pregnancy five years preceding the survey (n)	100.0 (2571)	69.7 (1791)	7.9 (202)
Woman and household variables			
Age[a]			
≤ 24 years	60.4	67.4	51.5
25-34 years	31.6	29.4	44.1
35-44 years	8.0	3.2	4.4
Number of living children[a]			
0-1 children	53.8	56.2	38.6
2 or more children	46.2	43.8	61.4
Number of living sons (mean)[a]	0.9	0.8	1.2
Education			
Below secondary schooling	74.2	76.4	64.4
Some secondary schooling or more	25.8	23.6	35.6
Personal network			
Does not have personal network	22.0	21.2	15.1
Has personal network with no abortion	73.9	74.3	78.2
Has personal network with abortion experience	4.1	4.2	6.7
Caste/tribe			
Scheduled caste/scheduled tribe	29.0	30.6	25.3
Other backward caste	39.3	39.3	31.7
Upper caste	31.7	30.1	43.0
Religion			
Hindu	81.7	82.2	81.2
Non-Hindu	18.3	17.8	18.8
Household standard of living index			
Low	27.8	30.7	14.4
Medium	37.8	38.6	37.6
High	34.4	30.7	48.0
Household residence area			
Rural	41.5	44.8	23.8
Urban	58.5	55.2	76.2
Contextual variables			
Mean years of completed education	3.2	2.9	4.2
Women currently using modern contraception	41.5	40.2	47.1
Women who know that abortion is legal (%)	15.4	15.2	16.9
Women who believe husband's consent is	77.7	77.9	74.7
Women who know someone who had a sex-	53.2	52.3	62.2

[a]At start of reference period.

Table 3. Bivariate probit estimates of pregnancy and abortion in the five years preceding the survey for total sample.

	Model 1						Model 2					
		Pregnancy			Abortion			Pregnancy			Abortion	
	Coefficient	SE	p-value	Coefficient	SE	p-value	Coefficient	SE	p-value	Coefficient	SE	p-value
Woman and household variables												
Age[a]												
≤ 24 years (ref)	0.000			0.000			0.000			0.000		
25-34 years	0.525	0.064	0.000	0.695	0.090	0.000	0.536	0.064	0.000	0.698	0.092	0.000
35-44 years	0.039	0.098	0.689	1.027	0.147	0.000	0.045	0.098	0.649	1.037	0.147	0.000
Number of living children[a]	-0.495	0.034	0.000	0.196	0.087	0.025	-0.491	0.034	0.000	0.194	0.085	0.023
Number of living sons[a]	-0.227	0.057	0.000	0.036	0.117	0.756	-0.229	0.056	0.000	0.050	0.116	0.664
Education												
Below secondary schooling (ref)	0.000			0.000			0.000			0.000		
Some secondary schooling or more	-0.173	0.083	0.038	-0.024	0.110	0.829	-0.093	0.093	0.315	-0.053	0.128	0.679
Personal network												
Does not have personal network (ref)	0.000			0.000			0.000			0.000		
Has personal network with no abortion experience	0.039	0.074	0.603	0.250	0.107	0.020	0.026	0.075	0.725	0.263	0.109	0.016
Has personal network with abortion experience	0.233	0.156	0.137	0.468	0.199	0.019	0.215	0.157	0.172	0.478	0.205	0.020
Religion												
Hindu (ref)	0.000			0.000			0.000			0.000		
Non-Hindu	0.036	0.078	0.642	-0.107	0.100	0.284	0.020	0.079	0.800	-0.111	0.100	0.268
Household standard of living index												
Low (ref)	0.000			0.000			0.000			0.000		
Medium	-0.142	0.077	0.064	0.443	0.113	0.000	-0.128	0.077	0.095	0.434	0.112	0.000
High	-0.321	0.090	0.000	0.661	0.142	0.000	-0.264	0.094	0.005	0.620	0.139	0.000
Household residence area												
Rural (ref)	0.000			0.000			0.000			0.000		
Urban	-0.202	0.072	0.005	0.330	0.098	0.001	-0.096	0.081	0.234	0.172	0.125	0.167
Contextual variables												
Mean years of completed education							-0.022	0.015	0.142	-0.011	0.022	0.629
Women currently using modern contraception (%)							-0.322	0.259	0.214	0.367	0.336	0.275
Women who know that abortion is legal (%)										-0.133	0.353	0.705
Women who believe husband's consent is mandated by law (%)										-1.305	1.021	0.201
Women who know someone who has had a sex selective abortion (%)										0.531	0.281	0.059
N	3857			3079			3857			3079		
Log pseudo likelihood	-2196.504						-2187.285					

[a]At start of reference period or before the index pregnancy if the woman had ≥1 pregnancy.

Notes: All p-values are from the z-test, ref=reference group, estimates take into account clustering by household and by woman.

Table 4. Bivariate probit estimates of pregnancy and abortion in the five years preceding the survey, by geographic area.

	Urban						Rural					
		Pregnancy			Abortion			Pregnancy			Abortion	
	Coefficient	SE	p-value	Coefficient	SE	p-value	Coefficient	SE	p-value	Coefficient	SE	p-value
Woman and household variables												
Age[a]												
≤ 24 years (ref)	0.000			0.000			0.000			0.000		
25-34 years	0.564	0.086	0.000	0.755	0.098	0.000	0.566	0.093	0.000	0.603	0.160	0.000
35-44 years	0.035	0.137	0.799	1.118	0.171	0.000	0.127	0.137	0.356	0.893	0.270	0.001
Number of living children[a]	-0.500	0.044	0.000	0.113	0.091	0.216	-0.499	0.051	0.000	0.295	0.133	0.027
Number of living sons[a]	-0.337	0.078	0.000	0.103	0.124	0.407	-0.080	0.082	0.332	-0.026	0.202	0.896
Education												
Below secondary schooling (ref)	0.000			0.000			0.000			0.000		
Some secondary schooling or more	-0.144	0.102	0.157	0.031	0.132	0.813	0.356	0.276	0.196	-0.281	0.316	0.375
Personal network composition												
Does not have personal network (ref)	0.000			0.000			0.000			0.000		
Has personal network with no abortion experience	-0.033	0.103	0.746	0.230	0.132	0.081	0.095	0.109	0.380	0.351	0.208	0.091
Has personal network with abortion experience	0.058	0.195	0.766	0.350	0.232	0.132	0.487	0.271	0.072	0.798	0.369	0.030
Religion												
Hindu (ref)	0.000			0.000			0.000			0.000		
Non-Hindu	-0.047	0.091	0.607	-0.103	0.107	0.337	0.234	0.200	0.240	-0.366	0.321	0.254
Household standard of living index												
Low (ref)	0.000			0.000			0.000			0.000		
Medium	-0.295	0.128	0.022	0.324	0.147	0.027	-0.045	0.099	0.650	0.517	0.170	0.002
High	-0.452	0.138	0.001	0.481	0.161	0.003	-0.249	0.142	0.080	0.749	0.232	0.001
Contextual variables												
Mean years of completed education	-0.024	0.017	0.145	-0.025	0.023	0.274	0.112	0.055	0.044	0.069	0.090	0.440
Women currently using modern contraception (%)	-0.234	0.365	0.522	0.605	0.419	0.149	-0.643	0.373	0.085	0.294	0.531	0.580
Women who know that abortion is legal (%)				0.168	0.432	0.698				-0.572	0.584	0.327
Women who believe husband's consent is mandated by law (%)				-0.389	1.213	0.748				-3.663	1.455	0.012
Women who know someone who has had a sex selective abortion (%)				0.372	0.372	0.317				0.683	0.496	0.168
N	2179			1664			1678			1415		
Log pseudo likelihood	-1369.367						-790.611					

[a]At start of reference period or before the index pregnancy if the woman had ≥1 pregnancy.

Notes: All p-values are from the z-test, ref=reference group, estimates take into account clustering by household and by woman.