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Choosing Plan B Over Plan A: Risk Compensation Theory and Contraceptive Choice in India

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ABSTRACT Can women's contraceptive method choice be better understood through risk compensation theory? This theory implies that people act with greater care when the perceived risk of an activity is higher and with less care when it is lower. We examine how increased over-the-counter access to emergency contraceptive pills (ECPs) accompanied by marketing campaigns in India affected women's contraceptive method choices and incidence of sexually transmitted infections (STIs). Although ECPs substantially reduce the risk of pregnancy, they are less effective than other contraceptive methods and do not reduce the risk of STIs. We test whether an exogenous policy change that increased access to ECPs leads people to substitute away from other methods of contraception, such as condoms, thereby increasing the risk of both unintended pregnancy and STIs. We find evidence for risk compensation in terms of reduced use of condoms but not for increases in rates of STIs.

KEYWORDS Contraception • Emergency contraceptive pills • Risk compensation theory

Introduction

Access to a range of contraceptive methods is an integral part of quality reproductive healthcare. Given access, the choice between different methods of contraception may be driven by a range of factors, including availability, efficacy, individual preferences, and economic considerations. This study looks at how the availability of a new method of contraception impacts the choice of contraception methods among women in India. More specifically, we look at whether providing increased access to emergency contraceptive pills (ECPs), or Plan B, results in substitution away from other available methods of contraception. We test Peltzman's (1975) theory of risk compensation, which suggests that people adjust their behavior according to their perceived level of risk instead of actual risk. To understand potential compensatory behavior in the choice of contraception methods, we exploit a plausibly exogenous policy change in India that allowed over-the-counter access and advertising of ECPs in all states in India except the state of Tamil Nadu. Using Tamil Nadu as control and neighboring states as treatment, we employ two empirical strategies—a stan-

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dard double-difference estimation and a parametric difference-in-difference estimator incorporating propensity scores (PSM-DiD)—to test for the impact of this policy change. Our estimates indicate that increased access to ECPs resulted in substitution away from some methods of contraception. However, we find no evidence of an impact on the rates of sexually transmitted infections (STIs). We also do not find population effects of providing increased access to ECPs, which is a result similar to findings by Raymond et al. (2007) and Durrance (2013). These results are robust to multiple alternative model specifications, including limiting the sample to border districts of the treatment and control states in a standard double difference strategy.

Family Planning and ECPs in India: Policy, Need, Attitudes, and Beliefs

ECPs, also called morning-after pills or Plan B, are a reproductive health intervention to prevent unwanted pregnancy in cases of unprotected intercourse, incorrect use of contraceptives, or contraceptive failure. When taken within the first 72 hours after pregnancy, ECPs prevent pregnancy 87% to 90% of the time (Rodrigues et al. 2001). Effectiveness is lower when used after 72 hours and when used by overweight or obese women (Glasier et al. 2011). Compared with some other methods, ECPs are significantly less effective as a regular method of contraception. One study concluded that if an average woman used levonorgestrel ECPs in perfect compliance for a year instead of her regular contraceptive method, her risk of pregnancy would be 20%, compared with 4% for perfect compliance with the withdrawal method (Trussell 2011; Trussell et al. 2014).

Since their debut in 2002 in India, ECPs have met with mixed reactions from central and state governments. In 2005, ECPs became available over-the-counter drugs in India. To promote their use, the Indian government incorporated them in the national family planning and rural health programs, making them available at highly subsidized rates in rural areas. With prices ranging from (in U.S. dollars) $0.03 to $0.05 in rural areas and $0.35 to $1.60 in urban areas, the ECP sector saw more than a 245% growth in sales between 2007 and 2010 (Relph 2010). However, in September 2006, the state government of Tamil Nadu banned over-the-counter sales and any form of advertisement of ECPs in the state. With major pharmaceutical companies launching an aggressive advertisement campaign to promote ECP use, the advertisement and sale of ECPs continued in the rest of the country. Currently, ECPs are available over the counter in all the states of India except Tamil Nadu, where ECPs are neither advertised nor available over the counter. Figure 1 shows the history of ECP availability in India, together with a timeline of the survey data used in this study.

In addition to being big business for the companies, the use and availability of ECPs is also an important issue for women's reproductive health in India. In all three rounds of National Family Health Survey (NFHS) in India, almost 25% of women reported at least one unintended pregnancy (Dutta et al. 2015). Two-thirds of all abortions in India take place outside authorized health service facilities (Åhman and Shah 2011). Each year, nearly 11 million abortions are induced, more than 20,000 deaths from abortion-related complications are officially recorded, and potentially more abortions and deaths remain unrecorded. In a WHO study on sexual and reproductive health, Grimes et al. (2006) stated that approximately 28% of Indian women reported attempting self-abortion even though abortion has been legal in India since 1971. Recent research has provided more persuasive evidence that abortion and modern

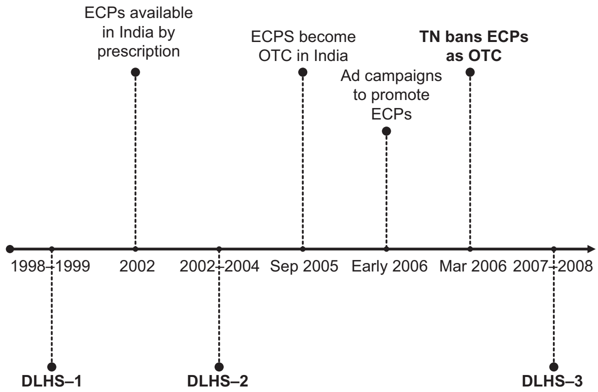

Fig. 1 Timeline of ECP availability in India. OTC=over the counter. TN=Tamil Nadu. DLHS = District Level Household and Facility Survey on Reproductive and Child Health.

contraception are substitutes (Miller and Valente 2016). With these statistics and the belief that having greater control over one's reproductive cycle is empowering, providing increased access to contraceptives is vital. Adding ECPs to the choice set of contraceptives can help lower the costs due to unwanted pregnancies in India.

The launch of ECPs in India was met with opposition unlike any other method of family planning, with objections ranging from behavioral to moral. Opponents argued that making ECPs available over the counter would encourage women, particularly adolescents, to choose riskier contraception methods—ones with lower efficacy and no protection from STIs. In this light, we test the hypothesis that making ECPs more widely available results in users becoming less diligent with their current non-ECP contraceptive method and leads to a higher incidence of STIs.

Literature Review

In the family planning literature, research on AIDS prevention and contraceptive method choice examines risk compensation behavior, particularly the question about how perceived risks of AIDS affect sexual behavior. Godlonton et al. (2016) examined the impact of a change in the perceived level of risk on the sexual behavior of men in rural Malawi. In a randomized control trial, they informed circumcised and uncircumcised men that circumcision significantly reduces the risk of HIV infection in men. With this new information given to the participants, they tested whether a reduction in the perceived level of risk in circumcised men led to risk compensation and thus riskier sexual behavior. They found no evidence that the information led circumcised men to engage in riskier sex. In addition, they found a decrease in risky sexual behavior among uncircumcised men.

Many studies have concluded that making ECPs more widely available does not increase risk-taking or adversely affect regular contraceptive use (Ellertson et al. 2001; Marston et al. 2005; Moreau et al. 2009). The evidence suggesting the contrary—prevalence of risk compensation in women when ECPs are easily available—is smaller but considerable. In a controlled trial in women's health clinics in San Francisco, California, Raine et al. (2000) found that women aged 16–24 who received an advanced provision of ECPs accompanied by education were three times more likely to use it than women who were provided only education. Although the treatment group did not report higher frequencies of unprotected sex than the control group immediately after the intervention, women in the treatment group were more likely than those in the control group to report using less effective contraception at follow-up than at the time of enrollment. Weaver et al. (2009) explored the attitude and behavior effects in a randomized trial of increased access to emergency contraception. They found that, on average, women in the increased-access group had significantly stronger perceptions of the relative benefit of emergency contraception. Women in the increased-access group were also significantly more likely to report that they had ever used emergency contraception because they did not want to use either condoms or another contraceptive method. A more recent study by Atkins and Bradford (2015a) looked at the effect of changes in policy for over-the-counter access to ECPs on young adults across New England states. They found that switching ECPs to a nonprescription status had no systematic effect on the probability of sexual activity or of hormonal birth control use, but it significantly reduced the probability that public school students used condoms by 5.2% to 7.2%. Another study by Atkins and Bradford (2015b) found that increased access to ECPs from a national policy change in the United States had no impact on risky sexual practices of women aged 18 or older. However, state-level policy changes were associated with an increased likelihood of sex without a condom for women with multiple partnerships.

These results are similar to what we find in this study: increased access to ECPs has resulted in a statistically significant reduction in the use of other types of contraceptive methods. However, unlike this study, Durrance (2013) and Mulligan (2016) found that over-the-counter access to ECPs in the United States led to a statistically significant increase in rates of STIs among both men and women.

Although limited research is available on the impact of increased ECP access in India, some evidence has suggested concerns regarding awareness about proper ECP use. In a study of college students in India, Joseph et al. (2016) found that although more than 85% of students had heard of ECPs, less than 34% of the total sample knew that they did not prevent STIs. Almost one-half of the students interviewed said they would recommend ECPs to their friends. In an effort to understand the level of awareness among pharmacists who regularly dispense ECPs over the counter, Saxena et al. (2016) used mystery shopper techniques and found that approximately 79% of the pharmacists in the sample were unclear about the side effects of ECP use, 86% did not know whether subsequent unprotected intercourse would lead to pregnancy, and only 16% were able to discuss the risk of STIs when asked leading questions.

In most studies reviewed here, the use and impact of ECPs were estimated for women whose access to ECPs was accompanied by education and in-person counseling for proper use by trained medical professionals. The women included in these studies, who were largely from urban areas in developed countries, experienced much higher exposure to media and healthcare services compared with the Indian women included in the data set we analyze here. The women who had access to and chose to consult a clinic to seek contraceptives would also be systematically different from the women in our data set who buy EPCs over the counter from local pharmacies.

In addition to disparities in information, the Indian women included in our sample are likely to differ from their counterparts in developed countries with respect to intertemporal discount rates and intrahousehold bargaining power over the preferred method of contraception. The social context in which most Indian women must navigate their options related to fertility and contraception is complex. For unmarried young women, the social cost of failed contraception is enormously high in both urban and rural areas. Moreover, given the lower intrahousehold bargaining power of women in India, fertility decisions and the choice of contraceptives may largely be driven by the preferences of their male partners, who may prioritize personal pleasure over the choice of most appropriate contraception method for their partner.

Theoretical Framework: Risk Compensation Theory

Peltzman's (1975) theory of risk compensation behavior resulting from mandatory automobile safety regulation led many social scientists to look for evidence of similar risk behavior in a variety of fields. Peltzman's theory suggests that people adjust their behavior according to their perceived level of risk, acting with greater care when the perceived risk is higher and with less care when it is lower. If risk-reducing techniques (such as the use of automobile seat belts) reduce risk to a level that is perceived as low enough to encourage people to engage in riskier behavior (such as reckless driving), then the potential net benefits of these techniques might be undermined. The empirical literature on risk compensation behavior has traditionally focused on examining behavioral responses to risk-reducing technologies, such as seat belts, bicycle helmets, and other protective sports gear (Evans and Graham 1991; Hagel and Meeuwisse 2004; Phillips et al. 2011). More recently, researchers have also looked at similar risk compensation responses in the context of HIV prevention and whether a difference in the perceived risk of infection changes people's behavior. Choosing a method of contraception similarly requires evaluating costs and benefits, and a gap between perceived costs and benefits can lead people to choose methods that may not be the most suitable for their needs.

Past research found that women's choice of contraception method is guided by a range of socioeconomic factors, access, efficacy, individual preferences, and partnership characteristics (Frost and Darroch 2008; Trussell and Guthrie 2007). However, a significant gap between perceived versus actual costs and benefits may lead users to choose contraceptives that do not reflect their preferences. With the increased availability of ECPs and aggressive advertising campaigns by pharmaceutical companies, potential users might have an inaccurate perception of the benefits and costs of using ECPs compared with other methods of contraception. This may lead to substituting away from other more effective methods of contraception, such as condoms, which are also the only form of modern contraception that prevents STIs. Unlike ECPs, regular oral contraceptives require women to take medication daily. The cognitive costs of following a strict schedule might be small yet nonzero for women. With the price of oral and emergency contraceptives being comparable, this small nonzero cost might also become a determining factor in the choice between regular oral contraceptives and ECPs.

Following the framework posited by Peltzman (1975), we can think about risk-taking behavior—in this case, intercourse without using regular or non-emergency contraception—as a desirable good that provides some utility in terms of, for example, increased satisfaction, pleasure, and thrill-seeking or conversely, in terms of decreased cognitive costs. Thus, the equilibrium will be a trade-off between perceived avoidance of (an unwanted) pregnancy and unprotected intercourse: more of one can be achieved by forgoing some of the other. If the equilibrium level of perceived risk to a woman is altered by a risk-reducing technology, she compensates by increasing her willingness to take a higher level of risk. Studies trying to measure the effectiveness of ECPs (or any risk-reducing technology for that matter) usually measure the effectiveness without taking into account the possibility of risk compensation. If people are risk compensating, the new equilibrium of the optimal level of risky behavior will tend to be higher than estimated previously. We test the hypothesis of risk compensation by looking at possible substitution between ECPs and other safer, more effective methods of contraception.

Data

We use three rounds of the District Level Household and Facility Survey on Reproductive and Child Health (DLHS) conducted by the International Institute of Population Sciences (IIPS) in India. The survey covers a repeated cross-section of a representative household sample at the district level. Rounds 1, 2, and 3 were carried out in 1998–1999, 2002–2004, and 2007–2008, respectively. Each round of the survey covered approximately 600 districts in India, with 1,000 to 1,500 households in each district, resulting in a sample size of more than 720,000 households and 644,000 women. Rounds 1 and 2 interviewed currently married women in the sample households, and Round 3 covered women who were ever married.[1] The surveys are designed to provide information on family planning, maternal and child health, reproductive health of married women (aged 15–49), and use of maternal and child healthcare services at the district level for India. In addition, the surveys also provide information on postnatal care, health institutions and facilities, and coverage of all maternal and child health programs—all representative at the district level. The survey consists of three parts: a village questionnaire, a household questionnaire, and a women's questionnaire in both English and the vernacular. The women's questionnaire consists of detailed questions asked to ever-married women about their awareness and use of contraception methods (including ECPs) as well as about the incidence of STIs and other topics, which are of particular interest for the analysis in our study.

Methodology

The state of Tamil Nadu, unlike all other states, has not allowed advertisement or over-the-counter sale of ECPs since September 2006. The ban has been enforced with frequent raids, fines, and closing down of pharmaceutical stores (Ramalingam 2006). Tamil Nadu is bordered by three other states—Kerala, Andhra Pradesh, and Karnataka—all of which have seen a significant increase in the use of ECPs in the

[1] In our analysis, we limit the Round 3 sample to currently married women to maintain consistency with observations from the previous two DLHS survey rounds.

past few years. The timing of the Tamil Nadu ban and the DLHS surveys (see Figure 1 for a timeline) allows us to estimate the impact of increased ECP access on sexual behavior using the ban as a natural experiment. Given that the policy change in Tamil Nadu involved a ban on over-the-counter sales and advertising of ECPs, we can measure only the net impact of both these channels: easier availability and increased exposure to advertising campaigns of ECPs in the neighboring states.

We use a double-difference estimator followed by a parametric difference-in-difference estimator incorporating propensity scores (PSM-DiD) as an additional robustness check. Limiting our sample to border districts to again estimate a double difference, we find that our results are robust. Two key concerns regarding the validity of the analysis are whether Tamil Nadu is a good counterfactual for the other states and whether the ban in Tamil Nadu was indeed exogenous and uncorrelated with any baseline characteristics specific to the state. In the following subsection, we present evidence and argue that both assumptions hold true.

The Case for an Exogenous Policy Change

In September 2005, the Drug Controller General of India (DCGI) officially made the levonorgestrel-based ECP available over the counter in all states in India, including the state of Tamil Nadu. This was seen as a step toward promoting women's reproductive rights in India. However, in most states—including Tamil Nadu, Karnataka, Andhra Pradesh, and Kerala—fringe organizations, such as Responsible Parents Forum, Swarna Bharat Trust, and some religious interest groups, protested against the move. The protest alone was not enough in any state to persuade the state administration to place a ban on over-the-counter sales of ECPs. As a result, even though ECPs had not yet gained popularity, they were easily available in Tamil Nadu until September 2006.

In March 2006, an ex-official of the Drugs Control Authority of Tamil Nadu moved the State High Court to remove the director of the Drugs Control Authority, arguing that he did not meet the educational qualifications required for the position (Subramani 2006). The petition supported the promotion of junior officials who met the eligibility criteria to the position. In light of support for the petition from the High Court, the Tamil Nadu State Department of Health removed the director and in June 2006, promoted and appointed Mr. N. Selvaraju as the new director of the Drugs Control Authority (Babu 2006). Among the important duties of the director are issuing approvals for the sale and distribution of various drugs in the state and enforcing the Drugs and Cosmetics Act of 1940 and the Drugs and Magical Remedies Act (Objectionable Advertisements) of 1954 (Selvaraju 2006). Within a few months of assuming office, citing moral reasons, Mr. Selvaraju placed a ban on over-the-counter sales of ECPs in the state under the Drugs and Cosmetics Act and the Drugs and Magical Remedies Act. As he stated in an interview on the issue (Ravindran 2009):

> We are not against women's rights, but this is a moral concern. The advertising of this drug will mean that women will think, "I can do anything and there is an easy way not to get pregnant." We can't allow such an attitude to grow.

Against medical information and evidence, Selvaraju also claimed that ECPs are abortifacient and not contraceptives and thus cannot be made available over the counter. We argue that given the circumstances, the change in the administration of the Drug Control Authority was an exogenous one leading to the appointment of a supporter of the ban. We use normalized differences to perform balance tests using key baseline characteristics from the treatment and control groups and find no significant differences.[2] If a normalized difference exceeds one-quarter, estimates from linear regression methods are classified as being sensitive to the specification. This anecdote provides evidence that the timing of the change in the law was random.

To show that enactment of the ban was not correlated with unobserved characteristics specific to Tamil Nadu, we use the first two rounds of the DLHS data to empirically test the parallel trends assumption. We find no significant differences in the rates of change in contraception use, STI prevalence, and so forth between the comparison states and Tamil Nadu. Finally, we also control for pretreatment years in the main regression estimates to empirically test for differences in outcome variables between treatment and control states before the policy change. Again, we find no statistically significant differences, thus lending further credibility to our assumption.

The first empirical method we use to estimate the impact of the policy change is a standard double-difference estimation for the full sample followed by the same estimation for a sample limited to border districts while trying multiple different model specifications. We then perform a double difference combined with propensity score matching to further check our estimates. We outline the empirical underpinnings of both our strategies, along with the underlying assumptions that we need to test for its validity.

Double Difference

Before we perform the standard double-difference estimation, we check the validity of the underlying assumption of common trends between the treatment and control states in the pretreatment period. As an additional robustness check, we then limit our sample to border districts and perform the same tests.

Given that our assumption about common trends is valid, we estimate a regression model of the following form:

$$Y_{ist} = \beta_0 + \gamma_s + \delta_t + \beta_1(Non_{TN_s} \times d_{t=3}) + \beta_2(Non_{TN_s} \times d_{t=2}) + \beta_3\mathbf{X}_{ist} + \varepsilon_{ist}, \quad (1)$$

where Y_{ist} is the outcome variable for individual i in state s in period t. We use γ_s as a set of state fixed effects and δ_t as a set of survey year fixed effects. Further, Non_{TN_s} is a dummy variable for three states that did not have the ban, and $d_{t=3}$ is a dummy variable for the after (treatment) period (the third round of DLHS). The estimated impact is β_1. Our regression model also includes the interaction of $d_{t=2}$ (a dummy variable for the second DLHS survey round conducted prior to the policy change), and Non_{TN_s}. The coefficient β_2 on this interaction term that is statistically indistin-

[2] We use normalized differences because they are less sensitive to misspecification and sample sizes than t statistics (Imbens and Wooldridge 2009).

guishable from zero provides further evidence for the lack of differential pre-trends between the treatment and control groups.

The main outcome variables of interest are rates of contraceptive use and the incidence of STIs. We restrict the analysis to contraceptives that are close substitutes for ECPs, such as condoms, regular oral contraceptives, the withdrawal method, and the rhythm or abstinence method. We do not compare any changes in the use of permanent methods of contraception (e.g., sterilization) or semipermanent methods (e.g., IUDs) because those are not close substitutes for over-the-counter ECPs, which are short-term methods whose use requires no planning, invasive medical procedure, or intervention from trained medical staff.

If ECP use is likely to substitute for other contraceptives, then coefficient β_1 on the interaction of $Non_{TNs} \times d_t$ should be negative in Eq. (1) with contraceptive use as the outcome variable. Intuitively, this means that with increased access to ECPs, fewer women will tend to use other contraceptives compared with women in Tamil Nadu. This would be evidence for ECPs being used as a substitute for other contraceptives, such as condoms. Furthermore, if people are risk compensating in riskier sexual encounters, using the incidence of STIs as an outcome variable should result in a positive coefficient for β_1 in Eq. (1). This would imply an increase in STI rates increased in states that had increased access to ECPs compared with Tamil Nadu.

Finally, we also control for a number of individual characteristics ($\mathbf{X}_{ist}$) that are likely to have an influence on the outcome variable. The set of individual characteristics used as control variables includes years of woman's education, years of husband's education, woman's age and age at marriage, religion, location (rural or urban), and some indicators of household wealth (such as type of house).

We replicate the model using only the observations from border districts in Tamil Nadu and the adjoining states because these districts are likely to share many common cultural features that would reduce any bias in the initial estimates. One of the concerns while analyzing only the border districts of these states would be the possible illicit trade of ECPs across the border. Note that Tamil Nadu faces a ban on not only ECP sales but also any advertising of the product. The ban on advertising since the launch of the product will affect both the awareness about and demand for the product. Nevertheless, some spillover may occur between border districts of treatment and control states. Any spillover of information accompanied by illegal sales across the border from treatment to control states would lead to an underestimation of the actual impact of the policy.

Double Difference Using Propensity Score Matching (PSM-DiD)

We augment our analysis with a parametric difference-in-difference estimator incorporating propensity scores (PSM-DiD) for this analysis. We apply the PSM-DiD analysis, limiting our sample to the border districts and using only the last two rounds of survey data: DLHS Round 2 and DLHS Round 3. A number of studies have used PSM-DiD estimators, mostly in panel settings (Mu and van de Walle 2011). These studies used pretreatment variables to construct propensity scores and estimated the impact using a weighted regression in first differences (Khandker et al. 2009).

However, integrating propensity score matching in difference-in-differences under a repeated cross-section setting is different owing to the fact that we effectively have four groups—treatment pre (G_1), treatment post (G_2), comparison pre (G_3), and comparison post (G_4)—as opposed to the binary treatment control under usual propensity score matching settings.

To implement propensity score matching in this setting, we follow the multiple group propensity score weighting methodology proposed by Stuart et al. (2014). Their method is similar to the inverse probability of treatment weighted estimator with multiple treatments. Stuart et al. proposed a weighting strategy in which the four groups are weighted to reflect the distribution of the individual covariates in the treatment group in the pre-policy change period. Following this method, we estimate a multinomial logistic model to predict the group in which an individual observation belongs to a function of covariates. We use individual age, education, age at marriage, fertility, and indicators for rural/urban, religion, caste, and housing conditions in the pre-policy change period. We allow for flexible functional forms using the levels of the covariates as well as a mixture of their interactions. The resulting multinomial model is used to predict four propensity scores for each observation. Following the notation in Stuart et al. (2014), the propensity scores are $e_k(\mathbf{X}_i)$:

$$\begin{aligned} &e_k(\mathbf{X}_i) = \Pr(i \in g_k), \quad k = 1,2,3,4 \\ &\sum_{k=1}^{4} e_k(\mathbf{X}_i) = 1 \quad \forall i. \end{aligned} \tag{2}$$

These predicted probabilities are then used to construct individual weights, w_i:

$$w_i = \frac{e_1(\mathbf{X}_i)}{e_g(\mathbf{X}_i)}, \tag{3}$$

where g is the group to which individual i belongs. By construction, all individuals in the treatment group in the pre-policy period receive a weight of 1. Individuals in other groups receive weights proportional to how similar they are to observations in Group 1 relative to individuals in their own group. We then estimate a difference-in-differences weighted linear regression.

Results

Table 1 presents descriptive statistics for the three rounds of DLHS data for all the four states used for our analyses. As shown in the table, a large proportion of the population report awareness of STIs in the data set. The survey asks women whether they have heard about STIs, reproductive tract infections, AIDS, or HIV; and if the answer to any one of these is affirmative, the survey considers the woman as aware of STIs. Given the relatively high awareness of AIDS, owing largely to the efforts of the central government body National AIDS Control Organization (NACO), the survey registers a high overall awareness of STIs. We see a modest increase in the share of women who use any family planning method, from roughly 59% in the first round to nearly 65% in the third round.

Table 1 Descriptive statistics of main variables across three DLHS survey rounds

	Round 1 (1998–1999) (1)	Round 2 (2002–2004) (2)	Round 3 (2007–2008) (3)	Total (4)
Current Age of Woman	30.09	30.26	31.95	30.73
	(7.403)	(7.166)	(8.224)	(7.665)
Years of Education, Woman[a]	4.479	8.898	8.452	6.872
	(4.866)	(3.387)	(3.574)	(4.623)
Years of Education, Husband	6.158	9.762	8.706	7.888
	(5.168)	(3.681)	(5.179)	(5.078)
Age When Started Living With Husband	17.55	19.31	19.25	18.54
	(3.304)	(3.498)	(3.574)	(3.546)
Fertility	2.239	1.901	2.081	2.103
	(1.467)	(1.136)	(1.208)	(1.316)
Aware of STI	0.770	0.943	0.943	0.869
	(0.421)	(0.232)	(0.233)	(0.337)
Symptoms of STI (past 3 months)	0.245	0.145	0.106	0.175
	(0.430)	(0.352)	(0.308)	(0.380)
Currently Use Any Family Planning Method?	0.586	0.635	0.649	0.619
	(0.492)	(0.481)	(0.477)	(0.486)

Notes: Each cell reports the sample mean of the corresponding variable. Standard deviations are reported in parentheses. Columns 1–3 report summary statistics for the three DLHS rounds separately, and column 4 reports the same for the pooled sample of observations across the three rounds.

[a] The sudden increase in the years of woman's education and husband's education from Round 1 to Round 2 is due to a change in definition of the variable between the rounds. However, the definition of this variable remains consistent within rounds and across states for each round. For our analysis across different rounds, we redefine the variable to account for this change.

One of the limitations of our data is the low rate of ECP adoption in the time frame for which data are available. Almost 36% of the sample in rural areas and 49% in urban areas report awareness of ECP as a method of contraception, but the adoption rates are much lower. Female sterilization remains the leading method of contraception among women in India: in the DLHS data, 36% of ever-married women have opted for sterilization, and 65% of ever-married women who use at least one method of contraception reported opting for sterilization. Male sterilization remains low, at less than 1%.[3] Figure 2 shows the percentage of current contraception use by ever-married women who are not sterilized and report using at least one method of family planning. Among this sample, the majority of women report using traditional methods, such as periodic abstinence or withdrawal method.

We now estimate a standard double difference. To ensure its validity, we perform cross-sectional balance tests for treatment and control states and then conduct empir-

[3] Table A1 in the online appendix presents a summary of reported awareness among ever-married women on contraception methods from Round 1 to Round 3 for all four states. Table A2 of the online appendix shows the cross-sectional difference in ECP awareness for the treatment period. Respondents were not asked about ECP awareness in previous survey rounds. The cross-sectional regression results in Table A2 suggest that women in non–Tamil Nadu states had, on average, higher awareness about ECPs than women in Tamil Nadu.

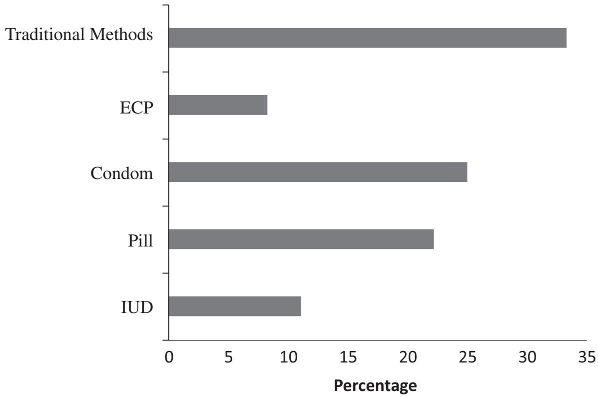

Fig. 2 Current contraception use among ever-married women who are not sterilized and reported using any method of contraception

ical tests for common trends using the first two rounds of survey data. Panel A of Table 2 shows the sample means in the treatment and control states for individual and household characteristics that are likely to affect the outcome variables when we pool the observations from all three rounds of the DLHS data in the first two columns. Columns 3 and 4 show the *p* value from a *t* test for the difference in means and the normalized differences, respectively. Our estimates show no significant differences in most covariates between the treatment and control samples. In panel B of Table 2, using the data from only the two survey rounds prior to the policy change, we show that the differences between treatment and control states for the outcome variables and their subcategories are not statistically different in the period before the treatment. These cross-sectional comparisons make the case that before the policy change, the outcome variables in the treatment and control states were comparable, and this is further confirmed in the test for common trends that we perform.

Table 3 presents the results of the double-difference estimation. For brevity, the table displays the coefficient on the main variables of interest. The complete estimation results are available in the online appendix. In panel A of Table 3, we first present evidence for the validity of the common trends assumption, which is crucial for the use of a double-difference strategy. For this, we estimate a version of Eq. (1) using the data from only the two survey rounds prior to the policy change. As shown in the table, the interaction term between treatment state and pretreatment period has no significant impact on the outcome variables providing support for the common trend assumption.

Panel B of Table 3 presents the results of double-difference estimation on the impact of policy change on contraceptive use and STIs. Column 1 of the table presents the estimates for a regression in which the outcome variable takes the value 1 to indicate any non-ECP contraceptive use, including sterilization, intrauterine devices, condoms, oral contraceptives, and traditional methods. We examine this variable for each type of contraceptive in the subsequent columns (columns 2 to 5). Our coefficient of interest is the interaction between treatment states and the treatment period (β_1). We also present the coefficient on β_2, the interaction of the treatment with the second survey round (prior to the policy change). The coefficient on the pre-period interaction remains statisti-

Table 2 Sample means and tests for differences between treatment and control states for individual and household characteristics (panel A) and for outcome variables in the pre-period (panel B)

	Treatment States Mean (1)	Control State (TN) Mean (2)	p Value (3)	Normalized Difference (4)
A. Individual and Household Characteristics				
Current age of woman	28.17	30.41	0.05	0.27
	(8.24)	(8.20)		
Years of education, husband	7.61	7.78	0.88	0.04
	(4.75)	(4.48)		
Years of education, woman	7.48	8.10	0.48	0.12
	(5.15)	(4.69)		
Age when started living with husband	18.17	19.48	0.23	0.34
	(3.89)	(3.49)		
Religion				
Hindu	0.75	0.87	0.27	0.28
	(0.43)	(0.34)		
Muslim	0.18	0.08	0.18	–0.29
	(0.38)	(0.27)		
Christian	0.06	0.05	0.77	–0.05
	(0.24)	(0.22)		
Other	0.01	0.00	0.09	–0.06
	(0.08)	(0.04)		
Caste				
Scheduled caste	0.17	0.23	0.13	0.17
	(0.37)	(0.42)		
Schedule tribe	0.07	0.02	0.05	–0.25
	(0.26)	(0.12)		
Other backward caste	0.47	0.73	0.00	0.52
	(0.50)	(0.44)		
Housing characteristics				
Concrete	0.39	0.37	0.88	–0.04
	(0.49)	(0.48)		
Semi-concrete	0.43	0.44	0.94	0.02
	(0.50)	(0.50)		
Mud	0.18	0.19	0.81	0.03
	(0.38)	(0.39)		
B. Outcome Variables in Pre-period				
Condom	0.037	0.036	0.942	–0.006
	(0.190)	(0.186)		
Oral pill	0.015	0.006	0.089	–0.065
	(0.122)	(0.076)		
Periodic abstinence	0.051	0.030	0.600	–0.077
	(0.220)	(0.170)		
Withdrawal method	0.030	0.016	0.673	–0.065
	(0.170)	(0.126)		
Symptoms of possible STI (past 3 months)	0.073	0.061	0.215	–0.036
	(0.261)	(0.239)		
Vaginal discharge (past 3 months)	0.109	0.191	0.17	0.160
	(0.312)	(0.393)		

Table 2 (continued)

	Treatment States Mean (1)	Control State (TN) Mean (2)	*p* Value (3)	Normalized Difference (4)
Pain during urination (past 3 months)	0.049 (0.216)	0.037 (0.189)	0.046	–0.042
Pain during intercourse (past 3 months)	0.048 (0.213)	0.039 (0.194)	0.272	–0.030

Notes: TN=Tamil Nadu. Columns 1 and 2 of both panels report mean values and standard deviations (shown in parentheses) for the characteristics of control and treatment groups. Column 3 reports the *p* value of the *t* test for the difference in means. Column 4 reports the normalized difference (Imbens and Wooldridge 2009). A normalized difference greater than 0.25 indicates significant differences between treatment and control. The sample in panel A consists of all observations pooled across the three DLHS survey rounds. To test for differences in outcomes in the pre-period, the sample in panel B is limited to the observations from the first two rounds of the DLHS (1998–1999 and 2002–2004) conducted prior to the treatment period.

cally insignificant across all the outcomes, thereby further bolstering the common trend assumption and lending validity to the double-difference estimates.

In column 1 of panel B, we find that the overall use of any non-ECP contraceptive use decreases by nearly 0.05 percentage points due to over-the-counter access to ECP. In column 2, we replace the outcome variable with condom use. We see that when given increased access to ECPs without counseling for proper use, condom use decreases significantly in the treatment states compared with the control state, Tamil Nadu, where ECPs are not easily available. Condom use decreased by more than 13% in the treatment states compared with the control state. The use of the abstinence method also significantly decreased by about 0.01 percentage points (column 4), although this decrease is significant only at the 10% level. Apart from these differences, we find no significant change in any of the other outcome variables (oral pill usage, withdrawal method, or STI symptoms). Thus, we find some evidence for substitution between ECPs, condoms, and abstinence but none for ECPs and other methods. We also find that increased access to ECPs did not result in an increase in the incidence of STIs.

As an additional check, we limit our sample to the border districts of the treatment and control states and perform the analysis again. These results are presented in Table 4. Similar to the previous estimates, we show a test for parallel trends using only the two pre-period survey rounds in panel A and present the impact estimates in panel B. The results from using the sample of border districts remain qualitatively consistent with the estimates resulting from using the full sample in the previous table. Panel A of Table 4 shows that the interaction term between treatment state and pre-treatment period has no significant impact on any of the outcome variables, thus supporting our assumption of parallel trends. Panel B of the same table presents the results of the double difference analysis and impact of the policy change when the sample is limited to border districts.[4] The coefficients on the variable of interest—the interaction of treatment states with treatment period (β_1)—are similar to those found using

[4] The full table of estimates for the results in panel B is presented in the online appendix. The full set of estimates for panel A is available upon request.

Table 3 Difference-in-difference estimates on the probability of using other contraceptive methods and STI symptoms (using full sample)

	Non-ECP Family Planning Use (1)	Condom (2)	Oral Pill (3)	Periodic Abstinence (4)	Withdrawal Method (5)	STI (6)
A. Test for Parallel Trends Assumption Using DLHS Rounds 1 and 2						
Non-TN × Survey Round 2 (pre-treatment period)	–0.0203	–0.0059	0.0024	0.0021	0.0049	0.0086
	(0.0176)	(0.0046)	(0.0016)	(0.0082)	(0.0105)	(0.0055)
Number of observations	110,529	110,529	110,529	110,529	110,529	110,529
R^2	.2610	.0268	.0057	.0317	.0159	.0171
B. Impact of Increased Access to ECPs (using all three DLHS rounds)						
Non-TN × treatment period	–0.0462*	–0.0048**	0.0018	–0.0141†	–0.0023	0.0113
	(0.0220)	(0.0002)	(0.0013)	(0.0058)	(0.0016)	(0.0153)
Non-TN × Survey Round 2 (pre-treatment period)	–0.0206	–0.009	0.0022	–0.0024	0.0015	0.0208
	(0.0231)	(0.0038)	(0.0015)	(0.0063)	(0.0083)	(0.0100)
Number of observations	167,658	167,658	167,658	167,658	167,658	167,658
R^2	.2650	.0284	.0069	.0361	.0304	.0349

Notes: Standard errors, shown in parentheses, are clustered at the state level. Each column presents the results from an OLS regression. Panel A uses data from the two DLHS survey rounds prior to the policy change. The regressions in panel B use all three DLHS survey rounds. Non-TN is a dummy variable taking the value 1 if the individual is not located in Tamil Nadu; treatment period takes the value 1 for observations from DLHS 3 that correspond to the period post the policy change; and Survey Round 2 is a dummy variable taking the value 1 for DLHS 2 observations. The dependent variable in column 1 includes sterilization, IUDs, and other contraceptive methods in addition to the methods shown in columns 2–5. All specifications include state and survey year fixed effects, along with individual and household characteristics, and are shown in panel A of Table 2. The full table is available in the online appendix.

†$p<.10$; *$p<.05$; **$p<.01$

the full sample and continue to provide evidence for substitution between ECPs and other contraceptive methods. The magnitude of the coefficient on overall non-ECP contraceptive use in column 1 indicates a reduction of nearly 0.07 percentage points, slightly larger than the estimate of 0.05 found using the full sample. Similar to the results in Table 3, we find that this decline is driven by the shift away from condom and abstinence methods. The decrease in condom use is still statistically significant, with a 10% decrease in the states where ECP is easily available, also accompanied by an almost 35% decrease in abstinence method of contraception. Apart from these differences, we find no statistically significant change in any other method of contraception or the incidence of STIs.

We now turn to our second analysis strategy: a parametric difference-in-difference estimator combined with propensity scores (PSM-DiD). Table 5 presents a summary of the covariate means for observations in each group in the pre- and post-periods as

Table 4 Impact of increased access to ECPs on the probability of using other contraceptive methods and STI symptoms (using border districts only)

	Non-ECP Family Planning Use (1)	Condom (2)	Oral Pill (3)	Periodic Abstinence (4)	Withdrawal Method (5)	STI (6)
A. Test for Parallel Trends Using DLHS Rounds 1 and 2						
Non-TN × Survey Round 2 (pre-treatment period)	–0.0150	–0.0005	0.0031	0.0205	0.0131	0.0151
	(0.0412)	(0.0040)	(0.0016)	(0.0096)	(0.0087)	(0.0229)
Number of observations	32,190	32,190	32,190	32,190	32,190	32,190
R^2	.264	.0282	.0057	.0424	.0321	.0342
B. Impact of Increased Access to ECPs (using all three DLHS rounds)						
Non-TN × treatment period	–0.0677*	–0.0035†	0.0015	–0.0159*	0.0018	0.0068
	(0.0151)	(0.0014)	(0.0012)	(0.0034)	(0.0011)	(0.0242)
Non-TN × Survey Round 2 (pre-treatment period)	–0.0118	–0.0009	0.0028	0.0217	0.0131	0.0180
	(0.0050)	(0.0037)	(0.0014)	(0.0095)	(0.0083)	(0.0218)
Number of observations	48,780	48,780	48,780	48,780	48,780	48,780
R^2	.2484	.0280	.0050	.0354	.0297	.0435

Notes: Standard errors, shown in parentheses, are clustered at the state level. Each column presents the results from an OLS regression. The sample consists of observations from border districts only. Panel A uses data from the two DLHS survey rounds prior to the policy change. The regressions in panel B use all three DLHS survey rounds. Non-TN is a dummy variable taking the value 1 if the individual is not located in Tamil Nadu; treatment period takes the value 1 for observations from DLHS 3 that correspond to the period post the policy change; and Survey Round 2 is a dummy variable taking the value 1 for DLHS 2 observations. The dependent variable in column 1 includes sterilization, IUDs, and other contraceptive methods in addition to the methods shown in columns 2–5. All specifications include state and survey year fixed effects, along with individual and household characteristics, and are shown in panel A of Table 2. The full table is available in the online appendix.

†$p < 0.10$; *$p < 0.05$

well as the unweighted and weighted standardized difference in means. The weighted differences for almost all groupwise comparisons are less than 0.25, indicating that the weighted sample covariates are balanced across the four groups. This is crucial for the validity of PSM-DiD.

Table 6 presents the results of the weighted regression. For brevity, we present only the coefficient of interest for each estimation and suppress the coefficients on the other variables in the model. Overall, the pattern of impact that we see from the PSM-DiD results remains qualitatively similar to the findings from the standard double-difference models shown earlier. Consistent with the previous results, the use of non-ECP family planning methods decreased significantly overall in the states where ECP is easily available (column 1 of Table 6). The magnitude of 0.11 percentage point reduction is larger than the results from the previous double-difference estimate (about 0.07, using the border districts sample). Specifically, the use of condoms, abstinence, and withdrawal methods decreased significantly when ECP was available over the counter. Here again, we find no evidence for any change in STIs as a result

Table 5 Covariate means and normalized difference in means, weighted and unweighted

	Group				Unweighted Normalized Difference in Means			Weighted Normalized Difference in Means		
Covariate	1 Non-TN pre (1)	2 Non-TN post (2)	3 TN pre (3)	4 TN post (4)	2 vs. 1 (5)	3 vs. 1 (6)	4 vs. 1 (7)	2 vs. 1 (8)	3 vs. 1 (9)	4 vs. 1 (10)
Age	27.47	28.78	28.83	29.04	0.49	0.51	0.23	–0.07	–0.02	–0.08
Years of Education, Woman	9.70	9.91	9.49	8.94	0.12	–0.11	–0.23	–0.03	–0.07	0.15
Year of Education, Husband	9.86	9.65	10.30	8.87	–0.09	0.23	–0.28	–0.23	0.21	–0.06
Age at Marriage	19.79	20.12	20.37	20.34	0.17	0.30	0.14	–0.04	0.07	0.13
Births (fertility)	1.44	1.64	1.33	1.59	0.18	–0.10	0.13	–0.02	–0.05	–0.13
=1 if Rural	0.62	0.73	0.41	0.43	0.17	–0.29	–0.38	0.00	–0.12	–0.13
Housing Characteristics					0.23	–0.06	–0.14	–0.01	–0.02	0.01
Concrete	0.53	0.69	0.48	0.46	–0.25	0.03	0.14	0.01	–0.01	0.00
Semi-Concrete	0.41	0.24	0.43	0.48	0.02	0.04	0.00	0.00	0.05	–0.01
Mud	0.07	0.08	0.09	0.07	0.04	0.37	0.53	0.02	0.05	0.17
Religion					–0.01	–0.35	–0.52	–0.02	–0.05	–0.04
Hindu	0.59	0.61	0.83	0.85	–0.04	–0.05	–0.07	–0.01	–0.01	–0.16
Muslim	0.30	0.29	0.08	0.06	0.00	–0.01	–0.03	0.00	0.00	–0.01
Christian	0.12	0.09	0.09	0.09	–0.07	–0.46	–0.59	0.01	–0.02	–0.13
Other	0.00	0.00	0.00	0.00	0.03	0.08	0.24	0.01	0.02	0.03
Caste Groups					0.02	–0.07	–0.12	0.00	–0.01	0.02
Upper caste	0.28	0.24	0.03	0.02	0.04	0.46	0.42	–0.03	0.00	0.08
Scheduled caste	0.12	0.14	0.17	0.20	0.49	0.51	0.23	–0.07	–0.02	–0.08
Scheduled tribe	0.03	0.04	0.01	0.01	0.12	–0.11	–0.23	–0.03	–0.07	0.15
Other backward caste	0.56	0.58	0.79	0.77	–0.09	0.23	–0.28	–0.23	0.31	–0.06
Number of Observations	3,419	3,924	3,194	2,716						

Notes: Sample consists of observations from border districts limited to the second ("pre") and third ("post") rounds of the DLHS. TN=Tamil Nadu. Columns 1–4 present the group means for the corresponding covariates. Columns 5–7 present the unweighted normalized differences (Imbens and Wooldridge 2009). Columns 8–10 present the weighted normalized difference in means using propensity score-based weights from a multinomial regression.

Table 6 Impact of policy change on the probability of using other contraceptive methods and STI symptoms: PSM-DiD estimates

	Non-ECP Family Planning Use (1)	Condom (2)	Oral Pill (3)	Periodic Abstinence (4)	Withdrawal Method (5)	STI (6)
Non-TN × Treatment Period	–0.114**	–0.0156†	–0.0001	–0.0803**	–0.0300**	–0.0086
	(0.0159)	(0.0086)	(0.0040)	(0.0091)	(0.0069)	(0.0068)
Number of Observations	12,459	12,459	12,459	12,459	12,459	12,459
Control Group (TN) Mean in Pre-Period	0.3986	0.0598	0.0051	0.3931	0.1931	0.0544

Notes: Standard errors are shown in parentheses. TN=Tamil Nadu. Each column presents the results from weighted linear regression that uses a specification similar to that shown in Eq. (1) and uses the weights calculated from predicted probabilities based on multinomial logistic model. The sample consists of observations from border districts from DLHS Rounds 2 and 3. The dependent variable in column 1 includes sterilization, IUDs, and other contraceptive methods in addition to the methods shown in columns 2–5.

†$p < .10$; ** $p < .01$

of the increased availability of ECPs. Comparing our estimates with control group means to understand the effect size, we find that when ECPs were easily accessible, the use of overall non-ECP family planning methods decreased by 28%, compared with approximately 26% for condom use, 20% for abstinence, and 15% for the withdrawal method. Overall, the PSM-DiD estimates continue to provide support for the likelihood of risk compensation in terms of reduced non-ECP contraception use but provide no evidence for increased risk of STIs.

Conclusion

Consumer demand models would suggest that a response to reduced risk would be an increase in consumption of a risky good, resulting in a higher than predicted level of risk-taking by the users. Risk compensation theory suggests a similar behavioral adaptation in which users of a risk-reducing technology adjust their behavior in response to the perceived level of risk, acting with less care when they feel safe given access to the technology. In this paper, we examine such compensatory behavior in the contraceptive choice among women in India. We test whether having increased access to ECPs accompanied by marketing campaigns led people to substitute away from other more effective methods of contraception, resulting in an increase in the risk of both unintended pregnancy and STIs. Using a unique policy experiment in India, we find that increased availability of ECPs along with advertisement campaigns by pharmaceutical companies led to substitution away from other types of contraception—mostly condoms—but had no impact on the rates of STIs. ECPs are less effective than any other regular ongoing method of contraception, thus increasing the risk of unintended pregnancies.

Because the policy change that we examine banned both over-the-counter sale as well as advertising of ECPs, a limitation of our study is that we cannot distinguish between the effect of a ban on selling ECPs over the counter from the effect of advertising campaigns in the states that did not have a ban. The impacts that we find on the substitution in contraceptive use are the combined result of increased availability and increased exposure to advertising campaigns of ECPs by pharmaceutical companies in the states that were not subject to the ban. However, any ECP product that is sold over the counter is likely to be accompanied by advertising and marketing campaigns. As a result, the net effect of both over-the-counter availability and advertising is more relevant from a policy perspective.

Research on the impact of increased ECP access on contraceptive choice comes largely from developed countries. In most of those studies, access to ECPs was accompanied by in-person counseling, information about effectiveness and proper use, and follow-up by healthcare professionals. When ECPs become available over the counter, women in developing countries who use ECPs do not necessarily have the same level of information about its effectiveness as the women in developed countries or receive adequate counseling from trained healthcare professionals. Another notable difference between the context in developed and developing countries is that the percentage of women using ECPs in developed countries such as the United Kingdom has decreased each year (Marston et al. 2005), a trend that is the opposite of what we see in India. Given these factors, it is important to examine the effect of ECP use on reproductive behavior among women in developing countries. However, evidence of the impact of increased access to ECPs on contraceptive choice in developing countries has been limited. Most of this information comes from small-sample focus group discussions and interviews of doctors, nurses, and pharmacists but rarely users. This study provides one of the first quantitative analyses of the impact of ECP availability on risk compensation and contraceptive choice using a large, nationally representative data set.

As Stillman et al. (2014) reported, in 2007–2008, approximately 21% of married women in India reported wanting to space or limit births but were not using any contraceptive method. The reported demand was higher among rural, low-income, and young women across the country. Given the widespread demand for contraception and the evidence that increased availability of ECPs has not resulted in increased rates of STI among women in India, making ECPs available over the counter and incorporating them in the national family planning and rural health programs is a step in the right direction. This study, however, makes a case for governments to sponsor comprehensive information campaigns to promote the proper use of ECPs, not as a regular contraceptive but as an emergency one. Another possible approach could be to mandate pharmaceutical companies to stress the emergency nature of ECPs in their advertising campaigns, as opposed to the currently advertised content, which is nearly indistinguishable from that of daily oral contraceptives. Between 2007 and 2010, the ECP sector grew by more than 245%, and the demand for ECPs continues to grow in India. In light of a survey of pharmacists who regularly dispense ECPs showing a low level of awareness of the proper use and effectiveness of ECPs (Saxena et al. 2016), information campaigns led either by the government or pharmaceutical companies may help promote more informed decision-making by potential contraception users.

Unsafe, self-administered abortions in India account for almost 29% of all abortions, and abortion-related deaths account for nearly 9% of all maternal mortality in

India (Stillman et al. 2014). The unmet need for contraception, coupled with the poor availability of public reproductive healthcare services and prohibitive costs of private healthcare services, make a case for public-funded access to safe and subsidized methods of contraception as a critical input for women's health. Recent research lends more support to the hypothesis that modern contraception and abortions are substitutes (Miller and Valente 2016). Thus, access to ECPs accompanied by information about usage and effectiveness can be instrumental in lowering the health and human costs associated with failed regular use of non-ECP contraception.

Thus, even though we find evidence for risk compensation, our results do not justify a ban on ECPs given the lack of evidence for an increase in the prevalence of STIs. Even if people are risk compensating, policymakers should not eliminate mandatory safety regulations. For example, if seatbelts encourage reckless driving, then instead of banning seatbelts, policymakers educate people to reduce risk compensation in order to realize the full benefits of the risk-reducing technology. Similarly, there is conclusive evidence that increased control over one's reproductive cycle is empowering. A ban on ECPs, as in Tamil Nadu, is an expensive and unnecessary burden on women's health in an environment where the government fails to provide the required basic public healthcare support to women. ■

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