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ABSTRACT

Population Policy: Abortion and Modern Contraception Are Substitutes*

There is longstanding debate in population policy about the relationship between modern contraception and abortion. Although theory predicts that they should be substitutes, the existing body of empirical evidence is difficult to interpret. What is required is a large-scale intervention that alters the supply (or full price) of one or the other – and importantly, does so in isolation (reproductive health programs often bundle primary health care and family planning – and in some instances, abortion services). In this paper, we study Nepal's 2004 legalization of abortion provision and subsequent expansion of abortion services, an unusual and rapidly-implemented policy meeting these requirements. Using four waves of rich individual-level data representative of fertile-age Nepalese women, we find robust evidence of substitution between modern contraception and abortion. This finding has important implications for public policy and foreign aid, suggesting that an effective strategy for reducing expensive and potentially unsafe abortions may be to expand the supply of modern contraceptives.

JEL Classification: J13, N35

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1. Introduction

There is longstanding debate in reproductive health circles about the relationship between modern contraception and abortion use. Over several decades, population scholars have documented concomitant increases in both contraceptive prevalence and abortion rates around the world in settings as diverse as Cuba, South Korea, Bangladesh, Singapore, Netherlands, Denmark, and the United States (Noble and Potts 1996; Rahman et al. 2001; Marston and Cleland 2003). This phenomenon is commonly attributed to rapid reductions in desired fertility, which in turn increase demand for all methods of birth control (Marston and Cleland 2003).

However, theory predicts that holding demand for birth control constant (and absent absolute moral or religious constraints), women (couples) [1] should use modern contraceptives and abortion interchangeably – that is, they are substitutes (Westoff et al. 1981; Kane and Staiger 1996; Bongaarts and Westoff 2000; Westoff 2000; Rahman et al. 2001; Marston and Cleland 2003).[2] A relative increase in the affordability, availability, or acceptability of one should lead women wishing to regulate their fertility to substitute away

[1] Because we study married women in a patriarchal society, the choice of contraception is likely to be the result of intra-household bargaining. We do not theoretically or empirically distinguish individual preferences from the choices that result from this bargaining process. However, our reduced-form estimates isolate important – and policy relevant – parameters of interest. Recognizing this point, we refer to contraceptive decisions as women's decisions for simplicity throughout the paper.

[2] A separate strand of economic theory, which studies the response of risk-taking behavior to perceived changes in the consequences of a bad outcome (e.g., increased automobile safety, availability of treatment for a medical condition), suggests an additional mechanism through which women who do not want to become pregnant may reduce contraceptive use when access to abortion improves. There is indeed evidence that reducing the cost of a bad outcome may increase risk-taking in other health areas. Examples are Peltzman (1975) on the effect of automobile safety on dangerous driving, Dilley et al. (1997) on HIV treatment and risk-taking among men who have sex with men, and Peltzman (2011) on the effect of medical breakthroughs (e.g., new treatments for heart disease) on offsetting behavior (e.g., obesity).

from the other.[3] Since the mid-1990s (as declining fertility rates have plateaued), global contraceptive prevalence has continued to rise, while abortion rates have declined – a relationship consistent with substitution.

Debate about the relationship between contraception and abortion has fundamental implications for public policy and foreign aid. Importantly, if modern contraceptives and abortions are substitutes, then an effective strategy for reducing expensive and potentially life-threatening abortions may be to boost the supply[4] of modern contraceptives. Two recent analyses of the United States' "Mexico City Policy" (MCP) suggest that by reducing funding for family planning programs, the MCP may have actually reduced the availability of modern contraceptives relative to abortion and thus increased abortion rates (Bendavid et al. 2011, Jones 2011).[5]

Understanding the trade-off between contraception and abortion would also shed light on ways to prevent maternal deaths. Research on the determinants of maternal mortality worldwide suggests that unsafe abortion plays a quantitatively important role. In Latin American and Caribbean countries, a systematic review found that unsafe abortion accounts for roughly 50% more maternal deaths than better-known complications like sepsis (Khan et al. 2006). The World Health Organization estimates that 13% of maternal

[3] The theoretical discussion of the tradeoff between contraception and abortion among demographers has tended to focus on the effect of changing contraceptive prevalence on the abortion rate (e.g., Bongaarts and Westoff 2000). In the economics literature, the tradeoff is understood as going both ways (see Kane and Staiger 1996 for a discussion of the effect of a change in the cost of abortion on contraceptive use). The difference stems from the economic modeling of contraceptive choices as depending on the cost of contraception relative to the cost of not using contraception, which in turn depends on the cost of abortion (see Section 4).

[4] Changes in supply include both changes in availability and changes in the full price of contraception (monetary, social, and emotional price). For brevity, we refer to these changes collectively as 'supply' changes throughout.

[5] First announced in Mexico City in 1984 by President Reagan's administration, the 'Mexico City Policy' requires all non-governmental organizations operating abroad to refrain from performing or counseling women about abortion as a means of fertility control as a condition for receiving U.S. federal funding.

deaths worldwide are linked to unsafe abortion (WHO 2010). Given concerns about under-reporting, existing evidence is also suspected to underestimate mortality from unsafe abortion (Gerdts et al. 2013).

What is needed to establish whether or not the use of modern contraceptives and abortions are complements or substitutes is a large-scale intervention that alters the supply of either one or the other – and importantly, does so in isolation. To date, finding such cases has been challenging because real-world reproductive health programs generally deliver a bundle of services together, making it difficult to disentangle the effect of supply of modern contraceptives or abortion from other program components. As a case in point, the well-known Matlab Family Planning Experiment bundled the provision of modern contraceptives with the provision of both abortion services (menstrual regulation) and child health services, making it difficult to isolate the effect of contraceptive supply (Rahman et al. 2001; Miller and Singer Babiarz 2013).

This paper studies an unusual policy change well-suited to assessing the relationship between the use of modern contraceptives and abortion. Starting in March 2004, Nepal legalized the provision of abortion by selected existing health service providers. In addition to its scale, what distinguishes this policy is that in doing so, Nepal did not expand the supply of modern contraceptives, bundle the legalization of abortion with changes in the provision of any other type of service, or expand the health care workforce. We utilize unusually rich individual-level data representative of fertile age Nepalese women collected in four waves both before and after the legalization of abortion to estimate how the use of modern contraceptives (and other reproductive behaviors) responded to this policy.

We find that the addition of a legal abortion center in one's district is associated with a 2.6% decrease in the odds of using any contraceptive [OR:0.974, 95% CI: (0.961;0.987)], implying that a move from zero to the mean number of centers post-legalization was associated with a reduction in contraceptive prevalence of 2 percentage points - 6% of the pre-legalization prevalence rate. Decomposing this effect among traditional contraceptive methods (such as withdrawal and the rhythm method), female sterilization, and reversible modern methods, we find that the decrease occurs principally among reversible modern methods.

2. Background

2.1. Global and Regional Trends

Globally, contraceptive use and abortion rates have been inversely related over the past several decades. Contraceptive prevalence has increased steadily over the past twenty years, rising from 54.8% to 63.3% between 1990 and 2010 (Alkema et al. 2013). Simultaneously, there has been a steady decline in abortion rates, falling from 35 to 28 abortions per 1,000 women on average worldwide between 1995 and 2008 (Sedgh et al. 2012). These global trends are of course consistent with substitution of modern contraception for abortion, but a number of potentially important confounding factors have also been at work over time (changes in desired fertility, for example).

The inverse relationship between abortion and contraception is particularly evident in formerly socialist Eastern European countries. Under communism, abortion was a major (if not the principal) method of birth control across much of Eastern Europe and Central Asia

(Frejka 1983).[6] After the collapse of communism, abortion rates declined steeply with the diffusion of modern contraceptives during the 1990s (Westoff et al. 1998; Westoff 2000; Pop-Eleches 2010) again suggesting that contraception and abortion may have been used interchangeably.

On the other hand, concomitant increases in both contraceptive prevalence and abortion rates have been observed in a variety of countries further back in time, including Cuba, South Korea, Bangladesh, Singapore, the Netherlands, Denmark, and the United States (Noble and Potts 1996; Rahman et al. 2001; Marston and Cleland 2003). Bongaarts and Westoff (2000) and Marston and Cleland (2003) suggest that these simultaneous increases may occur during transitions to lower fertility if the supply of modern contraceptives fails to keep pace with the reduction in desired fertility. Then, as desired fertility plateaus, substitution between modern contraceptives and abortion should become more evident (Marston and Cleland 2003). This is consistent with global trends since the mid-1990s, as the worldwide decline in fertility decelerated (World Development Indicators 2014).

2.2. Previous Estimates of Substitution between Abortion and Contraception

Many studies of the relationship between contraception and abortion in developing countries are limited to informal analyses of their co-movement. Only a handful of studies have attempted to estimate the causal relationship between the two. Two recent studies investigate changes in abortion and contraceptive use induced by the Mexico City Policy (MCP). Bendavid et al. (2011) compare changes in abortion and contraceptive use over time in countries highly exposed to the Mexico City Policy (MCP) relative to less exposed

[6] The Soviet Union was the first country to legalize abortion in 1920.

countries. The authors find that more exposed countries experienced slower increases in contraceptive prevalence and higher increases in abortion after the re-enactment of the MCP, suggesting that reduced contraceptive supply may have increased the incidence of abortion. Jones (2011) compares abortion rates among women in Ghana during periods in which the MCP is both enforced and not enforced. She finds that rural women are more likely to have an abortion during periods of enforcement, which she links to the increased number of unwanted pregnancies following the reduction in contraceptive supply under the policy.

Rahman et al. (2001) analyzes changes in abortion linked to the Matlab Family Planning Experiment intervention. The authors show that abortion rates fell in treatment villages relative to control villages between 1979 and 1998 (despite increasing secular trends in both contraceptive use and abortion). However, the experimental treatment bundled menstrual regulation [7] services together with the provision of modern contraceptives between 1977 and 1983 (donors then stopped supporting this component of the program). Most of the relative decline in abortion in treatment areas occurred around 1983 – and so is plausibly due to the end of abortion services. Antenatal and child health services were also bundled together with the provision of modern contraceptives beginning in 1978 (Phillips et al. 1984), making it difficult to disentangle the independent contribution of contraceptive supply from improvements in child survival.[8]

Evidence from wealthy countries is also thin. Ananat and Hungerman (2012) find that the availability of oral contraceptives starting at age 16 is associated with a reduction in

[7] The term "menstrual regulation" refers to manual vacuum aspiration procedures carried out after a missed period but before pregnancy is clinically confirmed.

[8] For instance, Phillips et al. (27) find that contraceptive prevalence is independently correlated with some of the maternal and child health components of the Matlab programme, and that the sign of the correlation varies with the type of intervention.

the probability of reporting having had an abortion between ages 16 and 19. Glasier et al. (2004) find no change in abortion rates in Scottish communities following free distribution of advance emergency contraception to women ages 16-29. Finally, Durrance (2013) analyzes the diffusion of emergency contraception through pharmacies in the state of Washington, finding no change in the abortion rate.

3. The Nepalese Natural Experiment

3.1. The Legalization of Abortion in Nepal

Prior to 2002, Nepalese women who terminated their pregnancies faced imprisonment for infanticide.[9] On September 27, 2002, the King of Nepal signed a bill legalizing abortion prior to the twelfth week of pregnancy, prior to the eighteenth week in cases of rape or incest, and at any gestational age with appropriate medical advice (to protect the health of the mother or in cases of severe birth defects, for example) (MOHP, WHO & CREHPA 2006). When this law was enacted, however, Nepalese reproductive health providers were neither permitted nor adequately trained to begin offering safe abortion services. Consequently, there was very little increase in abortion, if any, following this law in 2002 (Valente 2014).

Nepal's first legal abortion services were offered in March 2004, and the number of health centers registered to provide them grew rapidly over time, rising to 141 in June 2006 and 291 by February 2010. To place this expansion into context, the number of registered abortion providers grew from none to nearly twice as many providers per capita as in the

[9] Although imprisonment was not a common outcome among women who had an abortion, among the small population of female inmates in Nepalese prisons (405 in 1997), a substantial proportion is believed to have been convicted on abortion-related charges (Ramaseshan 1997).

United States by 2010 – over a period of just six years.[10] This large-scale policy change has been hailed by advocates as a success, and, according to observers, "Nepal's experience making high-quality abortion care widely accessible in a short period of time offers important lessons for other countries seeking to reduce maternal mortality and morbidity from unsafe abortion" (Samandari et al. 2012, p.1).

Under the policy, senior gynecologists from central and regional hospitals as well as from some NGO and private clinics were trained to become both the first legal abortion providers as well as safe abortion trainers themselves. With the aim to result in rapid national scale-up, training then cascaded from regional and zonal hospitals to public district hospitals (Samandari et al. 2012). The private sector (primarily Marie Stopes International and the Family Planning Association of Nepal) also "fill(s) an important niche in urban areas" (Samandari et al, 2012) and is less prevalent in rural areas – which were home to 83% of the Nepalese population according to the 2011 population census. As a result, more populous districts, districts in the more accessible regions of the country, and urban areas were more likely to have legal abortion services in early years.[11]

Although illegal abortions have always been available to some degree, legalization greatly reduced the effective (quality-adjusted) full price. The cost of a legal abortion ranges

[10] 291 abortion centers in 2010 relative to a total Nepal population of 26.49 Million reported in the 2011 Nepalese population census implies one center per 91,031 inhabitants. In the United States, there were 1,793 abortion providers in 2008 (Guttmacher Institute 2013) relative to a total population of 305 Million (Population Reference Bureau 2008), implying one provider per 170,106 inhabitants.

[11] In addition, Nepal experienced a Maoist insurgency in 1996, which led to a 10-year low- to medium-intensity conflict, peaking in 2002. Conflict areas between 2004 and 2006 may have also experienced slower, less intense increases in the supply of legal abortion. If areas in which abortion supply grew more slowly had pre-existing trend differences in contraceptive use, this could bias our estimates. In Section 7, we show that our results are robust to allowing for more populous districts, districts in more accessible regions of the country, and urban areas to experience differential time trends in contraception – as well as to controlling for conflict intensity.

from Rs800 to Rs2000 (USD11.33 to USD28.33) (MOHP & CREHPA 2006) relative to mean annual income Rs51,978 in 2004 (Central Bureau of Statistics 2004, p.37). Government policy stipulates that poor women are entitled to abortion services free of charge, but eligibility criteria have not been clearly defined, and in practice, they tend not to receive any preferential treatment (CREHPA 2007, Samandari et al. 2012). Comparisons to the cost of illegal abortions are difficult; five case studies in MOHP et al. (2006) report considerable variation (Rs200, Rs500, Rs700, Rs3000, Rs8000). However, legal abortions are much safer, reducing the likelihood of maternal death and post-abortion complications requiring expensive medical care (MOHP et al. 2006).[12] Consistent with legalization reducing the effective (quality-adjusted) price on an abortion, Valente (2014) shows that having a legal abortion center nearby at the start of a pregnancy reduces the probability of carrying the pregnancy to term by 8.1 %.[13]

In contrast to abortion, contraception services are available free of charge through government facilities (and at a subsidized price through social marketing organizations like PSI – and at full price in private facilities) (Shrestha et al. 2012). Condoms, pills, and injectables are provided by all levels of government facilities and providers, while IUDs and implants can be obtained in selected hospitals, primary health centers, and health posts (Shrestha et al. 2012). In the latest Demographic and Health Survey (DHS 2011), 55% (47.5%) of sterilized women (men) were sterilized in a government hospital or clinic, while 19.4% (32.5%) were sterilized through a government-run mobile clinic.

[12] MOHP et al. (2006) reports that costs for post-abortion emergency care can range from Rs2000 to Rs5000.
[13] This figure is based on a binary definition of proximity to a legal abortion centre corresponding to the median distance to the nearest legal abortion centre (28.6 kilometers). Various robustness checks for different definitions of access to a legal abortion centre are presented in Valente (2014).

A unique feature of Nepal's legalization of abortion is its narrow focus. In particular, it was not accompanied by a meaningful increase in the supply of modern contraceptives, an expansion of the reproductive health workforce, or improvements in the provision of other health services. Instead, pre-existing reproductive health care providers were trained and licensed to offer abortion services as part of their existing practices.[14] This feature of Nepal's policy change allows us to isolate changes in the use of modern contraceptives linked directly to expansions in abortion supply (that are not attributable to simultaneous changes in either health service delivery or contraceptive supply that often accompany such changes in abortion policy as in, e.g., Pop-Eleches (2010)).[15]

3.2. Trends in Modern Contraceptive Use and Abortion in Nepal

Figure 1 shows the contraceptive prevalence and abortion rates in Nepal over time. After a rapid, sustained, increase in the use of modern contraceptives from the late 1970s until the mid 2000s (from only 2% to 48%), contraceptive prevalence then plateaued with the legalization of abortion in 2004 (Figure 1 Panel 1). As in other countries, this pattern of co-movement is consistent with substitution (and occurred during a period of declining fertility, with Nepal's total fertility rate falling from 4.6 in 1996 to 2.6 in 2011 (MOHP et al. 2012)).

[14] A survey of Comprehensive Abortion Care (CAC) providers conducted in 2009 revealed that only 8 of 139 surveyed providers introduced new contraceptive services or maternal and child health services at around the same time as they started providing abortion services (Valente 2014).

[15] Of course, most abortion clients receive post-abortion contraceptive counselling (MOHP & CREHPA 2006). This could lead us to underestimate the extent of the substitution away from contraception if women who use abortion services are more likely to use contraception after having had an abortion. However, the results of our statistical analysis are virtually unchanged when excluding women who report having had an abortion within one year of the survey, thus suggesting that post-abortion changes in contraceptive use are not influencing our findings (full results are available on request).

However, these aggregate trends may reflect changes in contraceptive use unrelated to the legalization of abortion. A better test of whether or not the plateauing of contraceptive prevalence is linked to Nepal's increase in abortion supply would use district-level variation in the magnitude of abortion supply. Figure 2 shows the concentration of legal abortion center across Nepal's districts, illustrating that there is substantial geographic variation. Splitting Nepal's 75 districts into terciles of legal abortion center concentration in 2010, Figure 1 Panel 2 shows that plateauing in contraceptive prevalence is greater in districts with higher concentrations of legal abortion centers. Figure 1 Panel 2 also shows that areas with fewer abortion centers initially had lower contraceptive prevalence rates. Our estimation strategy accounts for these baseline differences across districts (due to both observable and unobservable, time-invariant factors), assuming that there are no time-varying omitted variables correlated with both the increase in legal abortion centers and contraceptive use. In Section 7, we report a number of robustness tests showing that our results are unlikely to be driven by time-varying omitted variables.

4. Conceptual Framework

Before turning to our data and methods used to estimate the relationship between abortion supply and contraceptive use in Nepal, we first present a simple conceptual framework to clarify the hypothesis tested in this paper.

To fix ideas, consider the choice between using contraception and not using contraception faced by a woman (couple) who does not want to have a child now (Figure A2). Define C_i, a dummy variable equal to one if woman i uses contraception, and zero

otherwise; A_i is a dummy variable equal to one if woman i has an abortion, and zero otherwise. Finally, define p_f, the probability of failure of the contraceptive method used by the woman (and so $0 < p_f < 1$). For simplicity, we assume that, in the absence of contraception, the woman becomes pregnant with probability one. Assuming a strictly positive probability of less than one does not change the qualitative implications of the model, nor does allowing for imperfect predictions of the probabilities of becoming pregnant with and without contraception.[16] If a woman uses contraception, then with probability $1 - p_f$, she does not become pregnant and therefore never aborts. With probability p_f, she becomes pregnant and either aborts or not. If a woman decides to not use contraception, then she becomes pregnant and either aborts or not.

Now define the costs (financial and psychological) attached to using contraception as c^c, the direct costs attached to having an abortion as c^a, and the net present value of the costs attached to having an unwanted child as c^u, which are all allowed to vary across women. Conditional on being pregnant with an unwanted pregnancy, woman i aborts if and only if $c_i^a < c_i^u$. Woman i will use contraception if and only if her expected cost from using contraception is lower than that from not using contraception, i.e., if and only if[17]:

$$c_i^c < (1 - p_f)c_i^a \; if \; c_i^a < c_i^u$$
$$c_i^c < (1 - p_f)c_i^u \; if \; c_i^a \geq c_i^u$$

[16] The only difference when assuming a probability of becoming pregnant in the absence of contraception inferior to one is that inequality (1) becomes: $c_i^c < p_p(1 - p_f)\min(c_i^a, c_i^u)$, where p_p is the probability of becoming pregnant in the absence of effective contraception, and p_f is the probability of becoming pregnant despite using contraception when contraceptive protection is needed (which is the case with probability p_p). Allowing women to hold erroneous beliefs in terms of p_p and p_f changes the ranges of costs over which women decide to use contraception or not, but does not alter the qualitative conclusions of the model about the effect of a decrease in the cost of abortion relative to contraception.

[17] Note that when $c_i^a < c_i^u$, the expected cost of using contraception is: $p_f(c_i^c + c_i^a) + (1 - p_f)c_i^c = p_f c_i^a + c_i^c$ and the cost of not using contraception is c_i^a. When $c_i^a \geq c_i^u$, the expected cost of using contraception is: $p_f(c_i^c + c_i^u) + (1 - p_f)c_i^c = p_f c_i^u + c_i^c$ and the cost of not using contraception is c_i^u.

In summary, a woman will use contraception if and only if:

$$c_i^c < (1 - p_f)\min(c_i^a, c_i^u) \quad (1)$$

Our hypothesis is that when a legal, safe, and affordable abortion center opens in a woman's district of residence, c_i^a decreases while all the other parameters of the model remain constant, and hence $\min(c_i^a, c_i^u)$ either decreases or stays the same. Therefore, given that $1 - p_f$ is positive, inequality (1) becomes less likely to hold and fewer women use contraception, resulting in substitution of abortion to contraception.

Previous studies estimating the trade-off between contraceptive use and abortion generally analyze how abortion use responds to changes in contraceptive supply. This approach relies heavily on the accuracy of abortion reporting, which is known to be poor in survey data (Jones and Forrest 1992). In contrast, our study investigates how the use of modern contraceptives responds to the provision of legal abortion centers. In doing so, we provide a test of whether or not women decide not to use contraception *up-front* when it is less difficult/costly to have an abortion (rather than whether or not they are less likely to have an abortion *ex-post* when the supply of contraceptives increases).

5. Data and Methods

5.1. Data on Nepalese Women and Legal Abortion Centers

To measure modern contraceptive use among Nepalese women, we use four waves from the Nepalese Demographic and Health Surveys (DHS), two pre-legalization and two post-legalization (Demographic and Health Surveys of Nepal 1996-2011). Collecting nationally representative data from fertile-age women (defined as ages 15-49) in 1996, 2001, 2006, and 2011, these surveys provide the best available information about

reproductive behavior among Nepalese women. Each wave includes a household survey (collecting general information about household composition and socio-economic characteristics), and an individual survey administered to all fertile-age women (including questions about current and retrospective fertility regulation practices over the preceding four or five years – as well as complete retrospective fertility histories detailing all pregnancies, including those that did not end in a live birth). We restrict the sample to married women (because the 1996 and 2001 surveys only included married women), but we also assess the robustness of our results to alternative approaches.[18] Our pooled sample across these four survey waves includes 32,098 women.[19]

A brief note about the use of contemporaneous data (from survey years only) versus retrospective contraceptive history data (for years prior to the survey year, as recalled by respondents in survey years) is warranted. An important virtue of using only contemporaneous data is that it minimizes measurement error in reported use of modern contraceptives.[20] The drawbacks of using only contemporaneous data are the possibility of lower statistical power (because of smaller sample sizes) and less flexibility to examine the evolution of contraceptive use over time relative to the expansion of legal abortion centers.

[18] For example, we also restrict our sample to women ages 25 and above, among whom marriage is nearly universal – 97.3% of respondents ages 25 and above in the 2006 and 2011 were married at the time of interview. Focusing on married women is consistent with the composition of legal abortion service clients in Nepal. A survey carried out by CREHPA in 2006 indicates that nearly 98% of clients were or had been married, close to 60% were between 20 and 29 years old (only 5% were under 20), and less than 7% had no living child (23%, 40%, and 31%, had one, two, and three or more living children, respectively) (MOHP & CREHPA 2006). An international comparison of legal abortion service client characteristics suggests that the characteristics of Nepalese clients are generally comparable to those observed in other less developed countries (Bankole et al. 1999, MOHP & CREHPA 2006).

[19] 40,622 women were interviewed in total (8,429 in 1996, 8,726 in 2001, 10,793 in 2006 and 12,674 in 2011). After dropping 2,175 women who are not usual residents of the household in which they are observed, 6,348 unmarried women interviewed in 2006 and 2011, and one woman whose level of education is missing, we obtain the final sample of 32,098.

[20] The question asked in the DHS is "Are you currently doing something or using any method to delay or avoid getting pregnant?,"

Although we cannot be certain about how much measurement error exists in the retrospective recall data about contraceptive use, studies of contraceptive history recall error suggest substantial limitations in the use of such recall data (Strickler et al. 1997, Beckett et al. 2001).[21] Beyond contraceptive use, more recent research suggests that the quality of recall data deteriorates very rapidly and that the length of the recall period influences self-reported morbidity and use of health services in ways not previously demonstrated (Das et al. 2012).[22] Given these concerns, the availability of an unusually large number of DHS waves for our analysis (four), and the fact that we have adequate power to examine the correlation between trends in contraceptive use and the intensity of abortion supply (as shown in Section 6), we focus on contemporaneous data in our analysis.

We use the total number of legal abortion centers in each district, month, and year to measure the intensity of abortion supply. We constructed this measure using administrative records from the Nepalese Technical Committee for Implementation of Comprehensive Abortion Care (TCIC 2010) containing exact registration dates for each legal abortion facility authorized before February 2010. We then assign intensity of abortion supply to each

[21] Strickler et al. (1997) and Beckett et al. (2001) compare contraceptive use by the same woman for the same periods of time – but reported at two different survey dates – and find that there are substantial inconsistencies at the disaggregated level. Specifically, Strickler et al. (1997) find that, among Moroccan women reporting at least one period of contraceptive use, only 45.1% reported periods of use and non-use in the same order in two different surveys, and only 29.3% reported the same sequence and length of contraceptive use. Similarly, when comparing individual reports of contraceptive use in contemporaneous and recall data for Malaysia, Beckett et al (2001) obtain a Kappa coefficient of only 0.38. In the presence of misclassification (e.g., reporting not using contraception when in fact using and vice-versa), Hausman et al. (47) show that estimates are inconsistent and their precision can be overstated.

[22] Note that recall error for the variables examined by Das et al. (2012) – which include visits to the doctor and self-medication – is very relevant to recall error in contraceptive use, but less so for more salient events such as the birth of a child.

individual woman in our pooled DHS sample at the district-month-year level (according to her interview date).[23]

Table 1 reports descriptive statistics both for our pooled sample and separately for each survey year. The first row reports the mean number of legal abortion centers in the woman's district in each survey wave. The intensity of abortion supply varies considerably both across survey waves and across districts within each post-legalization wave. On average, women interviewed in 2006 had 2.72 centers in their district (s.d.: 2.997), and this number rises to 6.34 (s.d.: 6.702) by 2011.

The next eight rows then summarize modern and traditional contraception and abortion. Modern contraceptive use increases between each survey wave until 2006 (from 27% in 1996 to 46% in 2006) but then ceases to rise between 2006 and 2011. Among modern methods, the most common is female sterilization, but reversible methods account for most of the increase in contraceptive prevalence between survey waves. In 1996, 2% of women report ever having an abortion, [24] rising to 8% by 2011. Desired fertility also declined across survey waves. For example, the average "ideal" number of children fell from 2.95 in 1996 to 2.24 in 2011.[25]

[23] By definition, an abortion center is only legal if it is "listed" with the Technical Committee for Implementation of Comprehensive Abortion Care (TCIC), and the data used here are based on the list of all facilities included on the TCIC list up to February 2010.

[24] For each pregnancy in the pregnancy history of the woman, she is asked whether the baby [was] "born alive, born dead, or lost before birth"; then when the pregnancy ended and how long it lasted; and then only "did you [the respondent] or someone else do something to end this pregnancy?". The sequence of questions is the same for the four surveys, but the variables available changed in 2011. Before 2011, we count as an abortion any pregnancy not ending in live birth for which the woman either says that something was done to end the pregnancy or refuses to answer the last question. In the 2011 survey, the dataset does not contain the necessary raw data to apply the exact same rule, but contrary to the previous surveys, provides a classification of pregnancies as live birth/stillbirth/miscarriage/abortion based on the same survey questions.

[25] Panel C shows that our sample is a predominantly rural and with low levels of education (especially among women) that increase rapidly across study waves.

5.2. Statistical Methods

We estimate logit models of the following general form for woman *i* in district *d* observed in survey *s*:

$$Pr(y_{ids} = 1) = F(\alpha_0 + \alpha C_{ds} + X'_{ids}\boldsymbol{\beta} + \delta_d + \varphi_s) \qquad (2)$$

Where $F(z) = e^z/(1 + e^z)$ is the cumulative logistic distribution. Here y_{ids} is a dichotomous indicator for various measures of contraceptive use (equal to 1 if woman *i* reports using a given method of contraception, and 0 otherwise), C_{ds} is the number of legal abortion centers in the district at the time of the survey, X_{ids} is a vector of individual characteristics (urban dummy, age, religion dummies, education attainment dummies), δ_d is a vector of district dummy variables, φ_s is a vector of (3) DHS wave dummies (equivalent to year dummy variables).[26] We estimate equation (2) using survey weights and allowing for error correlation of an arbitrary nature within district. Equation (2) implements a `difference-in-difference' estimation strategy in which α captures the effect of each legal abortion center in a woman's district on contraceptive use, controlling for baseline differences in contraceptive use between districts (δ_d) and time trends common to all districts (φ_s). The validity of our estimates thus relies on the assumption of no meaningful differences in pre-existing fertility regulation trends across districts with varying increases in the supply of legal abortions. In Section 7, we report evidence consistent with this assumption.

[26] Note that C_{ds} is coded using abortion facility data as of February 2010 for the 2011 DHS wave since the administrative records we have had access to end in February 2010.

6. Results

The first six columns of Table 2 report odds ratios estimates of the effect of the number of legal abortion centers (α) for various indicators of contraceptive use (shown at the top of each column) obtained by estimating Equation (2). The first column shows results for use of any form of contraception (modern or traditional): the addition of a legal abortion center in a woman's district of residence is associated with a 2.6% reduction in the odds of using any contraceptive [OR: 0.974, 95% CI: (0.961;0.987)].[27] This odds ratio corresponds to a decrease in the probability of using any form of contraception of 0.5 percentage points per legal abortion center [95% CI: (-0.007;-0.002)], a 2 percentage point reduction from the pre-legalization mean of 35% associated with four legal abortion centers – the mean number of centers in the two post-legalization survey waves).[28]

Columns (2) and (6) report separate estimates for use of any modern and any traditional method of contraception (respectively). [29] The odds of using modern contraceptives decrease by 2.6% with an additional abortion center, while the odds ratio for use of traditional methods is indistinguishable from one [OR: 0.974, 95% CI: (0.960; 0.989) and OR: 0.992, 95% CI: (0.978; 1.006), respectively]. Taken together, these results suggest that when a legal abortion facility opens in a woman's district, she reduces her use of modern contraceptives, while traditional contraception remains unchanged. Analyzing the effect of an additional abortion center on modern contraceptive use by age group, we find the largest

[27] This and the other point estimates of interest in Table 2 are nearly unchanged when the linear age variable is replaced with seven 5-year age categories. Results are available on request.
[28] Marginal effects reported in the paper are computed at the mode of all categorical covariates, the mean of maternal age, and the mean number of abortion centers per district in the two post-legalization surveys.
[29] Traditional methods such as withdrawal and the rhythm method are only used by 4% of women in our pooled sample, but their use has increased over time, from 2% in 1996 to 7% in 2011.

decrease in contraceptive use among the 15-19 and the 30-34 age group, while the effect is statistically significant for all groups up to ages 35-39 (Table A1).

Columns (3), (4), and (5) of Table 2 then analyze how substitution away from modern contraception with the opening of legal abortion centers varies between sterilization and reversible modern methods.[30] Column (3) shows that an additional abortion center is associated with a 2.2% reduction in the odds of female sterilization [OR: 0.978, 95% CI:(0.957; 0.999)], implying a 0.23 percentage point decrease in the prevalence of female sterilization. On the contrary, we find that abortion centers have no effect on male sterilization (Column (4)). The estimated change in odds of using reversible modern methods reported in Column (5) is similar to that of using female sterilization, declining by 2.4% with each additional legal abortion facility [OR: 0.976, 95% CI:(0.968;0.984)].[31]

If our interpretation of the estimates in the first six columns of Table 2 is correct, the expansion of legal abortion centers should also be associated with an increase in the probability that women abort (although an effect on contraceptive use may be detected before the effect on abortion is realized). The seventh column of Table 2 reports results obtained by re-estimating Equation (2) using a dichotomous indicator for whether or not a woman reports ever having an abortion (defined as a pregnancy that did not result in a live birth and for which someone has done something to end the pregnancy). Each additional

[30] Among reversible modern methods, condoms may require more negotiation with male partners. Repeating our estimation separately for condom use (OR: .989 ; 95% CI: .979; 1.0004) and for other reversible methods (OR:.976; 95% CI: .967;.984), we find a larger association for other reversible modern methods, although the difference between them is not statistically significant.

[31] Odds ratios on the other covariates generally have the expected signs: the indicators for each DHS survey capture the overall trends in contraceptive use described in Section 5.1, and confirm that urban, better educated, and older women are more likely to use contraception. Coefficients on religious affiliation variables are also reasonable (e.g., Muslims are significantly less likely to use contraception than Hindus). It is interesting to note that the education gradient is very steep for traditional methods but much less so for use of any type of contraception.

legal abortion center in a woman's district is associated with a 1.3% increase in odds of ever having an abortion, which is statistically significant at the 90% level (OR: 1.013; 95% CI: 0.998; 1.029), and implies a 4 %-increase relative to the pre-legalization proportion reporting ever having an abortion for four legal abortion centers. Because the likelihood of ever having an abortion partly depends on the number of past pregnancies, we confirm that the estimates in column (7) are not driven by changes in fertility by using the share of pregnancies aborted by the respondent as the dependent variable (estimating a linear specification by ordinary least squares). Column (8) shows that the abortion center estimate is again positive and statistically significant (linear coefficient: 0.0019; 95% CI: 0.0015;0.0022).

7. Assessment of Robustness and Extensions

7.1 Testing for Pre-Existing Trend Differences

Although our 'difference-in-difference' estimation framework accounts for baseline differences in contraceptive prevalence across districts, it assumes that districts with varying concentrations of abortion facilities had parallel trends in contraceptive prevalence prior to the legalization of abortion. To test whether or not the number of abortion centers was targeted to districts with pre-existing trend differences in contraceptive prevalence, we conduct two related "placebo experiments".

In the first, we assign a district-level measure of the *future* number of abortion centers (the number of centers at the time of next survey) to each woman in the 1996 and 2001 DHS waves (i.e., before any legal abortion center opened). Re-estimating Equation (2) using

future number of abortion centers in lieu of the current number of centers, Table 3 reports estimates for the parameter α' in the equation

$Pr(y_{ids} = 1) = F(\alpha_0' + \alpha' C_{ds+1} + X_{ids}'\boldsymbol{\beta}' + \delta_d' + \varphi_s')$. Consistent with our assumption of 'parallel trends,' none of these estimated odds ratios are significantly different from 1 (nor is the estimate for future number of abortion centers estimated by ordinary least squares in Column (8) significantly different from zero).

The second placebo experiment repeats the first with two differences: it also uses data from the 2006 DHS wave, and it includes both current and future number of legal abortion facilities (because some centers were operating in 2006). Table 4 shows estimates for future and current number of legal abortion facilities, again suggesting that current contraceptive prevalence and past abortion behavior are not correlated with future abortion supply. Overall, these results suggest no targeting of abortion centers to districts with pre-existing trend differences in contraceptive prevalence – and are consistent with our interpretation of Table 2 showing evidence that abortion and the use of modern contraceptives are substitutes.

7.2 Other Robustness Tests

For completeness, we also estimate variants of equation (2) using recall data contained in the 2006 and 2011 DHS fertility histories and report our results in Table A2. Our specifications use woman-month observations from April 2000 to February 2010 and excludes women who were sterilized or whose husbands were sterilized by March 2004 ; C_{ds} is replaced by C_{dm}, the number of legal abortion centers in the district for each month and year. We find a negative, statistically significant relationship between the number

of abortion centers in a woman's district and her odds of reporting use of any contraceptive method, confirming our inferences from contemporaneous data (Column 1). This estimate is robust to controlling for linear, quadratic or cubic district-specific trends (Columns 2, 3, and 4, respectively). When adding a placebo treatment variable equal to the number of abortion centers in the district 12 months in the future, the result persists, and the effect of the placebo treatment variable is statistically insignificant (Column 5).

We then investigate the robustness of our main results to addressing a variety of other potential concerns:

1. First, we control for a number of additional regressors in Panel A of Table 5. Specifically, we control for respondents' ideal number of children; number of conflict casualties in the year preceding the survey in respondents' districts (per 1991 district population, the year of the last pre-conflict population census); whether or not respondents report having heard a family planning message on the radio in the last month; whether or not respondents were visited by a family planning worker in the previous 12 months; whether or not respondents had heard of AIDS; and socio-economic status (measured by quintile in the distribution of household asset ownership). Our conclusions do not change after we include these additional controls.[32]
2. Second, in Panel B, we restrict the sample analyzed in Panel A to women who were not sterilized and whose husbands were not sterilized as of March 2004.

[32] We also estimate the robustness test shown in Table 5, Panel A including both the number of children born to a woman and whether or not a woman had a job in the past 12 months. The resulting estimates change very little (and insignificantly so) when including these additional covariates. These results are available upon request.

The results confirm the sign, significance, and magnitude of the main estimates for all modern contraception and for temporary methods.[33]

3. Third, in Panel C, we further scale the number of abortion centers by district population (as of 2001, the date of the last pre-legalization population census). Our estimates become more imprecise (the standard errors nearly double), but the negative association between legal abortion centers and the prevalence of any modern contraception – and specifically temporary methods – remains statistically significant.[34]
4. Fourth, in Panels D, E, and F, we explicitly allow time trends to vary by pre-legalization district population (Panel D), region (Panel E), rural/urban location (Panel F), and wealth quintile (Panel G).[35] More populous districts, districts in the more accessible regions of the country, and urban areas experienced earlier/more intense expansions of legal abortion supply. Additionally, private providers are more prevalent in urban areas, and these private providers may be more responsive to local demand than public facilities. The two main national health and population programs in place during the relevant period (the Nepal Family Health Program during 2001-

[33] Note that in this restricted sample, by definition, there is no variation in sterilization status in the 1996 and 2001 DHS (as those sterilized by 1996 or 2001 are dropped from the sample), so that we can only use the 2006 and 2011 DHS surveys for the analysis of the sterilization outcomes. The findings on sterilization outcomes using only the last two surveys suggest a statistically insignificant decrease in female sterilization, and a marginally significant increase in male sterilization (but the total effect on modern contraception is still significantly and consistently negative overall).

[34] Although results are less precise, the number of abortion centers per inhabitant is very similar to our main measure of program treatment: the number of abortion centers. The correlation between these two variables is 0.71.

[35] A region is defined as the interaction between an economic region (of which there are five in Nepal) and an ecological belt (terai, hill or mountain), with 13 regions defined in the DHS.

2006 and the Nepal Health Sector Program Implementation Plan during 2004-2009) also aimed to prioritize the poor and those living in remote areas (MOHP et al., 2012). Interacting DHS wave and initial population, region, urban location, and wealth quintile in Panels D, E, F, and G show that our conclusions are unchanged when allowing for systematic trend differences in contraceptive use by these characteristics.

Finally, we explore the robustness of our conclusions to a variety of weighting, functional form, and sample considerations and find that our results are robust to using unweighted- rather than weighted logit models (Panel A of Table 6), to replacing our logit specification with a linear probability model (Panel B of Table 6), to excluding each DHS survey in turn to investigate if our conclusions depend on any individual survey (Table 7)[36], and to limiting the sample to all women ages 25-49 instead of restricting our sample to married women (Table 8).[37]

7.3 Consideration of Changes in Temporary Modern Methods vs. Sterilization

The results presented so far suggest that the increase in the supply of legal abortions affected the use of temporary modern contraceptive methods, but its effect on new sterilizations is less clear. One plausible explanation for reductions in the cost of abortion to

[36] The only outcome for which the conclusions vary when individual DHS surveys are excluded is male sterilization, which significantly increases with an additional abortion center if we exclude the 1996 survey, and significantly decreases if we exclude the 2011 survey, whereas it has a statistically insignificant effect if we include all four surveys or exclude the 2001 or 2006 surveys. We therefore conclude from the results in Table 7 that there is no robust evidence of a change in male sterilization, as in the main analysis.

[37] We also repeated the analysis excluding the capital Kathmandu, which has the largest number of abortion facilities of all districts. The estimated odds ratios are very similar to those obtained with the whole sample, but estimates become much less precisely estimated due to the loss in variation in our abortion supply variable, and therefore most odds ratios become statistically insignificant. Full results are available on request.

affect temporary contraception but not sterilization can be understood by returning to our conceptual framework in Section 4. Re-arranging Inequality (1) by dividing each side by $1 - p_f$ and allowing for more than one type of contraceptive method denoted by *m*, woman *i* will choose the contraceptive method with the lowest perceived ratio of cost to success rate ($\frac{c_{im}^c}{1-p_{fm}}$) as long as the value of this ratio is less than $\min(c_i^a, c_i^u)$. If changes in abortion supply only affect the decisions of women for whom the perceived ratio of cost to success ($\frac{c_i^c}{1-p_f}$) is higher for sterilization than for temporary methods, the relevant trade-off is between temporary methods and no contraception. This could be the case if women who face a high cost of having an abortion (regardless of whether or not it is legally and safely provided – due to moral considerations or high transport costs, for example) were also more likely to have a lower perceived cost-to-success rate of sterilization relative to temporary methods. If this were the case, then legal abortion centers would not decrease c_i^a sufficiently to affect $\min(c_i^a, c_i^u)$ for women who would choose sterilization over temporary methods.

8. Conclusion

Although scholars have written extensively about the relationship between the use of modern contraceptives and abortion – and have generally reported an inverse relationship between the two, the causal relationship between the two has been difficult to isolate. A key difficulty is the fact that reproductive health programs often alter many aspects of service delivery simultaneously – expanding the reproductive health workforce, bundling together new contraception and abortion services, and improving the quality of health services generally. Even the famous Matlab family planning experiment integrated the provision of

modern contraceptives with the provision of both abortion services (menstrual regulation) and antenatal and child health services, making it difficult to isolate the effect of contraceptive supply.

This study analyzes the relationship between contraceptive use and abortion during the rapid scale-up of legal abortion services across Nepal – a "natural experiment" in which abortion services were not accompanied by changes in contraceptive supply or other potentially confounding health policy changes. Using four DHS survey waves (two before and two after legalization) and an official census of all legal abortion centers, we find that each legal abortion center in a woman's (couple's) district of residence was associated with a 2.6% reduction in the odds of using any contraceptive. For the mean number of centers per district in the post-legalization period (four), our estimates imply that Nepal's expansion of abortion supply was associated with a 2 percentage point decline in the use of contraceptives – a 6% decrease relative to the pre-legalization mean.[38] This decline in contraceptive use occurs among modern (but not traditional) methods and is driven most robustly by changes in the use of reversible modern methods (primarily injections and, to a lesser extent, condoms and the pill). Our direct assessments of the "parallel trends" assumption underlying our difference-in-difference study design also strengthens the interpretation that our estimates provide evidence of true substitution between use of modern contraceptives and abortion.

We emphasize two important policy implications of our findings. First, policies aiming to reduce the full cost of abortion (financial, social, psychological, etc.) should be

[38] The effect estimated here is based on the variation over time in local availability of abortion centers across districts. It may therefore be an underestimate of the true substitution effect because women may be able to travel to abortion centers located outside their district (e.g., in the capital Kathmandu).

accompanied by measures to also reduce the full cost of contraceptive use (broadly defined to include social and psychological costs) if policymakers wish to avoid substitution from contraception to abortion. Second, in demonstrating a trade-off between contraception and abortion, our findings also suggest that reductions in the cost of contraception may reduce the incidence of abortion.

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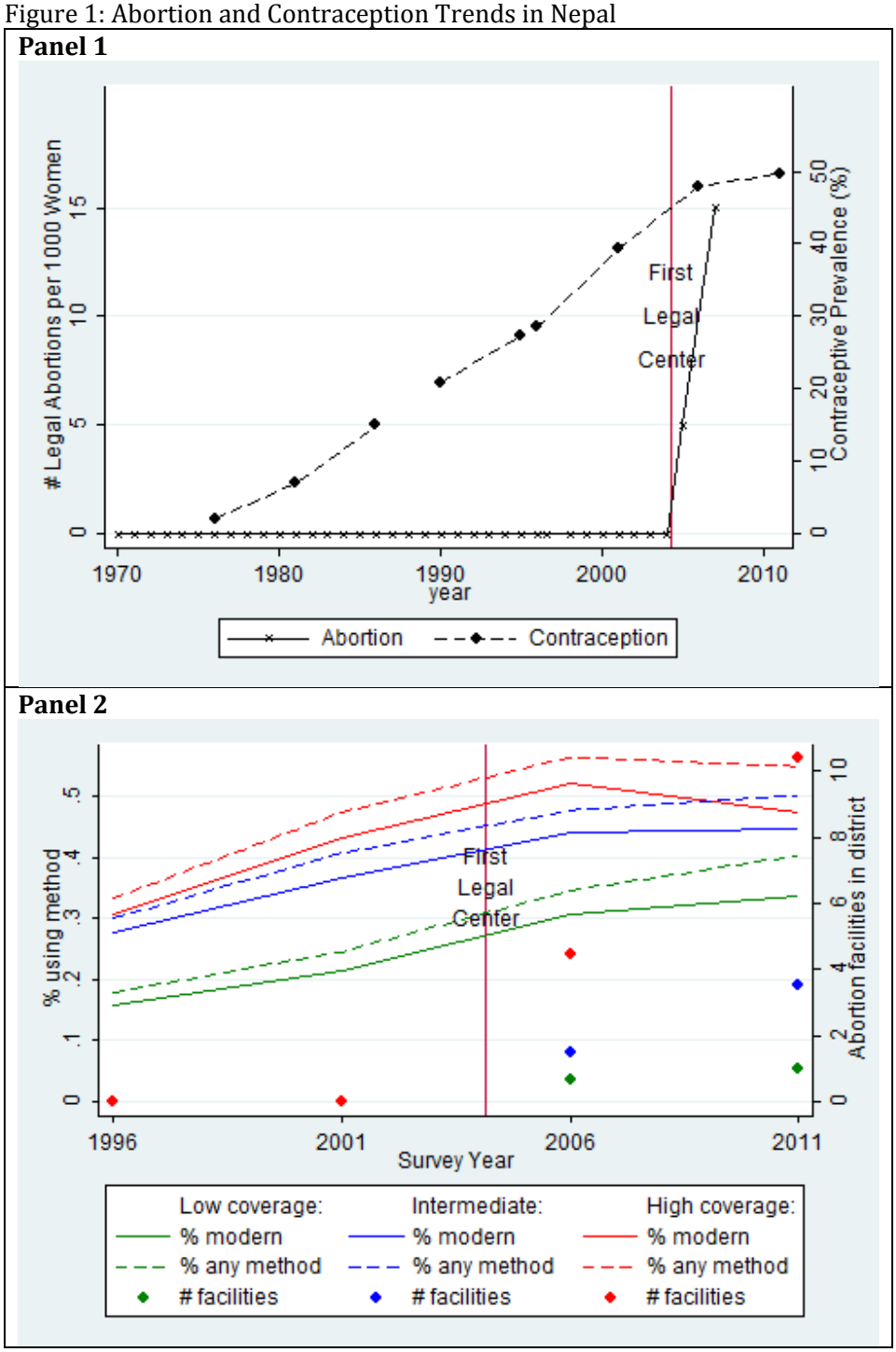
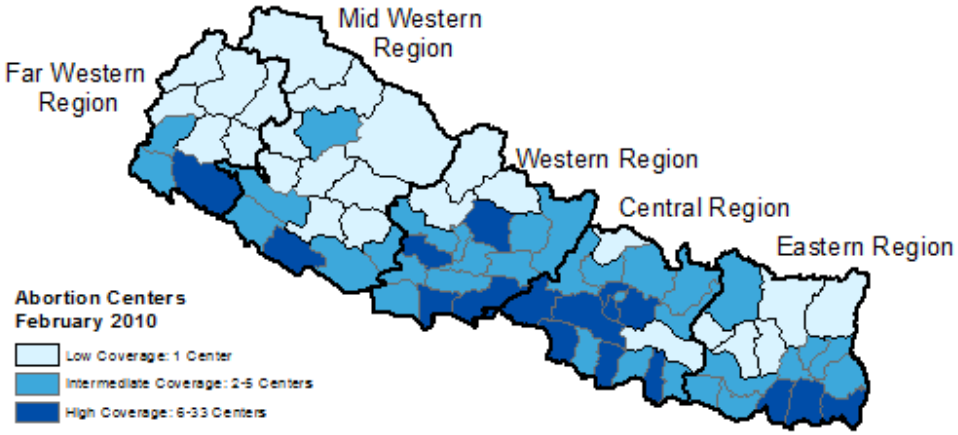
Figures

Figure 1: Abortion and Contraception Trends in Nepal



Sources: Panel 1: abortion: Sedgh et al. (2011); contraception: 1970-1987 from Mauldin and Segal (1988), 1990-1995 from United Nations (2004), and 1996-2011 from MOHP (2012). Panel 2: authors' calculations based on Demographic and Health Surveys of Nepal (1996-2011) (contraception) and Technical Committee for Implementation of Comprehensive Abortion Care (2010) (abortion facilities).

Figure 2: District-level Coverage of Abortion Centers



Source: Technical Committee for Implementation of Comprehensive Abortion Care (2010).

Tables

Table 1 – Summary Statistics

	(1) DHS 1996			(2) DHS 2001			(3) DHS 2006			(4) DHS 2011			(5) Pooled		
	mean	sd	N	mean	sd	N	mean	sd	N	mean	sd	N	mean	sd	N
Panel A: abortion supply and contraception															
Number of Legal Abortion Centers in District of Residence[a]	0.00	0.000	7496	0.00	0.000	7842	2.72	2.997	7776	6.34	6.702	8984	2.45	4.689	32098
Any Method	0.29		7496	0.41		7842	0.50		7776	0.51		8984	0.43		32098
Modern Method	0.27		7496	0.37		7842	0.46		7776	0.44		8984	0.39		32098
Traditional Method	0.02		7496	0.04		7842	0.04		7776	0.07		8984	0.04		32098
Modern Method Other than Sterilization	0.09		7496	0.14		7842	0.20		7776	0.21		8984	0.16		32098
Female Sterilization	0.13		7496	0.16		7842	0.19		7776	0.16		8984	0.16		32098
Male Sterilization	0.06		7496	0.07		7842	0.07		7776	0.08		8984	0.07		32098
Ever Had an Abortion	0.02		7496	0.02		7842	0.04		7776	0.08		8984	0.04		32098
Share of Pregnancies Aborted[b]	0.00	0.041	6798	0.00	0.039	7138	0.01	0.074	7204	0.03	0.111	8228	0.01	0.075	29368
Panel B: Fertility preferences															
Ideal Number of Children	2.95	1.059	7337	2.65	0.879	7712	2.43	0.830	7762	2.24	0.788	8960	2.55	0.927	31771
Panel C: Covariates															
Urban	0.08		7496	0.10		7842	0.15		7776	0.13		8984	0.12		32098
Age	30.58	8.968	7496	30.95	8.897	7842	31.47	8.923	7776	31.68	8.600	8984	31.20	8.847	32098
Hindu (excluded category)	0.87		7496	0.85		7842	0.86		7776	0.85		8984	0.86		32098
Buddhist	0.06		7496	0.07		7842	0.08		7776	0.08		8984	0.07		32098
Muslim	0.05		7496	0.05		7842	0.04		7776	0.04		8984	0.04		32098
Christian	0.00		7496	0.01		7842	0.01		7776	0.02		8984	0.01		32098
Other Religion	0.01		7496	0.02		7842	0.01		7776	0.01		8984	0.02		32098
No education (excluded cat.)	0.80		7496	0.72		7842	0.63		7776	0.49		8984	0.65		32098
Primary Education	0.11		7496	0.15		7842	0.17		7776	0.19		8984	0.15		32098
Secondary Education	0.08		7496	0.12		7842	0.18		7776	0.27		8984	0.16		32098
Tertiary Education	0.01		7496	0.01		7842	0.02		7776	0.06		8984	0.03		32098

Statistics weighted using survey weights. Sample of married women aged 15-49 who usually reside in the household. Source: Authors' calculations using Demographic and Health Surveys of Nepal (1996-2011) for all variables except number of legal abortion centers in district of residence, which is based on data from Technical Committee for Implementation of Comprehensive Abortion Care (2010). [a]Number of legal abortion centers in district of residence coded using abortion facility data as of February 2010 for the 2011 DHS wave since the administrative records we have had access to end in February 2010. [b] Defined only for women with at least one pregnancy

Table 2 – Effect of Availability of Legal Abortion Centers on Contraceptive Use and Self-Reported Abortions

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Any Method	Modern Method	Female Sterilization	Male Sterilization	Modern Method Other than Sterilization	Traditional Method	Ever Had an Abortion	Share of all pregnancies aborted
Number of Abortion Centers in District	0.974***	0.974***	0.978**	0.999	0.976***	0.992	1.013*	0.002***
	(0.0065)	(0.0072)	(0.0109)	(0.0106)	(0.0041)	(0.0071)	(0.0080)	(0.0002)
DHS 2001	1.759***	1.678***	1.339***	1.184	1.886***	1.552***	0.879	-0.002**
	(0.1112)	(0.0977)	(0.0817)	(0.1226)	(0.1452)	(0.2408)	(0.1302)	(0.0007)
DHS 2006	2.343***	2.293***	1.699***	1.105	2.681***	1.421**	1.900***	0.000
	(0.2003)	(0.1962)	(0.2224)	(0.1670)	(0.2289)	(0.2276)	(0.3310)	(0.0017)
DHS 2011	2.656***	2.410***	1.591***	1.289	2.987***	2.099***	3.216***	0.007***
	(0.2303)	(0.2249)	(0.2330)	(0.2110)	(0.3140)	(0.3676)	(0.5636)	(0.0025)
District Dummies Included?	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Maternal characteristics included?	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	32098	32098	31620	32078	32098	31657	31371	29368
No. of districts	75	75	72	74	75	70	70	75
(Pseudo) R-squared	0.1102	0.1014	0.1982	0.1604	0.0971	0.0818	0.1327	0.0626
Mean value of dependent variable	0.431	0.388	0.158	0.068	0.163	0.044	0.043	0.015

Maternal characteristics: urban residence, age, religion dummies (Hindu (omitted), Buddhist, Muslim, Christian or Other), education dummies (no education (omitted), primary education, secondary education, tertiary education). Columns (1) to (7) report odds ratios from a logit model. Column (8) presents coefficients from a linear regression including a constant (coefficient not reported here). District-correlated robust standard errors in parentheses. Regressions weighted using survey weights. Sample of married women aged 15-49 who usually reside in the household. Excluded religious category is "Hindu", excluded education category is "No education". Some observations are dropped in Columns (3), (4), (6), and (7) due to lack of variation in the value of the dependent variable within district. Observations for women who have never had any pregnancy are dropped in Column (8) since the share of aborted pregnancies is not defined for these women. Source: Authors' calculations using Demographic and Health Surveys of Nepal (1996-2011) and Technical Committee for Implementation of Comprehensive Abortion Care (2010). *** p<0.01, ** p<0.05, * p<0.10.

Table 3 - Control Experiment 1: Effect of Availability of Future Legal Abortion Centers Before Any Center Opened

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Any Method	Modern Method	Female Sterilization	Male Sterilization	Modern Method Other than Sterilization	Traditional Method	Ever Had an Abortion	Share of all pregnancies aborted
Number of Abortion Centers at Next Survey Date	1.011	1.004	1.000	0.928	0.994	0.986	0.967	-0.000
	(0.0386)	(0.0341)	(0.0220)	(0.0453)	(0.0190)	(0.0355)	(0.0243)	(0.0002)
Observations	15338	15338	14324	15338	15310	14601	12994	13936
No. of districts	72	72	61	72	71	63	50	72
(Pseudo) R-squared	0.1243	0.1219	0.1698	0.1640	0.1198	0.0800	0.0749	0.0207
Mean value of dependent variable	0.352	0.319	0.149	0.062	0.116	0.034	0.019	0.005

Output omitted for the following variables: three dummy variable for DHS 2001, district fixed-effects, and controls for urban location, age at interview, religion, and education summarized in Table 1 Panel C. Columns (1) to (7) report odds ratios from a logit model. Column (8) presents coefficients from a linear regression including a constant (coefficient not reported here). District-correlated robust standard errors in parentheses. Regressions weighted using survey weights. Sample of married women aged 15-49 who usually reside in the household. Some observations are dropped in Columns (3), (4), (6), and (7) due to lack of variation in the value of the dependent variable within district. Observations for women who have never had any pregnancy are dropped in Column (8) since the share of aborted pregnancies is not defined for these women. Source: Authors' calculations using Demographic and Health Surveys of Nepal (42) – DHS 1996 and 2001 only – and Technical Committee for Implementation of Comprehensive Abortion Care (2010). *** p<0.01, ** p<0.05, * p<0.10.

Table 4 - Control Experiment 2: Effect of Availability of Future Legal Abortion Centers Over and Above the Effect of Current Availability

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Any Method	Modern Method	Female Sterilization	Male Sterilization	Modern Method Other than Sterilization	Traditional Method	Ever Had an Abortion	Share of all pregnancies aborted
Number of Abortion Centers	0.928***	0.921***	0.909**	0.969	0.966	1.043	1.057	0.001
	(0.0257)	(0.0291)	(0.0374)	(0.0783)	(0.0223)	(0.0469)	(0.0609)	(0.0009)
Number of Abortion Centers at Next Survey Date	1.020	1.022	1.035	0.970	1.001	0.982	0.958*	-0.000
	(0.0173)	(0.0177)	(0.0235)	(0.0372)	(0.0104)	(0.0231)	(0.0245)	(0.0004)
Observations	23114	23114	22343	23063	23114	22730	22260	21140
No. of districts	75	75	68	73	75	69	66	75
(Pseudo) R-squared	0.1215	0.1173	0.1971	0.1546	0.1144	0.0692	0.1003	0.0318
Mean value of dependent variable	0.400	0.366	0.161	0.063	0.146	0.035	0.026	0.008

Output omitted for the following variables: two dummy variables for DHS 2001 and 2006, district fixed-effects, and controls for urban location, age at interview, religion, and education summarized in Table 1 Panel C. Columns (1) to (7) report odds ratios from a logit model. Column (8) presents coefficients from a linear regression including a constant (coefficient not reported here). District-correlated robust standard errors in parentheses. Regressions weighted using survey weights. Sample of married women aged 15-49 who usually reside in the household. Some observations are dropped in Columns (3), (4), (6), and (7) due to lack of variation in the value of the dependent variable within district. Observations for women who have never had any pregnancy are dropped in Column (8) since the share of aborted pregnancies is not defined for these women. Source: Authors' calculations using Demographic and Health Surveys of Nepal (42) – DHS 1996, 2001, and 2006 only – and Technical Committee for Implementation of Comprehensive Abortion Care (2010). *** p<0.01, ** p<0.05, * p<0.10.

Table 5: Robustness Checks

	(1) Any Method	(2) Modern Method	(3) Female Sterilization	(4) Male Sterilization	(5) Modern Method Other than Sterilization	(6) Traditional Method	(7) Ever Had an Abortion	(8) Share of all pregnancies aborted
Panel A: Include further controls (see notes below table for details)								
Number of Abortion Centers	0.980***	0.980***	0.983*	1.001	0.981***	0.996	1.014*	0.002***
	(0.0055)	(0.0062)	(0.0100)	(0.0089)	(0.0041)	(0.0074)	(0.0073)	(0.0002)
Observations	31762	31762	31288	31743	31762	31325	31045	29063
Panel B: Further controls + restrict sample to non-sterilized couples as of March 2004 (results in Columns (3) and (4) restricted to DHS 2006 and 2011)								
Number of Abortion Centers	0.973***	0.970***	0.987	1.141*	0.977***	0.994	1.011	0.002***
	(0.0058)	(0.0067)	(0.0265)	(0.0833)	(0.0044)	(0.0073)	(0.0076)	(0.0002)
Observations	25890	25890	12095	12026	25890	25517	25264	23214
Panel C: As Panel B + Scale number of abortion centers by district population								
Number of Abortion Centers	0.983	0.976*	1.001	1.063*	0.982**	1.007	1.012	0.001***
	(0.0106)	(0.0122)	(0.0238)	(0.0380)	(0.0083)	(0.0134)	(0.0104)	(0.0004)
Observations	25890	25890	12095	12026	25890	25517	25264	23214
Panel D: As Panel B + Allow for time trends to vary by district population								
Number of Abortion Centers	0.965***	0.955**	0.991	1.102	0.979**	1.015	1.030**	0.002***
	(0.0125)	(0.0173)	(0.0366)	(0.0932)	(0.0083)	(0.0156)	(0.0142)	(0.0004)
Observations	25890	25890	12095	12026	25890	25517	25264	23214

Panel E: As Panel B + Allow time trends to vary by (13) region								
Number of Abortion Centers	0.965***	0.960***	0.941	1.142	0.971***	1.009	1.018	0.002***
	(0.0077)	(0.0094)	(0.0491)	(0.1005)	(0.0094)	(0.0128)	(0.0166)	(0.0003)
Observations	25890	25890	12095	12026	25890	25517	24898	23214
Panel F: As Panel B + Allow time trends to differ in rural and urban areas								
Number of Abortion Centers	0.977***	0.976***	0.994	1.142	0.977***	0.993	1.017**	0.001***
	(0.0059)	(0.0063)	(0.0245)	(0.0950)	(0.0050)	(0.0086)	(0.0084)	(0.0003)
Observations	25890	25890	12095	12026	25890	25517	25264	23214
Panel G: As Panel B + Allow time trends to differ by wealth quintile								
Number of Abortion Centers	0.986**	0.986*	0.974	1.149*	0.984***	0.994	1.011	0.001***
	(0.0068)	(0.0072)	(0.0264)	(0.0965)	(0.0044)	(0.0088)	(0.0082)	(0.0002)
Observations	25890	25890	12095	12026	25890	25517	25264	23214

Output omitted for the following variables: three dummy variables for DHS 2001, 2006, and 2011, district fixed-effects, and controls for urban location, age at interview, religion, education, ideal number of children, control for the number of conflict casualties in the year preceding the survey (per district population as of 1991, the last pre-conflict population census), for whether or not the woman reports having heard a family planning message on the radio in the last month, whether she was visited by a family planning worker in the previous 12 months, whether she has heard of AIDS, and for the SES group to which she belongs (as measured by the her quintile in the distribution of household living standard). Columns (1) to (7) report odds ratios from a logit model. Column (8) presents coefficients from a linear regression including a constant (coefficient not reported here). District-correlated robust standard errors in parentheses. Regressions weighted using survey weights. Sample of married women aged 15-49 who usually reside in the household. Some observations are dropped in Columns (3), (4), (6), and (7) due to lack of variation in the value of the dependent variable within district. In Panels B to F, Columns (3) and (4) exclude observations for 1996 and 2001, since by definition there is no variation in sterilization status in these surveys after dropping those sterilized before March 2004. Observations for women who have never had any pregnancy are dropped in Column (8) since the share of aborted pregnancies is not defined for these women. Source: Authors' calculations using Demographic and Health Surveys of Nepal (42) – DHS 1996 and 2001 only – and Technical Committee for Implementation of Comprehensive Abortion Care (2010). *** p<0.01, ** p<0.05, * p<0.10.

Table 6: Further Robustness Checks

	(1) Any Method	(2) Modern Method	(3) Female Sterilization	(4) Male Sterilization	(5) Modern Method Other than Sterilization	(6) Traditional Method	(7) Ever Had an Abortion	(8) Share of all pregnancies aborted
Panel A: Unweighted regressions								
Number of Abortion Centers	0.968***	0.967***	0.979**	0.987	0.972***	0.995	1.003	0.002***
	(0.0058)	(0.0063)	(0.0096)	(0.0109)	(0.0043)	(0.0067)	(0.0067)	(0.0002)
Observations	32098	32098	31620	32078	32098	31657	31371	29368
Panel B: Linear probability model								
Number of Abortion Centers	-0.005***	-0.005***	-0.002**	0.000	-0.003***	-0.000	0.003***	
	(0.0016)	(0.0018)	(0.0011)	(0.0008)	(0.0007)	(0.0004)	(0.0006)	
Observations	32098	32098	32098	32098	32098	32098	32098	

Output omitted for the following variables: three dummy variables for DHS 2001, 2006 and 2011, district fixed-effects, and controls for urban location, age at interview, religion, and education summarized in Table 1 Panel C. See also Notes under Table 2. *** p<0.01, ** p<0.05, * p<0.10.

Table 7: Robustness of the Effect of Abortion Centers to Excluding One Survey at a Time

Excluded data	(1) Any Method	(2) Modern Method	(3) Female Sterilization	(4) Male Sterilization	(5) Modern Method Other than Sterilization	(6) Traditional Method	(7) Ever Had an Abortion	(8) Share of all pregnancies aborted
DHS 1996	0.975***	0.977***	0.980*	1.024*	0.977***	0.993	1.024**	0.002***
	(0.0065)	(0.0073)	(0.0120)	(0.0140)	(0.0048)	(0.0093)	(0.0097)	(0.0002)
	24602	24602	24228	24202	24602	24238	24056	22570
DHS 2001	0.976**	0.976**	0.979*	0.993	0.977***	0.990	1.013*	0.002***
	(0.0110)	(0.0107)	(0.0122)	(0.0158)	(0.0055)	(0.0076)	(0.0080)	(0.0002)
	24256	24256	23846	23902	24256	23529	23684	22230
DHS 2006	0.974***	0.974***	0.981*	0.996	0.974***	0.990	1.004	0.002***
	(0.0070)	(0.0077)	(0.0109)	(0.0111)	(0.0043)	(0.0074)	(0.0079)	(0.0002)
	24322	24322	23858	24322	24322	23810	23422	22164
DHS 2011	0.957***	0.951***	0.953*	0.924***	0.968***	1.016	0.986	0.000
	(0.0123)	(0.0144)	(0.0239)	(0.0245)	(0.0104)	(0.0212)	(0.0260)	(0.0005)
	23114	23114	22343	23063	23114	22730	22260	21140

Output omitted for the following variables: two dummy variables indicating DHS waves, district fixed-effects, and controls for urban location, age at interview, religion, and education summarized in Table 1 Panel C. See also Notes under Table 2. *** p<0.01, ** p<0.05, * p<0.10.

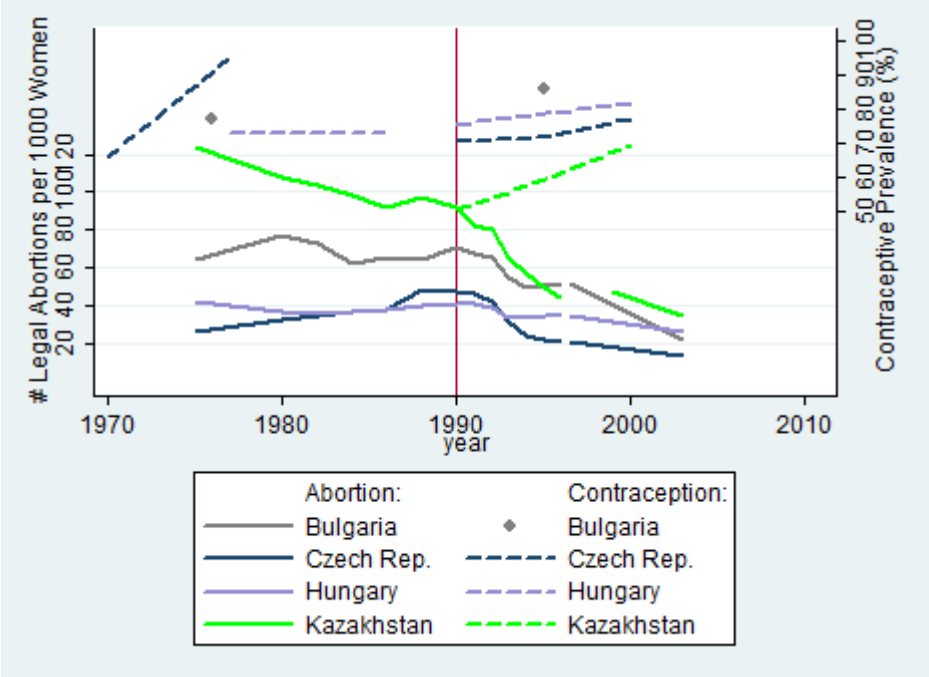
Table 8 – Robustness of the effect of abortion centers to including all interviewed women age>=25 instead of restricting 2006 and 2011 surveys to ever-married women

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Any Method	Modern Method	Female Sterilization	Male Sterilization	Modern Method Other than Sterilization	Traditional Method	Ever Had an Abortion	Share of all pregnancies aborted
Number of Abortion Centers	0.977***	0.979***	0.979*	1.001	0.977***	0.988	1.007	0.002***
	(0.0051)	(0.0060)	(0.0106)	(0.0099)	(0.0044)	(0.0078)	(0.0092)	(0.0003)
Observations	25174	25174	24843	25150	25174	24848	24454	24268
No. of clusters	75	75	72	74	75	70	69	75
Pseudo R-squared	0.0665	0.0618	0.1607	0.1177	0.1006	0.0828	0.1259	0.0736
Mean Y	0.479	0.435	0.196	0.085	0.155	0.045	0.050	0.016

Output omitted for the following variables: three dummy variable for DHS 2001, district fixed-effects, and controls for urban location, age at interview, religion, and education. Columns (1) to (7) report odds ratios from a logit model. Column (8) presents coefficients from a linear regression including a constant (coefficient not reported here). District-correlated robust standard errors in parentheses. Regressions weighted using survey weights. Sample of women aged 25-49 who usually reside in the household, irrespective of their marital status. Excluded religious category is "Hindu", excluded education category is "No education". Some observations are dropped in Columns (3), (4), (6), and (7) due to lack of variation in the value of the dependent variable within district. Observations for women who have never had any pregnancy are dropped in Column (8) since the share of aborted pregnancies is not defined for these women. Source: Authors' calculations using Demographic and Health Surveys of Nepal (1996-2011) and Technical Committee for Implementation of Comprehensive Abortion Care (2010). *** p<0.01, ** p<0.05, * p<0.10.

Appendix

Figure A1: Abortion and Contraception Trends in Former Communist Countries with Complete Abortion Data



Sources: Abortion: 1975-1996 from Henshaw et al. (1999), 1996-2003 from Sedgh et al. (2007). Contraception: 1970-1987 from Mauldin and Segal (1988), 1990-2000 from United Nations (2004). Contraception figures for 1970-1987 labeled "Czech Republic" are aggregate figures for Czechoslovakia.

Figure A2: Analytical Framework

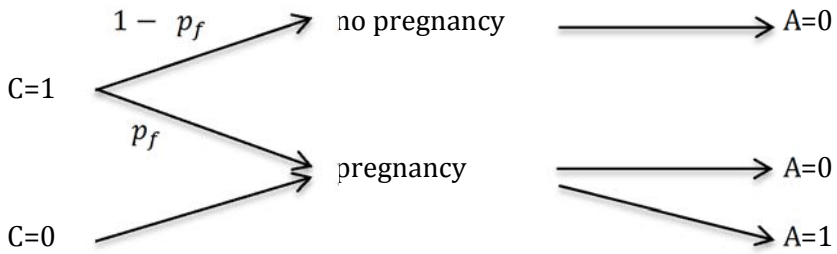


Table A1: Results by age group

	Dependent variable: =1 if Modern Method, 0 otherwise						
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Age Group:	15-19	20-24	25-29	30-34	35-39	40-44	45-49
Number of Abortion Centers	0.948***	0.971***	0.977***	0.956***	0.974*	1.000	0.994
	(0.0170)	(0.0076)	(0.0076)	(0.0078)	(0.0146)	(0.0109)	(0.0150)
Observations	2578	5868	6415	5435	4678	3852	2982

Output omitted for the following variables: three dummy variables for DHS 2001, 2006 and 2011, district fixed-effects, and controls for urban location, age at interview, religion, and education summarized in Table 1 Panel C. See also Notes under Table 2. *** p<0.01, ** p<0.05, * p<0.10.

Table A2: Results Obtained Using Recall Data

Dependent Variable: =1 if any method, 0 otherwise					
		District-Specific Trends			
	(1) Baseline	(2) Linear Trends	(3) Quadratic Trends	(4) Cubic Trends	(5) Placebo Test
Number of Abortion Centers	0.977***	0.970***	0.969**	0.984**	0.965**
in the woman's district	(0.0045)	(0.0111)	(0.0143)	(0.0082)	(0.0138)
Number of Abortion Centers 12 months later					1.008
					(0.0120)
District Dummies	Yes	Yes	Yes	Yes	Yes
Covariates	Yes	Yes	Yes	Yes	Yes
Observations	923886	923886	923886	923886	757050

Sample of married women interviewed in the 2006 and 2011 DHS surveys who were not sterilized and whose husbands were not sterilized prior to March 2004. Period included: April 2000 (start of the calendar period for the 2006 DHS) to February 2010 (last month for which we have data on registration of abortion centers). Output omitted across all columns for the following variables: a dummy variable for DHS 2011, district fixed-effects, month/year dummies (e.g., May 2008), and controls for urban location, age at interview, religion, and education. The sample in Column (5) is smaller as it excludes the last 12 calendar months for which we have data on current abortion centers but not future abortion centers. Source: Authors' calculations using Demographic and Health Surveys of Nepal (42) – DHS 1996 and 2001 only – and Technical Committee for Implementation of Comprehensive Abortion Care (43). *** p<0.01, ** p<0.05, * p<0.10.