Maternal Health Programs and the Continuation of Unintended Pregnancies

Hyunji Kim (hjkim26@uw.edu)

(Job Market Paper)

Abstract

This paper examines how maternal and child health (MCH) programs influence fertility and the continuation of unintended pregnancies. I study a large-scale MCH program in India that offered cash incentives for institutional delivery and engaged community health workers, using a difference-in-differences design exploiting variation in eligibility across states. The program generated two distinct responses: fertility declined among older women, while younger women became more likely to carry unintended pregnancies to term, increasing unplanned births. Mechanism analysis shows that increased access to community health workers was a key driver of the rise in unplanned births. Further evidence points to two behavioral responses underlying this channel: women's desired fertility declined more than men's, creating spousal disagreement that often results in more unintended pregnancies being carried to term in male-dominated settings; and contact with health workers led to more negative attitudes toward abortion. These findings suggest that while MCH programs aim to improve maternal care, they can also shape post-conception decisions in unintended ways.

Keywords: Maternal and Child Health (MCH), Unplanned Fertility, Reproductive Behavior, Community Health Workers, Difference-in-Differences, Public Health Intervention

1 Introduction

An unintended pregnancy ending in a live birth, often referred to as an unplanned birth, is a substantial public health and development concern. Between 2015 and 2019, an estimated 121 million unintended pregnancies occurred annually worldwide, and nearly 40 million of these were carried to term (Bearak et al., 2020). The burden is particularly high in low-income settings such as India, which accounted for over 14 percent of all unintended pregnancies during this period, with roughly one-third ending in live births (Mcfarlane et al., 2022). These births are associated with lower utilization of maternal health services, worse maternal mental health, and poorer health and developmental outcomes for children (Wado et al., 2013; Bahk et al., 2015; Nelson et al., 2022; Singh et al., 2012; Marston and Cleland, 2003; Shapiro-Mendoza et al., 2006; Foster et al., 2018). Considering their wide-ranging impact on maternal and child well-being, understanding the determinants of unplanned births is essential for designing policies that improve maternal and child health and support reproductive goals.

Maternal and child health (MCH) programs that subsidize the cost of delivery and prenatal and postnatal care, and provide maternal health counseling and follow-up through community health workers, could plausibly affect the likelihood of unplanned births. Existing research on MCH programs has primarily examined their effects on service utilization and maternal and infant mortality (Lim et al., 2010; Powell-Jackson et al., 2015), and, on the pre-conception margin, fertility levels (Nandi and Laxminarayan, 2016). While these interventions have been shown to improve health outcomes, their specific features can also influence reproductive decisions more broadly. They may affect behavior before conception through changes in contraceptive use, and after conception, through decisions about pregnancy continuation. Such post-conception responses can be shaped by the costs of delivery, information and support from health workers, and prevailing social norms regarding abortion (Ananat et al., 2009; Valente, 2014; Antón et al., 2018). Despite extensive evidence on service uptake and health outcomes, far less is known about how MCH programs affect the post-conception margin, particularly whether unintended pregnancies are carried to term.

This paper addresses this gap by focusing on India's Janani Suraksha Yojana (JSY), a nationwide maternal and child health program that provides conditional cash transfers to promote institutional deliveries. While JSY's primary aim is to improve maternal and newborn survival, its design alters both the cost structure and the information environment surrounding childbirth. Financial incentives for institutional delivery reduce out-of-pocket childbirth expenses, and performance-based payments to community health workers, known as Accredited Social Health Activists (ASHAs), encourage sustained engagement with pregnant women. These features create conditions that can influence not only the incidence and timing of pregnancies but also the likelihood that unintended ones are carried to term.

I estimate the causal effect of JSY on these reproductive behaviors using a difference-in-differences (DiD) strategy that leverages differences in program eligibility across Indian states. States were classified as either Low-Performing States (LPS) or High-Performing States (HPS) based on baseline institutional delivery rates.[1] In LPS, where institutional delivery rates were historically low, JSY benefits were universally available to all pregnant women. In HPS, eligibility was restricted to women below the poverty line, Scheduled Castes or Tribes, and those with up to two live births. The DiD design compares changes in outcomes between two groups with similar socioeconomic characteristics: ineligible women in HPS (those above the poverty line and not from Scheduled Castes or Tribes) serve as the control group, while eligible women with the same characteristics in LPS form the treatment group.

The analysis yields two main findings. First, JSY reduced fertility among older women and increased the uptake of contraceptive methods. This pattern suggests that improved access to family planning services through health programs enabled women to lower their total fertility. Second, the program increased the likelihood of unplanned births, with the effect concentrated among younger women. These results indicate that MCH programs can influence reproductive decisions along both the pre-conception margin, by affecting contraceptive use and fertility levels, and the post-conception margin, by

[1] LPS includes Uttar Pradesh, Uttarakhand, Bihar, Jharkhand, Madhya Pradesh, Chhattisgarh, Assam, Rajasthan, Odisha, and Jammu and Kashmir.

shaping whether unintended pregnancies are carried to term.

To investigate a key channel underlying the increase in unplanned births, I study the role of community health workers using a second difference-in-differences design. This analysis exploits a later-phase reform of the program that expanded ASHA incentives in High-Performing States.[2] The expansion increased unplanned births among younger women. Using a regression discontinuity design, I also show that the reform sharply increased women's interactions with the community health workers. These findings suggest that greater contact with health workers, driven by cash incentives, contributed to the rise in unplanned births.

I provide suggestive evidence for two mechanisms through which greater engagement with community health workers contributed to the rise in unplanned births. First, exposure to ASHAs increased the likelihood that women, but not their husbands, reported no desire for more children. This gender difference can lead to disagreements about continuing a pregnancy. In settings with male-dominated decision-making, spousal disagreement over fertility preferences often results in outcomes aligned with the husband's preference (Komura, 2013; Doepke and Tertilt, 2018; Mishra and Parasnis, 2021; Thomson, 1997). In such contexts, women may end up carrying unintended pregnancies to term if their husbands want the pregnancy to continue, even when the women themselves prefer not to have more children.

Second, more engagement with health workers leads to lower acceptance of abortion. This finding aligns with previous literature showing that community health workers often promote pronatalist norms and discourage abortion. They may do so through repeated counseling, concerns about confidentiality (Nandagiri, 2019; Glenton et al., 2017; Gupta et al., 2017), and financial incentives that pay ASHAs for each institutional delivery, which can encourage them to promote delivery over abortion (Javadekar et al., 2025). When abortion is seen as less acceptable, women with unintended pregnancies are more likely to carry them to term, contributing to the rise in unplanned births.

Taken together, the findings demonstrate that MCH programs affect not only whether

[2]Four years after JSY began, the program was reformed to extend cash incentives to ASHAs in High-Performing States, where previously only mothers received payments.

and when to conceive but also the likelihood that unintended pregnancies result in live births. While these programs aim to improve maternal and neonatal health, their incentive structures and delivery mechanisms can generate unintended effects on post-conception behavior. Understanding these broader impacts is essential for designing MCH interventions that support both health improvements and reproductive autonomy.

This paper contributes to four strands of literature at the intersection of maternal health policy, fertility behavior, community health workers, and incentive design in public service delivery.

First, it expands the literature on the effects of maternal and child health (MCH) programs, which has largely focused on service uptake and clinical outcomes such as institutional delivery rates and maternal or neonatal mortality (e.g., Lim et al., 2010; Powell-Jackson et al., 2015). Recent work has begun to examine behavioral outcomes such as sex-selective abortion (e.g., Javadekar et al., 2025). By further shifting attention to whether unintended pregnancies are carried to term, this paper highlights that MCH interventions can influence a broader set of reproductive intentions and birth composition. These outcomes are central to maternal well-being but are often overlooked in program evaluations.

Second, the paper contributes to research on the determinants of unintended fertility. Much of this work emphasizes pre-conception constraints, such as limited access to contraception or safe abortion services (e.g., Bongaarts, 1990; Bailey, 2010; Miller, 2010). I show that maternal health programs can also shape post-conception behavior. By reducing the financial and emotional costs of childbirth and increasing contact with health workers, such programs may increase the likelihood that unintended pregnancies are carried to term. This mechanism helps explain how unplanned births may rise even in settings where contraceptive access is improving.

Third, this study adds to the literature on community health workers (CHWs), which has emphasized their role in expanding access to care and improving health outcomes (e.g., Björkman and Svensson, 2009; Dupas, 2011). I provide new evidence that CHWs can also influence fertility preferences. Exposure to India's Accredited Social Health Activists (ASHAs) increases the likelihood that younger women report a desire to stop childbear-

ing, while the fertility preferences of their husbands remain unchanged. This divergence suggests a household-level channel through which CHWs may affect reproductive decisions beyond the delivery of clinical services.

Finally, this paper contributes to the literature on incentive design in public service delivery. Prior work has shown that performance-based pay can increase provider effort and improve the delivery of targeted services. For example, Gertler and Vermeersch (2013) and Singh and Masters (2017) show that provider incentives can improve child health and service delivery. Moreover, Mendelson et al. (2017) and Gadsden et al. (2021) find in systematic reviews that pay-for-performance programs often raise health service use and quality. I extend this literature by showing that incentives tied to institutional delivery affected not only service uptake but also behavioral outcomes. Specifically, the expansion of ASHA incentives increased their engagement with pregnant women, which in turn influenced decisions about whether to continue unintended pregnancies. This suggests that pay-for-performance programs can affect sensitive outcomes such as reproductive autonomy, with implications for how such incentives are designed and targeted.

The rest of the paper proceeds as follows. Section 2 provides institutional background on unplanned fertility and the JSY program. Section 3 outlines a conceptual framework for how MCH programs can influence fertility behavior along both pre- and post-conception margins. Section 4 describes the data and variable construction. Sections 5 and 6 present the empirical strategy and main results on overall fertility and unplanned births. Section 7 validates the empirical design using pre-trend tests. Section 8 examines mechanisms operating through exposure to community health workers. Section 9 investigates behavioral responses underlying this health worker channel, focusing on changes in fertility preferences and abortion attitudes. Section 10 reports robustness checks, and Section 11 concludes.

2 Background

2.1 Unintended Fertility Ending in Births

Between 2015 and 2019, an estimated 121 million unintended pregnancies occurred annually worldwide, accounting for nearly half of all pregnancies (Bearak et al., 2020; Mcfarlane et al., 2022). These pregnancies had various outcomes: approximately 61% ended in abortion, while the remainder resulted in live births or miscarriages. When unintended pregnancies are carried to term, the resulting live births are termed unplanned births.

India accounts for a substantial share of global unplanned births. The country experienced over 14% of all unintended pregnancies during 2015-2019 (Mcfarlane et al., 2022). In 2015, India's unintended pregnancy rate was 70 per 1,000 women aged 15-49. Of these unintended pregnancies, approximately 33% were carried to term as unplanned births or ended in miscarriage, while 67% ended in abortion (Singh et al., 2018).[3]

Unplanned births have important implications for maternal and child health. Women with unplanned births utilize fewer maternal health services, including reduced antenatal care visits and inadequate prenatal follow-up, particularly in low-income settings (Wado et al., 2013). These births are also associated with adverse mental health outcomes. Women experiencing unplanned births face higher risks of postpartum depression and elevated stress levels (Bahk et al., 2015). A recent meta-analysis confirms that unintended pregnancies carried to term are strongly associated with increased odds of maternal depression during and after pregnancy (Nelson et al., 2022).

Children born from unplanned births also face significant health challenges. These children experience lower vaccination rates, increased risk of stunting (impaired growth and development), and higher mortality during neonatal and early childhood periods (Singh et al., 2012). Studies show that children from unintended pregnancies have 15 per-

[3] Abortion has been legal in India under the Medical Termination of Pregnancy (MTP) Act since 1971. The law permits abortion up to 20 weeks of gestation under a broad range of conditions, including risk to the woman's physical or mental health, contraceptive failure, and fetal abnormalities (Stillman et al., 2014). In 2021, amendments extended the gestational limit to 24 weeks for certain categories of women (Kumari and Kishore, 2021).

cent higher odds of being stunted compared to those from intended pregnancies (Marston and Cleland, 2003; Shapiro-Mendoza et al., 2006). The effects extend to siblings as well: when women were unable to terminate unintended pregnancies, their existing children showed lower cognitive development scores and increased poverty rates compared to children whose mothers obtained wanted abortions (Foster et al., 2018).

Given their prevalence and wide-ranging health implications, understanding the factors that influence whether unintended pregnancies are carried to term is essential for health policy. They connect immediate reproductive decisions to long-term maternal and child well-being, shaping pathways of health, human capital, and household welfare over time. As countries expand maternal health programs, recognizing their broader effects on fertility decisions becomes increasingly important for policy design.

2.2 Janani Suraksha Yojana (JSY): A Safe Motherhood Initiative

The Janani Suraksha Yojana (JSY) is a conditional cash transfer program launched by the Government of India in 2005 with the primary objective of reducing maternal and neonatal mortality by encouraging institutional deliveries. The program operates under the National Health Mission (NHM) and targets economically vulnerable pregnant women, aiming to increase access to healthcare facilities and reduce home births, which are often associated with higher risks of maternal and neonatal complications.

A key feature of JSY is its cash incentive structure, designed to promote institutional deliveries. Under the scheme, pregnant women receive monetary support when they give birth in a health facility, reducing financial barriers to accessing medical care. Additionally, Accredited Social Health Activists (ASHAs), who are trained community health workers, are compensated for assisting expectant mothers. ASHAs provide guidance on maternal health, facilitate transportation to health facilities, and help with registration and documentation required to access JSY benefits. By offering incentives to both mothers and ASHAs, the program aims to promote broader outreach and greater uptake of maternal healthcare services.

The program distinguishes between Low-Performing States (LPS) and High-Performing

States (HPS) based on institutional delivery rates. In LPS, where institutional delivery rates were initially low, all pregnant women are eligible for JSY benefits. In contrast, in HPS, where institutional deliveries were already relatively high, eligibility is limited to women classified as Below the Poverty Line (BPL) or belonging to Scheduled Castes (SC) or Scheduled Tribes (ST), and only for up to two live births.

Since its start, the financial incentives provided under JSY have changed over time. In 2005, mothers in low-performing states (LPS) received 1,400 Rps (about $32 USD, or 1,000 Rps /$23 USD in urban areas) for giving birth in a health facility, and ASHAs were paid 600 Rps (around $14 USD) for each delivery they supported. In high-performing states (HPS), mothers received 700 Rps ($16 USD; 600 Rps/$14USD in urban areas), and ASHAs did not receive any payment initially. From April 2009, the program expanded to offer ASHAs in HPS a payment of 200Rps (about $5 USD) per delivery while keeping the same payments for mothers. To give a sense of scale, the 1,400 Rps payment to mothers in 2005 was about 4–5 percent of India's average annual income per person (roughly $740 USD in 2005, World Bank 2023), making it a significant amount for low-income households. Similarly, the 600Rps payment to ASHAs was a meaningful performance-based incentive in areas where other earning opportunities were limited. Table1 summarizes how JSY incentives varied over time and by state classification.

Table 1: Variation in JSY Incentive Structure

State Type	**Recipient**	**2005–2009 Payment (Rps)**	**From April 2009 Payment (Rps)**
LPS	Mother	1,400 (Rural) 1,000 (Urban)	1,400 (Rural) 1,000 (Urban)
	ASHA	600 per delivery	600 per delivery
HPS	Mother	700 (Rural) 600 (Urban)	700 (Rural) 600 (Urban)
	ASHA	None	200 per delivery

3 Conceptual Framework

Following Ananat et al. (2009), reproductive decision-making can be modeled as a sequential process with two stages. In the first stage, women decide whether and when to conceive. In the second stage, conditional on conception, they decide whether to carry the pregnancy to term or seek termination.

Both stages are shaped by financial, informational, and social constraints. Pre-conception decisions depend on access to contraception and family planning counseling, which can reduce fertility (Ashraf et al., 2014; Dupas, 2011), as well as on expected costs of childbearing. Post-conception decisions about pregnancy continuation reflect delivery costs, the cost of abortion, interactions with community health workers, and prevailing social norms regarding abortion (Ananat et al., 2009; Valente, 2014; Antón et al., 2018).

India's Janani Suraksha Yojana (JSY) program offers a useful empirical setting to examine how MCH components affect these processes. JSY is a nationwide maternal and child health initiative that provides financial incentives for institutional deliveries and mobilizes Accredited Social Health Activists (ASHAs) to engage with pregnant women and families. While its explicit goal is to reduce maternal and neonatal mortality, JSY may also reshape the broader reproductive environment by altering costs, information flows, and social interactions surrounding fertility decisions.

I hypothesize three primary channels through which JSY can influence reproductive outcomes:
(1) Expanding access to family planning services and information;
(2) Reducing the financial cost of childbirth;
(3) Intensifying health worker engagement with pregnant women and families.
These mechanisms are expected to operate differently across the two stages of reproductive decision-making.

Stage 1: Pre-conception Decisions Before conception, JSY can exert two opposing influences on overall fertility. On one hand, the cash incentives for institutional delivery and the reduced costs of pregnancy-related care can lower the expected costs of having

additional children, potentially raising fertility. This channel aligns with prior economic literature on the interaction between childbearing costs and fertility (Becker, 1973; Galor and Weil, 2000; Todd and Wolpin, 2010).

On the other hand, even though JSY is not a dedicated family planning intervention, ASHAs play an active role in promoting the use of contraceptive methods and reproductive health awareness in their communities. As a part of their routine responsibilities, ASHAs provide counseling on birth preparedness, safe motherhood, and family planning. They also act as local distributors of contraceptives such as oral pills and condoms (Saxena et al., 2018, 2021; Moughalian et al., 2024). These activities lower informational and access barriers to contraception, thereby reducing overall fertility. This pathway is consistent with evidence suggesting that health interventions can shift fertility behavior through improved contraceptive access in low-resource settings (Ashraf et al., 2014; Dupas, 2011).

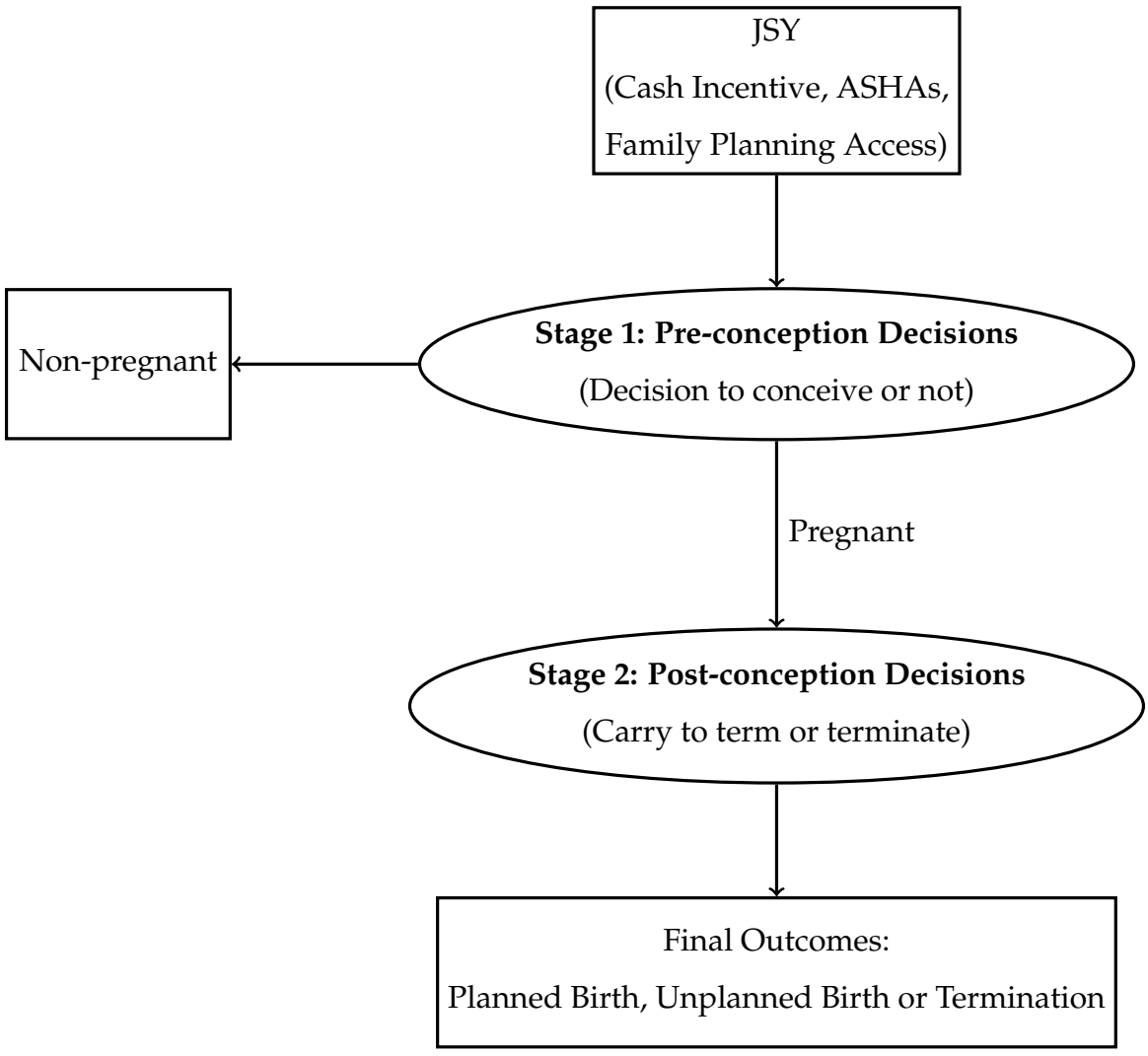
Stage 2: Post-Conception Decisions Once a pregnancy has occurred, JSY may unintentionally increase the likelihood that unintended pregnancies are carried to term. By lowering the out-of-pocket costs of childbirth, the program reduces the economic burden of continuing a pregnancy. Additionally, performance-based incentives for ASHAs encourage active engagement with pregnant women, which can discourage abortion by reinforcing moral, religious, or social norms against pregnancy termination (Javadekar et al., 2025; Gipson et al., 2008). Furthermore, ASHAs may unevenly shape fertility desires by engaging more directly with women than their husbands during family planning outreach. In settings with limited female autonomy, this can lead to discordance in fertility preferences—where wives desire fewer children than their husbands—potentially increasing the likelihood of unplanned births. (Komura, 2013; Doepke and Tertilt, 2018; Mishra and Parasnis, 2021; Thomson, 1997).

Figure 1 visually summarizes the pathways through which JSY may influence reproductive outcomes, integrating the two-stage structure with the hypothesized mechanisms.

Taken together, this study examines three primary research questions:

- **Hypothesis 1:** How does fertility respond to the availability of maternal health services under the JSY program?
- **Hypothesis 2:** Does the provision of maternal health services under the JSY program lead to an increase in unintended births?
- **Hypothesis 3:** If so, is this effect primarily driven by cash incentives or improved access to health workers?

Figure 1: Conceptual Framework Linking JSY Components to Reproductive Decisions



4 Data and variable construction

4.1 Data and Variables for Fertility Analysis (H1) and Unplanned Births Analysis (H2)

The primary data source is the National Family Health Survey (NFHS) of India, specifically waves 2 (1998–99), 3 (2005–06), and 4 (2015–16). The NFHS is a nationally representative household survey that provides detailed information on fertility, reproductive health, and maternal and child health outcomes. These three survey rounds span both the periods before and after the introduction of India's Janani Suraksha Yojana (JSY) program in 2005, allowing for an examination of changes in reproductive behavior associated with this program.

The analysis focuses on rural areas, which were the primary target of JSY and received higher cash incentives for both mothers and Accredited Social Health Activists (ASHAs). The main sample for the H1 fertility analysis consists of women aged 19 to 40, capturing the key childbearing years, who live in rural areas, are above the poverty threshold, and do not belong to Scheduled Castes or Scheduled Tribes[4].

For the H2 unplanned birth analysis, I focus on women directly eligible for JSY benefits. Because the program provides cash transfers only to those who give birth, exposure can be observed only among women with at least one live birth during the post-treatment period. Limiting the analysis to women with recent births ensures the sample includes those for whom the program was operationally relevant, allowing for a more precise estimate of JSY's impact.[5] To capture this, I define a recent birth cohort as women who gave birth within the five years preceding the survey. This sample, like that used in the H1 fertility analysis, is restricted to rural women who are above the poverty line and not from Scheduled Castes or Tribes.

[4]In NFHS-2, where data on Below Poverty Line (BPL) card ownership are unavailable, the bottom 20% of the household wealth index is used as a proxy for BPL status.

[5]Potential selection bias from conditioning on recent births is addressed in the robustness checks section, where I examine maternal compositional changes after treatment and replicate the main results using a broader sample that includes all women, regardless of birth status.

The Total Number of Birth The main variable for the H1 fertility analysis is the total number of births a woman had in the five years preceding the survey interview. For NFHS-3 (2005–06), special care is needed because the survey period itself overlaps with the program's launch in April 2005 although most fertility behavior it records predates JSY. To isolate pre-JSY fertility behavior, births resulting from conceptions after April 2005 are excluded. Assuming a nine-month gestation period, this window includes births conceived between April 2000 and March 2005.

The Unplanned Birth For the unplanned birth analysis using the recent birth cohort, I construct a binary variable indicating whether a woman experienced an unplanned birth within the five years preceding the survey interview. The measure compares a woman's reported ideal number of children to the birth order of her most recent child born during this period. The ideal number is based on her response to the question: *"If you could go back to the time you did not have any children and could choose exactly the number of children to have in your whole life, how many would that be?"* If the birth order of that child exceeds her stated ideal, she is coded as having had an unplanned birth (unplanned birth = 1); otherwise, the variable is coded as zero. In a robustness check using the full sample of women, including those who have never given birth, women with no births during this period are also coded as zero, consistent with defining unplanned birth conditional on having given birth.

Table 2 presents summary statistics disaggregated by treatment and control groups in the pre- and post-JSY periods. Panel A reports statistics for the H1 fertility analysis sample, and Panel B for the H2 unplanned birth analysis sample, which is limited to women who gave birth within the past five years.

4.2 Data and variables for mechanism (H3. Health worker access)

To test the health worker channel (H3) through which unplanned births may increase, I use data from the second round (2011–12) of the India Human Development Survey (IHDS). IHDS-II is a nationally representative panel survey of over 42,000 households across India, collecting detailed household- and individual-level information on health,

Table 2: Summary Statistics

	Treatment			Control		
Variable	N	Mean	SD	N	Mean	SD
A. Fertility analysis (H1)						
Age (years)	18426	29.4	5.83	20453	30.1	5.76
Number of births over the past 5 years	18426	.963	.876	20453	.727	.812
Number of children	18426	2.84	1.53	20453	2.38	1.2
Number of children who are older than 5	18426	1.88	1.69	20453	1.63	1.43
Birth order of the last child	18426	3.21	1.78	20453	2.57	1.34
Household head - Hindu (d)	18426	.82	.384	20453	.779	.415
Household head - Muslim (d)	18426	.165	.371	20453	.111	.315
Years of schooling (imp)	18426	3.13	4.2	20453	5.21	4.54
B. Unplanned births analysis (H2)						
Age (years)	10137	26.7	4.93	8890	26.5	4.6
Number of children	10137	2.7	1.59	8890	2.17	1.23
Household head - Hindu (d)	10137	.793	.405	8890	.753	.431
Household head - Muslim (d)	10137	.195	.396	8890	.132	.338
Years of schooling (imp)	10137	3.2	4.24	8890	5.85	4.66
Unplanned birth (d)	10137	.357	.479	8890	.278	.448
Birth order of the last child	10137	3.04	1.86	8890	2.34	1.37
C. Mechanism analysis (H3)						
Age (years)	2102	28.1	4.41	2870	29.2	4.83
No. children	2102	2.64	1.1	2870	3.27	1.48
Below poverty line	2102	.525	.499	2870	.675	.469
Scheduled caste/tribe	2102	.74	.439	2870	.651	.477
Woman's years of education	2102	5.09	4.29	2870	2.6	3.69
Unplanned Birth (d)	2102	.223	.416	2870	.329	.47

Note: Panel A includes the sample for the fertility analysis (H1), and Panel B includes the sample for the unplanned births analysis (H2). In both panels, the treatment group consists of rural women in low-performing states (LPS) who are above the poverty line and do not belong to Scheduled Castes or Tribes (SC/ST). Panel B further restricts the sample to women who had a birth within the past five years. Panel C presents the sample for the mechanism analysis (H3), focusing on the health worker channel. This sample includes births from rural women who are either below the poverty line or belong to SC/ST groups. The treatment group in Panel C consists of births from rural women residing in high-performing states (HPS).

education, economic conditions, and fertility behavior, including ideal family size and gender preferences, similar to the NFHS.

Assuming the 2009 JSY reform increased women's access to health workers, I construct a birth-level sample of rural births conceived in or after January 2005, as these conceptions could plausibly have been influenced by the program. The unit of observation is a birth, and the dataset includes multiple births per woman. Following the approach used in the main analysis, a birth is defined as unplanned if its birth order exceeds the mother's stated ideal number of children.

Panel C of Table 2 provides summary statistics for the sample used in the health worker channel analysis (H3). The treatment group consists of births from rural women residing in high-performing states (HPS), while the control group includes those in low-performing states (LPS).

Next, to verify that the 2009 reform increased pregnant women's access to health workers, I use data from the District Level Household and Facility Survey (DLHS) round 4 (2012–13). This survey includes births spanning both the period immediately after JSY's initial launch and the years following the 2009 reform, providing a natural setting to assess changes in exposure to health workers.

DLHS-4 collects retrospective information on ASHA interactions related to pregnancy, delivery, and postnatal care. I define a woman as exposed to an ASHA if she reports any of the following[6]: (i) receiving antenatal care from an ASHA, (ii) being assisted by an ASHA during facility delivery, (iii) receiving transport support from an ASHA, or (iv) being informed by an ASHA about danger signs related to diarrhea or pneumonia. This composite measure captures a broad range of ASHA engagement within the maternal and child health services. The sample is restricted to younger women aged 19 to 29 who meet JSY eligibility criteria in high-performing states (HPS). Eligibility in HPS is defined as being below the poverty line or belonging to a Scheduled Caste or Tribe, and having no more than two previous live births.

[6]While the measure is described in terms of ASHA workers, it also includes interactions with Anganwadi workers, consistent with JSY program guidelines that permit either type of frontline worker to provide maternal and child health services.

DLHS-4 covers only High-Performing States (HPS), where the reform applied. I use this variation in timing to implement a Regression Discontinuity (RD) design, which is described in detail in Section 8.3, to estimate its causal impact. Appendix Table A.1 presents summary statistics for this sample.

4.3 Data and Variables for Suggestive Evidence for the Mechanism

To explore suggestive evidence on the mechanism through which access to health workers influences unplanned fertility, I use panel data from rounds 1 and 2 of the India Human Development Survey (IHDS). This analysis is conducted at the woman level, using the subset of women from the IHDS round 2 birth sample (used in the analysis of the H3 health worker channel) who were also surveyed in round 1. I restrict the sample to women who were interviewed after April 2005 in IHDS1, ensuring that all observations were collected after the launch of JSY, and again in IHDS2 (2011–12), after the program's expansion in 2009. This panel allows me to examine within-woman changes in fertility preferences during a period of increasing access to health workers.

Both rounds of IHDS include questions on fertility intentions, asking whether the woman wants to have more children and whether she believes her husband wants more children than they currently have. These questions allow me to examine whether fertility preferences shifted and whether women's and husbands' preferences diverged or converged as health worker access expanded. Based on these responses, I construct three binary variables: whether the woman wants more children, whether the husband wants more, and whether the husband wants more while the wife does not, capturing discordance in fertility preferences.

Additionally, to explore whether access to ASHAs influenced attitudes toward abortion, I use data from the World Values Survey (WVS) waves 4 (2001), 5 (2006), and 6 (2012). These waves span the key policy periods: before the launch of JSY, after JSY but before the 2009 reform, and after the reform, respectively. The WVS includes a question on abortion attitudes: *"How justifiable do you consider abortion to be?"* with responses ranging from 1 (Never justifiable) to 10 (Always justifiable). Based on this question, I construct

a continuous index measuring the respondent's attitude toward abortion.

5 Empirical Stategy

5.1 Empirical Strategy for H1 Fertility Analysis

To estimate the impact of the JSY program on fertility, I implement a difference in differences (DiD) design that exploits variation in program eligibility across states and socio-economic groups, along with the timing of the program's launch. As discussed in Section 2.2, the JSY program classifies Indian states into Low Performing States (LPS) and High Performing States (HPS). In LPS, all pregnant women are eligible for JSY benefits, whereas in HPS, eligibility is restricted to women who are below the poverty line (BPL) or belong to Scheduled Castes (SC) or Scheduled Tribes (ST).

The treatment group consists of women in LPS who are not eligible for JSY in HPS. Specifically, these are women who are above the poverty line and do not belong to SC or ST groups. The control group includes women with the same socio economic characteristics residing in HPS. The DiD strategy compares fertility outcomes between these two groups before and after the program was introduced.

To test H1, the outcome is the number of births a woman reports in the five years preceding the survey. I define the pre-treatment period as observations for which the entire recall window precedes JSY's introduction in April 2005, and the post-treatment period as those for which the entire recall window falls after the program was introduced. This ensures that treatment assignment reflects exposure to JSY during the period when fertility decisions were made.

I estimate the following equation:

$$Num_Births_{isy} = \alpha_0 + \alpha_1 \text{Treat}_{is} \times \text{Post}_y + X'_{iy}\boldsymbol{\alpha} + \zeta_y + \lambda_s + \epsilon_{isy} \tag{1}$$

where the dependent variable, Num_Birth_{ist}, represents the number of births over the past five years for woman in state s from the interview year y. The key independent variable, $\text{Treat}_{is} \times \text{Post}_y$, is a dummy indicating whether the woman resides in an LPS and

her most recent conception within the five-year recall window occurred after the launch of the JSY program. The vector X_{iy} includes woman i's age, years of education, partner's education level, number of children over age five, religion (indicators for Muslim and Hindu), infecundity status, household head's age, and an indicator for whether the household is female-headed. Fixed effects for year of interview (ζ_y) and state (λ_s) are included. Standard errors are clustered at the state level, given that the JSY program was implemented at the state level.

5.2 Empirical Strategy for H2 Unplanned Birth Analysis

To assess whether improved access to maternal and child health (MCH) services increased the likelihood of unplanned births, I implement a similar difference-in-differences (DiD) strategy introduced in Section 5.1. The analysis compares the most recent birth within the past five years for women who are above the poverty line and from upper-caste households in Low-Performing States (LPS) to those of comparable women in High-Performing States (HPS). I estimate the following specification to test Hypothesis 2:

$$Unplanned_bir_{ibsty} = \beta_0 + \beta_1 \text{Treat}_{is} \times \text{Post}_t + X'_{iy}\boldsymbol{\beta} + \theta_b + \eta_t + \lambda_s + \zeta_y + u_{ibsty} \quad (2)$$

Here, $Unplanned_bir_{ibsty}$ is an indicator for whether the woman i's most recent birth was unplanned, where b is the order of that birth and t is its year, s indexes the state, and y is the interview year. The key explanatory variable, $\text{Treat}_{is} \times \text{Post}_t$, is an interaction term equal to one for women in the treatment group whose most recent birth was conceived after the launch of JSY in 2005. The regression includes fixed effects for birth order (θ_b), birth year (η_t), state (λ_s), and interview year (ζ_y), with standard errors clustered at the state level.

6 Main Results

6.1 Results for H1 Fertility Analysis

Table 3 reports estimates from Equation 1. Column (1) presents results for all women aged 19 to 40, while Columns (2) and (3) report separate estimates for younger women aged 19 to 29 and older women aged 30 to 40.

Table 3: The Impact of JSY on the Number of Births

	Number of births over the past 5 years		
	(1)	(2)	(3)
	All women	Young women (19-29)	Older women (30-40)
Treat × Post	-0.033	0.008	-0.099***
	(0.031)	(0.050)	(0.030)
Control mean (pre)	0.666	0.975	0.351
Observations	140832	70821	70011
Year-of-interview FE	Yes	Yes	Yes
State FE	Yes	Yes	Yes
Controls	Yes	Yes	Yes

Note: The dependent variable is the number of births a woman had in the past five years. Regressions control for the woman's age, the household head's age and an indicator for whether the head's age is missing, the woman's years of education, her partner's education level, the number of children over age five, indicators for Muslim and Hindu religion, infecundity status, and whether the household is female-headed. All models include fixed effects for year of interview and state. Standard errors are clustered at the state level and are presented in parentheses. Significance is indicated as follows: * p<0.1, ** p<0.05, *** p<0.01.

The results suggest that access to maternal and child health (MCH) services under JSY had different effects across age groups. Among older women, program exposure is associated with a reduction of 0.099 births over the past five years, significant at the 1 percent level. This decline corresponds to a 28 percent reduction relative to the pre-treatment mean in high-performing states (HPS). In contrast, there is no statistically significant change in fertility among younger women.

The observed fertility decline among older women is consistent with the intended role of JSY health workers in promoting family planning. As discussed in section 3, ASHAs, while primarily tasked with encouraging institutional delivery, also distribute contracep-

tives and provide counseling on birth spacing and fertility limitation (Saxena et al., 2018, 2021; Moughalian et al., 2024). These responsibilities position them to reduce informational and access barriers to contraception, particularly for women who have completed or nearly completed their desired fertility.

If this mechanism is at play, we would expect to see an increase in contraceptive use following JSY exposure—particularly among older women who exhibit fertility reductions. To test this, I estimate JSY's effect on current use of modern contraceptive methods, using the same difference-in-differences strategy as in the fertility analysis (Equation 1). The outcome is a binary indicator equal to one if the woman reports using any modern method of contraception at the time of the survey.[7]

Table 4 presents results separately by age group. Among older women, JSY exposure leads to a significant increase in modern contraceptive use. This pattern supports the interpretation that health worker engagement under JSY enabled women nearing their desired family size to adopt fertility-limiting methods, contributing to the observed decline in recent births.

Among younger women, contraceptive use also increases, yet fertility remains unchanged. One explanation is that younger women primarily adopt contraception to space rather than to limit childbearing (Westoff and Koffman, 2010; Timæus and Moultrie, 2020). Another possibility is that JSY influenced post-conception decisions by reducing the costs of childbirth or by shifting social norms around pregnancy continuation. These changes may have increased the likelihood that unintended pregnancies were carried to term, offsetting any fertility-reducing effects of contraception. The next section investigates this channel by examining whether JSY affects the probability that unintended pregnancies result in live births.

[7]This analysis uses data from NFHS waves 2 and 4. Wave 3 is excluded because its interview period overlaps with the rollout of JSY, making it difficult to consistently classify treatment status for contemporaneous outcomes, unlike in the fertility analysis based on retrospective birth histories.

Table 4: The Impact of JSY on Modern Contraceptive Use

	Currently using modern contraceptive method		
	(1)	(2)	(3)
	All women	Younger (19-29)	Older (30-40)
Treat × Post	0.065**	0.070**	0.071**
	(0.029)	(0.031)	(0.033)
Control mean (pre)	0.505	0.375	0.644
Observations	122002	61151	60851
Year-of-interview FE	Yes	Yes	Yes
State FE	Yes	Yes	Yes
Controls	Yes	Yes	Yes

Note: The dependent variable is an indicator for use of modern contraceptive methods. The sample includes higher-caste women above the poverty line in rural areas from NFHS waves 2 (1998-99) and 4 (2015-16). Regressions control for the woman's age, the household head's age and an indicator for whether the head's age is missing, the woman's years of education, her partner's education level, the number of children, indicators for Muslim and Hindu religion, infecundity status, and whether the household is female-headed. All models include fixed effects for year of interview and state. Standard errors are clustered at the state level and are presented in parentheses. Significance is indicated as follows: * p<0.1, ** p<0.05, *** p<0.01.

6.2 Results for H2 Unplanned Births Analysis

Table 5 reports the estimated effects of the MCH program on unplanned births. Columns (1)–(3) compare the post-program period to the pre-program period using a single post-treatment indicator. Columns (4)–(6) divide the post-program period into an early diffusion phase (2005–2008), before the 2009 reform that introduced ASHA cash incentives in HPS, and a later diffusion phase (2009–2016). Thus, the key variables of interest are $Treat \times Post$, $Treat \times Post(2005\text{–}2008)$, and $Treat \times Post(2009\text{–}2016)$.

The estimates indicate that the MCH program increased unplanned births. In Column (1), program exposure raises the probability of having an unplanned birth by 3.2 percentage points, significant at the 10 percent level. Column (4) shows that exposure during the early diffusion period increases this probability by 4.3 percentage points (significant at the 1 percent level), while the estimate for the later period is 3.2 percentage points (significant at the 10 percent level).

The heterogeneity analysis by age indicates that this increase is concentrated among

younger women. Columns (2) and (3) report that program exposure raises the probability of an unplanned birth among younger women by 4.2 percentage points, significant at the 1 percent level, with no statistically significant effect observed among older women. In Columns (5) and (6), both the early and later diffusion phases of the program significantly increase unplanned births among younger women, but not among older women.

Table 5: The Impact of JSY on Unplanned Births

	Unplanned birth (d)					
	(1) All	(2) Younger	(3) Older	(4) All	(5) Younger	(6) Older
Treat × Post	0.032*	0.042***	0.020			
	(0.017)	(0.015)	(0.029)			
Treat × Post (2005-2008)				0.043***	0.057***	-0.001
				(0.015)	(0.016)	(0.032)
Treat × Post (2009-2016)				0.032*	0.041**	0.021
				(0.017)	(0.015)	(0.030)
Control mean (pre)	0.278	0.205	0.507	0.278	0.205	0.507
Observations	63213	46465	16748	63213	46465	16748
Birth-year FE	Yes	Yes	Yes	Yes	Yes	Yes
Birth-order FE	Yes	Yes	Yes	Yes	Yes	Yes
State FE	Yes	Yes	Yes	Yes	Yes	Yes
Year-of-interview FE	Yes	Yes	Yes	Yes	Yes	Yes
Controls	Yes	Yes	Yes	Yes	Yes	Yes

Note: The dependent variable is an indicator for whether a woman's most recent birth in the past five years was unplanned. Regressions control for the woman's age, the household head's age and an indicator for whether the head's age is missing, the woman's years of education, her partner's education level, indicators for Muslim and Hindu religion, infecundity status, and whether the household is female-headed. All models include fixed effects for birth year, birth order, interview year, and state. Standard errors are clustered at the state level and reported in parentheses. Significance is indicated as follows: * p<0.1, ** p<0.05, *** p<0.01.

The rise in unplanned births among younger women, together with the null effect on fertility in Section 6.1, helps explain why fertility did not decline in this group despite increased contraceptive use. These results are consistent with more unintended pregnancies resulting in births. Among older women, fertility declined and unplanned births did not rise, consistent with improved fertility control in this group.

A potential concern is that this analysis conditions on having given birth in the past

five years, which could be problematic if the composition of younger women who give birth changes in treated states. Differences at the extensive margin are addressed in Table 3, which shows no change in the number of births among younger mothers. However, there may still be changes in the composition of mothers in treated areas. This concern is partially addressed in Section 10.3 through a robustness check that examines shifts in maternal characteristics, following Bossavie et al. (2023), and by replicating the analysis using the full sample of ever-married women, including those who have never given birth.

In sum, these results suggest that the MCH program affected fertility behavior differently by age, increasing unplanned births among younger women while improving fertility control among older women. In the next section, I test for pre-trends to assess the validity of the difference-in-differences design. I then isolate the health worker channel to better understand the mechanism underlying these effects.

7 Validation of Empirical Design

The empirical strategy in this paper relies on the Difference-in-Differences (DiD) approach. A key identifying assumption is that, in the absence of the program, the treatment and control groups would have followed parallel trends. In this section, I assess this assumption by examining whether the number of births and the probability of unplanned births evolved similarly between treatment and control groups in the pre-treatment period.

7.1 Test for Parallel Pre-Trends in Fertility Analysis (H1)

I begin by testing for parallel pre-trends in fertility outcomes. Following Griffith and Noonen (2022), I estimate a regression in Equation 3 using data from the pre-treatment period. The dependent variable is the number of births a woman reports in the five years prior to the interview. Year_y denotes the year of interview and accounts for common time trends across states. The interaction term between treatment status and interview year

($\text{Treat}_{is} \times \text{Year}_y$) captures any differential trends between the treated and control groups before the program. If the parallel trend holds, the interaction should be statistically insignificant ($\tilde{\alpha}_2 = 0$). The estimating equation is as follows:

$$Num_Births_{isy} = \tilde{\alpha}_0 + \tilde{\alpha}_1 \text{Year}_y + \tilde{\alpha}_2 \text{Treat}_{is} \times \text{Year}_y + X'_{iy}\tilde{\boldsymbol{\alpha}} + \lambda_s + \epsilon_{isy}, \tag{3}$$

In Table 6, estimates of Equation 3 presents the parallel pretrend tends to be rejected for all and younger women, but is not rejected for older women.

Table 6: Pre-Treatment Trends in Fertility

	Number of births over the past 5 years		
	(1)	(2)	(3)
	All women	Younger (19-29)	Older (30-40)
Year of Interview	-0.010***	-0.019***	0.007***
	(0.003)	(0.004)	(0.003)
Year of Interview × Treat	0.012*	0.014*	0.006
	(0.006)	(0.007)	(0.006)
Control mean (pre)	0.666	0.975	0.351
Observations	43997	23299	20697
State FE	Yes	Yes	Yes
Controls	Yes	Yes	Yes

Note: The dependent variable is the number of births a woman had in the past five years. Regressions control for the woman's age, the household head's age and an indicator for whether the head's age is missing, the woman's years of education, her partner's education level, the number of children over age five, indicators for Muslim and Hindu religion, infecundity status, and whether the household is female-headed. All models include state fixed effects. Standard errors are clustered at the state level and are presented in parentheses. Significance is indicated as follows: * p<0.1, ** p<0.05, *** p<0.01.

Next, to assess the robustness of the main results to violations of the parallel trends assumption, I implement the sensitivity check proposed by Kahn-Lang and Lang (2020), following the approach of Griffith and Noonen (2022). The method allows for differential linear trends between treatment and control groups in the pre-period and examines whether a treatment effect remains after extrapolating these trends into the post-period. Specifically, I estimate:

$$Num_Births_{isy} = \breve{\alpha}_0 + \breve{\alpha}_1 \text{Year}_y + \breve{\alpha}_2 \text{Treat}_{is} \times \text{Year}_y + \breve{\alpha}_3 \text{Treat}_{is} \times \text{Post}_y + X'_{iy}\breve{\boldsymbol{\alpha}} + \lambda_s + \epsilon_{isy} \tag{4}$$

In this specification, $(\breve{\alpha}_1 + \breve{\alpha}_2)$ captures the trends in treated states. This trend is then extended into the post-treatment period to estimate what would have happened in treated states had the program not been implemented. The coefficient $\breve{\alpha}_3$ measures how much actual outcomes in treated states differ from this projected trend. A statistically significant $\breve{\alpha}_3$ indicates that the treatment effect still exist.

The results from the sensitivity analysis in Table 7 remain qualitatively consistent with the main DiD estimates reported in Table 3. Once differential pre-treatment trends are extrapolated into the post-period, the estimated effect of JSY on fertility among older women remains large and statistically significant. Specifically, the magnitude increases from a 0.099 to a 0.371 reduction in births, suggesting that the original estimate is not driven by modest trend differences. In contrast, for younger women, the treatment effect remains close to zero and statistically insignificant across both specifications. These findings reinforce the interpretation that JSY reduced fertility among older women, while having no measurable effect on younger women's childbearing.

7.2 Test for Parallel Pre-Trends in Unplanned Birth Analysis (H2)

Next, I test for pre-treatment trends in unplanned births using the specification in Equation 5 on the pre-treatment sample. In this regression, the time variable is the year of birth, and treatment status is interacted with birth year to assess whether treated and control groups exhibited differential trends prior to JSY. The model includes standard controls, along with fixed effects for birth order (θ_b), state (λ_s), and interview year (ζ_y), as in the main analysis.

The estimating equation is:

$$Unplanned_bir_{ibsty} = \tilde{\beta}_0 + \tilde{\beta}_1 \text{Birth_year}_t + \tilde{\beta}_2(\text{Treat}_s \times \text{Birth_year}_t) + X'_{iy}\tilde{\boldsymbol{\beta}} + \theta_b + \zeta_y + \lambda_s + u_{ibsty} \tag{5}$$

Table 7: Sensitivity Analysis in Fertility

	Number of births over the past 5 years		
	(1)	(2)	(3)
	All women	Younger (19-29)	Older (30-40)
Year of Interview	-0.013***	-0.012***	-0.008***
	(0.001)	(0.002)	(0.001)
Year of Interview × Treat	0.015**	0.007	0.019***
	(0.006)	(0.007)	(0.004)
Treat × Post	-0.232***	-0.049	-0.371***
	(0.076)	(0.085)	(0.064)
Control mean (pre)	0.666	0.975	0.351
Observations	140832	70821	70011
State FE	Yes	Yes	Yes
Controls	Yes	Yes	Yes

Note: The dependent variable is the number of births a woman had in the past five years. Regressions control for the woman's age, the household head's age and an indicator for whether the head's age is missing, the woman's years of education, her partner's education level, the number of children over age five, indicators for Muslim and Hindu religion, infecundity status, and whether the household is female-headed. All models include state fixed effects. Standard errors are clustered at the state level and are presented in parentheses. Significance is indicated as follows: * p<0.1, ** p<0.05, *** p<0.01.

Table 8 reports the estimates. Across all groups, the interaction terms are statistically insignificant, consistent with the parallel trends assumption in unplanned birth outcomes during the pre-treatment period.

Event-Study for Nonlinear Pre-Trends. To complement the linear trend test, I also examine potential non-linear pre-treatment dynamics. I estimate an event-study specification restricted to pre-treatment birth years, following Autor (2003), Borusyak et al. (2024), Bossavie et al. (2023), and Salemi (2021). The model interacts treatment status with year-of-birth indicators, using 2004 as the omitted reference year. If trends were parallel, the coefficients on pre-treatment interactions (1994–2003) should be small and statistically insignificant.

The estimating equation is:

Table 8: Pre-Treatment Trends in Unplanned Births

	Unplanned birth		
	(1)	(2)	(3)
	All	Younger	Older
Year of Birth	0.001	-0.003	0.010
	(0.003)	(0.003)	(0.006)
Year of Birth × Treat	0.003	0.002	0.004
	(0.003)	(0.002)	(0.005)
Control mean	0.278	0.205	0.507
Observations	19026	14161	4865
Birth-order FE	Yes	Yes	Yes
State FE	Yes	Yes	Yes
Year-of-interview FE	Yes	Yes	Yes
Controls	Yes	Yes	Yes

Note: Regressions control for the woman's age, the household head's age and an indicator for whether the head's age is missing, the woman's years of education, her partner's education level, indicators for Muslim and Hindu religion, infecundity status, and whether the household is female-headed. All models include fixed effects for birth order, interview year, and state. Standard errors are clustered at the state level and reported in parentheses. Significance is indicated as follows: * p<0.1, ** p<0.05, *** p<0.01.

$$Unplanned_bir_{ibsty} = \breve{\beta}_0 + \sum_{\tau \neq 2004} \breve{\beta}_\tau (\text{Treat}_{is} \times \text{Birth_year}_{t=\tau}) + X'_{it}\breve{\boldsymbol{\beta}} + \theta_b + \lambda_s + \zeta_y + u_{ibsty} \tag{6}$$

where $\breve{\beta}_\tau$ captures the difference in outcomes between treated and control groups for each birth cohort τ relative to 2004.

Panels A–C of Figure A.1 plot the estimated coefficients with 90% confidence intervals separately for all women, younger women, and older women. Pre-treatment estimates are small in magnitude and statistically indistinguishable from zero across most birth-year cohorts, providing visual support for the parallel trends assumption.

To formally test this, I follow Borusyak et al. (2024) and Salemi (2021) in assessing whether the pre-treatment coefficients are jointly significant. Table 9 reports the corre-

sponding F-statistics and p-values. The results fail to reject parallel pretrends for the full sample and the younger cohort. However, the test performs less well in the older cohort, likely due to smaller sample size and limited variation across pre-policy cohorts in that subgroup.

Table 9: F-tests for Parallel Trends

	F-stat	p-value
Unplanned birth (All)	1.118512	.3824725
Unplanned birth (Younger)	.7927717	.6255642
Unplanned birth (Older)	5.721733	.0001664

8 Mechanism Analysis: Health Worker Channel

This section explores mechanisms through which access to MCH may have contributed to the observed increase in unplanned births for the young women. Especially, I examine health worker channel using the reform of JSY program in 2009 which gives the cash incentives for health workers (ASHAs) in HPS. First, I discuss the impact of the 2009 reform on unplanned births assuming that the reform increases women's access to health workers. Then, I confirm whether the 2009 reform enhanced access to health workers using regression continuity approach.

8.1 Empirical Strategy for Health Worker Channel

To isolate the effect of access to health workers from the overall impact of the JSY program, I implement a secondary difference-in-differences (DiD) strategy. This approach compares JSY-eligible women—those below the poverty line (BPL) or from Scheduled Castes or Tribes (SC/ST)—across high-performing states (HPS) and low-performing states (LPS).

This strategy exploits a policy reform in April 2009, which extended performance-based incentives to ASHAs in HPS. Before this reform, ASHAs in LPS were already incentivized, while those in HPS were not. After the reform, ASHAs in HPS became eligible for cash incentives per institutional delivery, likely increasing their interactions with pregnant women. This variation in ASHA incentives forms the basis for identifying the causal effect of access to health workers on reproductive outcomes.[8]

The treatment group consists of JSY-eligible women in HPS who gained access to incentivized ASHAs after April 2009. The control group includes similar women in LPS, who were exposed to incentivized ASHAs both before and after the reform. Because the only policy change affecting the treatment group was the introduction of ASHA incentives, this comparison isolates the effect of expanded access to ASHAs.

The estimating equation is as follows:

[8]Section 8.3 provides evidence that the reform increased women's exposure to ASHAs.

$$Unplanned_Bir_{cbmst} = \gamma_0 + \gamma_1 \text{HPS}_{mst} \times \text{Post}_t + X'_{cbhst}\gamma + \eta_t + \theta_b + \mu_m + \omega_{cbmst} \quad (7)$$

Here, $Unplanned_Bir_{cbhst}$ is an indicator for whether birth c of birth order b from mother m in state s at time t was unplanned. The interaction term $\text{HPS}_{mst} \times \text{Post}_t$ captures exposure to incentivized ASHAs. The specification includes fixed effects for birth year (η_t), birth order (θ_b), and mother (μ_m). Standard errors are clustered at the state level.

This analysis isolates the health worker channel from other components of the JSY program. A positive and statistically significant estimate of γ_1 would indicate that greater access to ASHAs led to an increase in unplanned births, independent of other components of the JSY program.

8.2 Results for Health Worker Channel

The estimation results show that expanded access to health workers increases unplanned births, with effects concentrated among younger women. Table 10 reports the estimates from regression 7. Column (1) shows that the likelihood of unplanned birth significantly rises by 4.1 percentage points following the introduction of ASHA incentives. Columns (2) and (3) show that this effect is driven by younger women, among whom the probability increases by 5 percentage points (significant at the 5% level). No statistically significant effect is observed for older women.

These results closely mirror the main findings in Table 5, where the overall JSY program also increases unplanned births, particularly among younger women. Taken together, the evidence suggests that health worker engagement is an important channel through which the JSY program affects reproductive outcomes.

Several mechanisms may explain this pattern. First, ASHAs may have influenced women's fertility preferences, for example, by encouraging birth spacing or lowering desired fertility. If male partners did not adjust their preferences in parallel, however, this mismatch could increase the likelihood of unplanned births. Second, ASHAs may have discouraged abortion, either directly through counseling or indirectly through registration into the JSY program and follow-up visits, making it more likely that unintended

pregnancies were carried to term. Section 9 explores these underlying mechanisms in greater detail.

Table 10: The Impact of Health Worker Access on Unplanned Births

	Unplanned birth		
	(1)	(2)	(3)
	All	Younger	Older
HPS × Post	0.041**	0.050**	0.010
	(0.018)	(0.019)	(0.045)
Control mean (pre)	0.329	0.329	0.329
Observations	4726	3192	1532
Birth-year FE	Yes	Yes	Yes
Birth-order FE	Yes	Yes	Yes
State FE	Yes	Yes	Yes
Mother FE	Yes	Yes	Yes

Note: The dependent variable is an indicator for whether the birth was unplanned. The sample is restricted to births to rural women from Scheduled Castes or Tribes or those below the poverty line. All regressions include fixed effects for birth year, birth order, state, and mother. Standard errors, clustered at the state level, are reported in parentheses. Significance is indicated as follows: * p<0.1, ** p<0.05, *** p<0.01.

8.3 Effect of 2009 Reform on Access to Health Workers

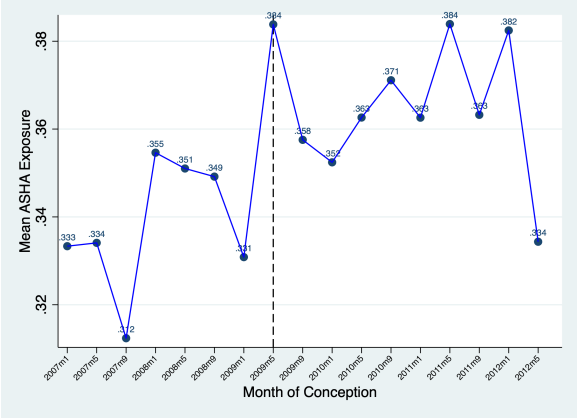
This section tests whether the 2009 reform increased women's access to community health workers (ASHAs) in high-performing states (HPS). Verifying this first-stage relationship is important for interpreting the main results in the following section, which attribute changes in unplanned births to increased exposure to health workers.

The analysis uses data from DLHS-4 (2012–13), which includes retrospective information on ASHA involvement during pregnancy, delivery, and postnatal care. As detailed in the data section, I construct a composite indicator for ASHA exposure based on reported interactions related to antenatal care, delivery support, transport assistance, and health education. The estimation sample includes JSY-eligible younger women aged 19 to 29 in HPS.

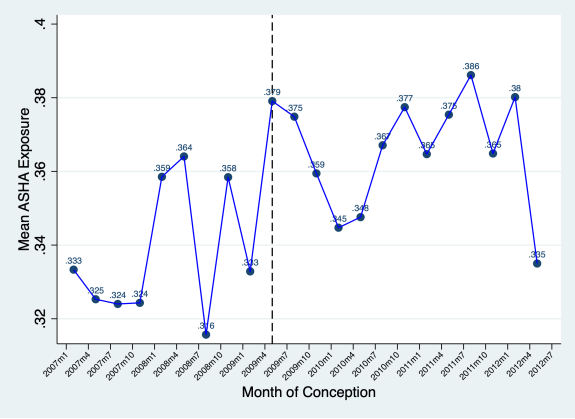
Figure 2 presents average ASHA exposure by estimated conception cohort, using four-month intervals (Panel A) and three-month intervals (Panel B). Conception dates are calculated as nine months prior to the reported birth month to approximate gestational timing.

All panels in Figure 2 shows a clear increase in ASHA exposure beginning in May 2009, coinciding closely with the April 2009 policy implementation. In Panel A, Between January 2007 and April 2009, average exposure fluctuated between 31.2% and 35.5%. After the reform, it rose to between 33.4% and 38.4%, with a notable increase from 33.1% in Jan 2009 to 38.4% in May 2009. A similar upward shift is evident in Panel B. Based on this visual evidence, I define May 2009 as the empirical cutoff in the analysis.

Figure 2: Exposure to ASHAs by Conception Cohort



Panel A: Mean Exposure by Conception Month (4-Month Bins)



Panel B: Mean Exposure by Conception Month (3-Month Bins)

To estimate the effect of the reform on ASHA exposure, I implement a sharp regression discontinuity (RD) design centered at the May 2009 conception threshold, following the approach in Sun and Zhao (2016). The running variable is the month of conception, and the outcome is the ASHA exposure indicator. The sharp RD framework is appropriate because the policy was implemented simultaneously across all HPS around the threshold.

The RD parameter is defined as:

$$\tau_{RD} = \lim_{c \uparrow l^*} E[exposure_i \mid c_i = l^*] - \lim_{c \downarrow l^*} E[exposure_i \mid c_i = l^*] \tag{8}$$

where c_i denotes the conception date and l^* represents the reform threshold in May 2009. I estimate this parameter using local linear regressions, implementing multiple specifications that vary by bandwidth selection (MSERD and CERRD) and kernel function (uniform and triangular), as recommended by Calonico et al. (2014) and Cattaneo et al. (2020). These alternative specifications allow for sensitivity checks around the choice of smoothing and weighting.

As an additional sensitivity check, I estimate a pooled OLS specification with an RD structure using the full sample, without restricting the bandwidth:

$$\text{Exposure}_i = \beta_0 + \beta_1 \mathbb{1}(c_i \geq l^*) + f(c_i - l^*) + \mathbb{1}(c_i \geq l^*) \times f(c_i - l^*) + \varepsilon_i,$$

where $\mathbb{1}(c_i \geq l^*)$ is an indicator for conception at or after the May 2009 threshold, and $f(c_i - l^*)$ denotes a linear polynomial in the number of months relative to the cutoff.

Table 11 reports estimates from the regression discontinuity (RD) analysis. Columns (1) through (4) present RD estimates using local linear regressions with different bandwidth selection methods and kernel functions. Specifically, Columns (1) and (2) use the MSERD criterion with uniform and triangular kernels, while Columns (3) and (4) use the CERRD criterion. Column (5) reports a pooled OLS estimate using the full sample as a robustness check. All standard errors are clustered by month of conception.

Across all RD specifications, the results consistently indicate a significant increase in ASHA exposure following the 2009 reform. The estimated effects range from 5.0 to 7.2 percentage points and are statistically significant at the 1 percent level. The OLS estimate in Column (5) also shows a significant increase of 4.0 percentage points, significant at the 5 percent level, providing further support for the main findings.

These results confirm that the reform substantially increased access to health workers among younger women in high-performing states. This validates the use of the reform as a source of exogenous variation in subsequent analysis of unplanned births in Section 8.2.

Table 11: The Impact of the 2009 Reform on Health Worker Access

	Exposure to ASHAs (d)				
	(1)	(2)	(3)	(4)	(5)
RD estimate	0.050***	0.067***	0.063***	0.072***	
	(0.015)	(0.013)	(0.022)	(0.011)	
OLS estimate					0.040**
					(0.012)
Bandwidth (months)	8	8	7	7	
BW selection	MSERD	MSERD	CERRD	CERRD	
Kernel	Uniform	Trinangular	Uniform	Triangular	
Observations	4541	4541	3927	3927	21500

Note: The sample includes younger rural women who are either from Scheduled Castes or Tribes (SC/ST) or below the poverty line (BPL), and who had a pregnancy in the past five years. It is further restricted to those with fewer than three births, reflecting JSY eligibility criteria in high-performing states (HPS). Standard errors, clustered at the month of conception level, are reported in parentheses. Significance is indicated as follows: * p<0.1, ** p<0.05, *** p<0.01.

9 Behavioral Responses Underlying the Health Worker Channel

This section explores potential mechanisms through which access to health workers may have contributed to the observed increase in unplanned births, with a specific focus on younger women. Specifically, I examine whether increased access to health workers influences (i) fertility preferences mismatch between women and their husbands, and (ii) individuals' attitudes toward abortion.

9.1 Couples' Discordance on Fertility Desire

This section investigates whether increased access to community health workers contributed to unplanned births by amplifying fertility desire discordance (FDD) within couples. FDD arises when partners express differing preferences over future childbearing (Gibbs and Moreau, 2017; Yeboah et al., 2023). In many low-income settings, including India, men are more likely than women to desire larger families—a pattern shaped by gender norms and son preference. When women have limited bargaining power within the

household, such discordance may result in fertility outcomes that deviate from women's intentions (Komura, 2013; Doepke and Tertilt, 2018; Mishra and Parasnis, 2021; Thomson, 1997).

This mechanism is particularly relevant in the context of JSY, which relies on Accredited Social Health Activists (ASHAs) to connect the public health system with women. While ASHAs are primarily tasked with promoting institutional delivery, they also counsel women on family planning and birth spacing. These interactions typically occur mostly with women, with minimal engagement with their male partners. If ASHAs encourage women to limit fertility but have little influence on men's preferences, this may increase disagreement between spouses. In contexts where men's preferences dominate actual reproductive decisions, women can be more likely to experience unplanned births.

To examine this mechanism, I use the same JSY-eligible sample described in Section 8, restricting it to women observed in both Waves 1 (2004–05) and 2 (2011–12) of the India Human Development Survey (IHDS). This panel structure allows for comparison of fertility preferences before and after the 2009 reform.[9] Fertility preferences are measured based on responses to whether the woman or her husband wants more children at the time of interview. The key outcome is a binary variable, *husb_want_more*, coded as one if the husband wants more children while the wife does not, capturing discordance in spousal fertility preferences.

The empirical strategy follows a two-way fixed effect difference-in-differences (TWFE DiD) framework:

$$y_{mst} = \delta_0 + \delta_1 \text{HPS}_{ms} \times \text{Post}_t + X'_{mst}\boldsymbol{\delta} + \lambda_s + \mu_m + \epsilon_{mst} \tag{9}$$

where y_{mst} denotes the outcome for individual m in state s at time t, including the wife's desire for more children, the husband's desire, and the discordance indicator, *husb_want_more*. The variable Post_t is equal to one for interviews conducted after April 2009, when ASHA incentives were expanded to high-performing states (HPS). HPS_{ms} is equal to one if the respondent resides in HPS, and the interaction term captures the differential change in

[9]The sample is restricted to women who were interviewed after the 2005 launch of JSY, so that their fertility preferences reflect the post-program period.

outcomes in HPS following the reform. The model includes women and state fixed effects. Standard errors are clustered at the state level.

Table 12 reports the effect of health worker access on fertility preferences. Among younger women (Panel B), exposure to the JSY reform leads to a significant decline in women's stated desire for more children, by 19.6 percentage points (significant at the 10% level), compared to a smaller and statistically insignificant reduction among their husbands. As a result, the likelihood that husbands want more children while their wives do not—a measure of spousal discordance—increases by 7.3 percentage points, also significant at the 10% level.

These findings suggest that ASHAs may influence women's fertility expectations more than men's. In settings where men's preferences often dominate reproductive decision-making, such discordance may help explain the rise in unplanned births among younger women documented in Section 8. The results are weaker or nonexistent among older women (Panel C), further underscoring that the effects of JSY on unplanned births are concentrated among younger women.

Table 12: The Impact of Health Worker Access on Fertility Preference

	Husband–Wife desire for more children		
	(1)	(2)	(3)
	Wife wants	Husband wants	Husband wants more
Panel A: All women			
HPS × Post	-0.169*	-0.115	0.027
	(0.086)	(0.085)	(0.036)
Control mean (pre)	0.551	0.564	0.037
Observations	690	690	690
Panel B: Younger women			
HPS × Post	-0.196*	-0.082	0.073*
	(0.112)	(0.112)	(0.040)
Control mean (pre)	0.725	0.754	0.049
Observations	276	276	276
Panel C: Older women			
HPS × Post	-0.124	-0.121	-0.023
	(0.105)	(0.115)	(0.035)
Control mean (pre)	0.459	0.462	0.030
Observations	414	414	414
State FE	Yes	Yes	Yes
Individual FE	Yes	Yes	Yes
Controls	Yes	Yes	Yes

Note: The dependent variable indicates whether the wife (column 1) or her husband (column 2) reports a desire for more children. Column 3 is an indicator for spousal discordance, equal to 1 if the wife does not want more children but her husband does. Panel A includes the sample of rural women from Scheduled Castes or Tribes, or those below the poverty line. Panel B restricts the sample to younger women aged 19–29, and Panel C to older women aged 30–40. All regressions control for the number of children, an indicator for current pregnancy, the woman's age and education, and her husband's education. State and individual fixed effects are included. Standard errors, clustered at the state level, are reported in parentheses. Significance is indicated as follows: * p<0.1, ** p<0.05, *** p<0.01.

9.2 Attitudes Toward Abortion

Another potential mechanism linking increased access to health workers with higher unplanned fertility is a shift in abortion-related attitudes. This channel may operate through

several pathways. First, repeated engagement with community health workers may increase the perceived moral or social cost of abortion. Studies show that health workers often hold conservative views on abortion and, through sustained interactions, can influence women's perceptions in ways that reinforce stigma (Nandagiri, 2019; Glenton et al., 2017). Second, qualitative evidence from India suggests that women may avoid seeking abortion services due to concerns that ASHAs will not maintain confidentiality (Gupta et al., 2017). Third, the performance-based incentive structure of the Janani Suraksha Yojana (JSY) may create financial motives for ASHAs to discourage abortion. As shown by Javadekar et al. (2025), ASHAs who receive payments conditional on institutional delivery may dissuade women from terminating pregnancies.

To examine whether abortion attitudes shifted following the JSY reform, I use data from Waves 4 (2001), 5 (2006), and 6 (2012) of the World Values Survey (WVS). Respondents were asked, *"How justifiable do you consider abortion?"* on a scale from 1 (*"never justifiable"*) to 3 (*"always justifiable"*). I construct a standardized index reflecting respondents' justification of abortion. The sample includes both men and women and is not restricted by age, as spousal age gaps are common in India, and broader shifts in abortion attitudes may influence fertility outcomes among younger women.

I exploit the phased rollout of the Janani Suraksha Yojana (JSY), which introduced cash incentives to mothers beginning in 2005 and expanded payments to health workers in 2009 in high-performing states (HPS). To estimate changes in abortion attitudes associated with increased exposure to health workers, I implement a triple-differences (DDD) strategy that compares outcomes across three periods: before JSY (pre-2005), after the initial rollout (post-2005), and following the expansion of ASHA incentives in HPS (post-2009).

The estimating equation is as follows:

$$\begin{aligned} Z_JustAbortion_{ist} = \gamma_0 + \gamma_1 \text{HPS}_{is} \times \text{Post } 2009_t + \gamma_2 \text{HPS}_{is} \times \text{Post } 2005_t \\ + X_{ist} + \delta_t + \lambda_s + \epsilon_{ist} \end{aligned} \tag{10}$$

In this equation, $Z_JustAbortion_{ist}$ is the standardized index of abortion justification

for individual i in state s at time t. The variable HPS_{is} is an indicator for whether the individual resides in a high-performing state. $\text{Post } 2005_t$ is an indicator for the early JSY diffusion period (post-2005), while $\text{Post } 2009_t$ captures the later diffusion period (post-2009). The term X_{ist} represents a vector of individual-level control variables. ζ_t and λ_s denote year and state fixed effects, respectively. Standard errors are clustered at the state level and denoted by ϵ_{ist}. The coefficient of interest, γ_1, captures the change in attitudes toward abortion associated with increased access to health workers during the later diffusion period in high-performing states.

Table 13 presents the estimation results. The triple-difference coefficient is –0.77 and is significant at the 10% level. This suggests that increased access to health workers is associated with lower support for abortion. Columns (2) and (3) show that this effect is concentrated among men: the estimate is negative and statistically significant for men, but smaller and statistically insignificant for women.

This pattern aligns with the hypothesis that men become less accepting of abortion following greater exposure to health workers. Given that male preferences often dominate fertility decisions, this shift may contribute to the rise in unplanned births among women.

These findings should be interpreted with caution, given important limitations of the WVS data. First, the sample is not restricted to individuals who recently experienced a pregnancy or birth, which may weaken the link between stated attitudes and actual fertility behavior. Second, the data are drawn from repeated cross-sections rather than panel surveys, meaning the analysis captures population-level changes rather than individual-level shifts over time. As a result, the estimates may reflect broader social trends rather than direct behavioral responses to the program.

Table 13: The Impact of JSY on Abortion Attitudes Among Women and Men

	Abortion Acceptability (z-score)		
	(1)	(2)	(3)
	All	Women	Men
HPS × Post 2009	-0.774*	-0.504	-0.925**
	(0.382)	(0.372)	(0.400)
HPS × Post 2005	0.300	-0.047	0.493
	(0.512)	(0.443)	(0.560)
HPS	0.125	0.085	0.175
	(0.233)	(0.214)	(0.272)
Post 2009	0.044	0.111	0.002
	(0.177)	(0.244)	(0.163)
Control mean (pre)	-0.000	-0.032	0.023
Observations	3641	1689	1952
Year FE	Yes	Yes	Yes
State FE	Yes	Yes	Yes

Note: The dependent variable is a standardized index measuring attitudes toward abortion. The sample includes rural women and men from lower socioeconomic backgrounds, defined based on indicators of lower caste status, low income, and residence in areas with fewer than 10,000 residents. Column (2) restricts the sample to women, and Column (3) to men. All regressions control for age, education, and number of children. Standard errors, clustered at the state level, are reported in parentheses. Significance is indicated as follows: * p<0.1, ** p<0.05, *** p<0.01.

10 Robustness Checks

10.1 Testing JSY Effects Among APL Women with Similar Characteristics to BPL

A potential concern in linking the main finding that JSY increased unplanned births to the mechanism analysis involving access to community health workers is that the two results are estimated on different samples. The main analysis focuses on women above the poverty line and not from Scheduled Castes or Tribes, while the mechanism analysis uses data on births to women who are either below the poverty line or from SC or ST groups. If these populations differ systematically in how they interact with health workers or re-

spond to JSY incentives, the interpretation that increased access to ASHAs explains the rise in unplanned births may be weakened.

To bridge the sample difference between the main and mechanism analyses, I restrict the main analysis sample to above-poverty-line (APL) women in the bottom two quintiles of the wealth index, representing the poorest segment of the APL population. Although these women are technically above the poverty line, their socioeconomic characteristics more closely resemble those of below-poverty-line (BPL) women included in the mechanism analysis. This subgroup is more likely to have comparable exposure to ASHAs and to face similar constraints in exercising fertility preferences.

Table 14 presents the results from this subsample analysis. The estimated effect of JSY on unplanned births remains positive and statistically significant among poorer APL women, with magnitudes similar to those in the main specification. The effect is again concentrated among younger women, significant at the 1% level. These results show that JSY increased unplanned births even among women whose socioeconomic status is closer to that of the BPL and SC/ST populations used in the mechanism analysis. While this test does not directly evaluate the mechanism, it supports the use of the BPL/SCST sample to examine how increased access to community health workers may have contributed to the observed rise in unplanned births.

10.2 Placebo Test: Ineligible Births Above Second Parity

To assess the internal validity of the mechanism analysis, I conduct a placebo test using births that were not eligible for JSY benefits. Specifically, I restrict the sample to third and higher-order births among rural women below the poverty line or from Scheduled Castes or Tribes. These higher-parity births were excluded from the main mechanism analysis in Section 8, which focused on JSY-eligible first and second births, in line with the program's parity-based eligibility rule in high-performing states (HPS). Since JSY incentives do not apply beyond the second birth, these women should not have experienced increased engagement with ASHAs following the 2009 reform. Although the sample size is limited, this exercise provides a useful robustness check.

Table 14: Impact of JSY on Unplanned Births Among Poorer APL Women

	Unplanned births					
	(1) All	(2) Younger	(3) Older	(4) All	(5) Younger	(6) Older
Treat × Post	0.040*	0.049***	0.022			
	(0.020)	(0.018)	(0.046)			
Treat × Post (2005-2008)				0.026	0.054**	-0.068
				(0.023)	(0.022)	(0.061)
Treat × Post (2009-2016)				0.041*	0.048**	0.028
				(0.022)	(0.019)	(0.047)
Control mean (pre)	0.278	0.205	0.507	0.278	0.205	0.507
Observations	25295	17923	7370	25295	17923	7370
Birth-year FE	Yes	Yes	Yes	Yes	Yes	Yes
Birth-order FE	Yes	Yes	Yes	Yes	Yes	Yes
State FE	Yes	Yes	Yes	Yes	Yes	Yes
Year-of-interview FE	Yes	Yes	Yes	Yes	Yes	Yes
Controls	Yes	Yes	Yes	Yes	Yes	Yes

Note: The dependent variable is an indicator for whether a woman's most recent birth in the past five years was unplanned. The sample is restricted to the poorest subgroup within the main sample—rural women from higher castes and above the poverty line. Regressions control for the woman's age, the household head's age and an indicator for whether the head's age is missing, the woman's years of education, her partner's education level, indicators for Muslim and Hindu religion, infecundity status, and whether the household is female-headed. All models include fixed effects for birth year, birth order, interview year, and state. Standard errors are clustered at the state level and reported in parentheses. Significance is indicated as follows: * p<0.1, ** p<0.05, *** p<0.01.

Table 15 reports the results. The interaction term between HPS status and the post-reform period is statistically insignificant in all columns, with point estimates close to zero. Among younger women, the coefficient is positive but not statistically distinguishable from zero, while the estimates for the full sample and older women are slightly negative and also insignificant.

These null results lend support to the interpretation that the rise in unplanned births observed in the main analysis is specific to JSY-eligible women and is not driven by broader trends affecting all women. The placebo test helps rule out alternative explanations and reinforces the claim that increased health worker engagement contributed to the rise in unplanned births among younger women.

Table 15: The Impact of Health Worker Access on Unplanned Births Beyond Second Parity

	Unplanned birth		
	(1)	(2)	(3)
	All	Younger	Older
HPS × Post	-0.012	0.114	-0.031
	(0.108)	(0.137)	(0.190)
Control mean (pre)	0.728	0.651	0.796
Observations	177	103	70
Birth-year FE	Yes	Yes	Yes
Birth-order FE	Yes	Yes	Yes
State FE	Yes	Yes	Yes
Mother FE	Yes	Yes	Yes

Note: The dependent variable is an indicator for whether the birth was unplanned. The sample is restricted to births to rural women from Scheduled Castes or Tribes or those below the poverty line. All regressions include fixed effects for birth year, birth order, state, and mother. Standard errors, clustered at the state level, are reported in parentheses. Significance is indicated as follows: * p<0.1, ** p<0.05, *** p<0.01.

10.3 Testing for Selection Bias in Unplanned Birth Estimates

A potential concern with the main analysis in Table 5 is that it conditions on women who gave birth in the past five years. If the Janani Suraksha Yojana (JSY) influenced fertility behavior, this restriction may introduce selection bias. Specifically, if the program affected who gives birth, comparisons limited to ever-mothers may conflate treatment effects with shifts in the composition of mothers.

As discussed in Section 6.2, this concern is partly mitigated by the earlier finding in Table 3, which shows no statistically significant change in overall fertility among younger women—the group where the increase in unplanned births occurred. This suggests that the rise in unplanned births is unlikely to be driven by an increase in the number of births. Nonetheless, it remains important to assess whether changes in the composition of women who give birth, that is, selection on the intensive margin, could bias the estimates.

As a first robustness check, I examine changes in observable maternal characteristics.

I follow the approach in Bossavie et al. (2023), estimating DiD regressions for five key covariates: age, age at marriage, religion, education, and partner's education. This strategy tests whether the observable profile of mothers changed across treatment and control groups after JSY implementation.[10]

Figure 3 plots the estimated effects of JSY on key maternal characteristics using a DiD specification. Across most outcomes—age, age at marriage, religion, education, and partner's education—estimates are small and statistically insignificant. Notably, point estimates are near zero for religion and partner's education across all age groups. While education declines slightly among older women, this is not observed for the younger cohort, which is the main sample of interest. Overall, there is no evidence of systematic changes in observable characteristics among younger women, suggesting that selection on observables is unlikely to bias the main results.

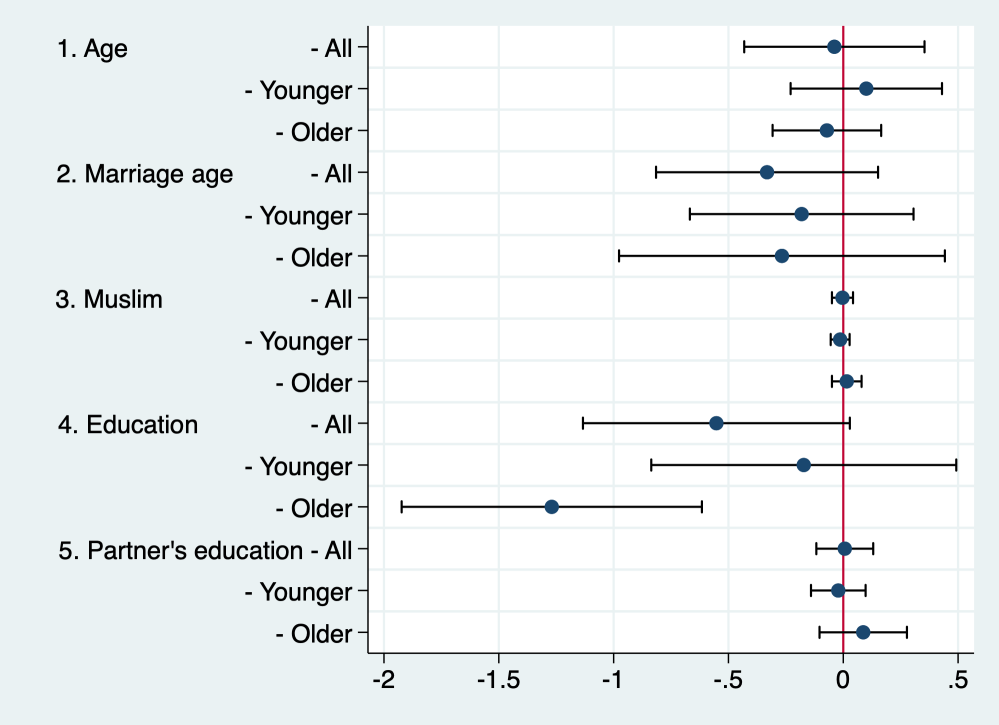
However, changes in unobserved characteristics may still bias the estimates. To address this, I conduct a second robustness check using the full sample of ever-married women, regardless of whether they gave birth in the past five years. As a second robustness check, I replicate the analysis using the full sample of ever-married women, regardless of whether they gave birth in the past five years. The dependent variable is an indicator for whether the respondent had an unplanned birth during that period, and women who did not give birth are coded as having zero unplanned births. This approach avoids conditioning on childbirth and allows estimation of the average treatment effect across all ever-married women.

One complication arises with the use of DHS Wave 3 (2005–06), which was fielded shortly after JSY was introduced. In the birth-only sample, exposure can be assigned based on the timing of the birth. However, for women who did not give birth, treatment status cannot be clearly assigned, because although their date of interview falls after the launch of JSY, most of the five-year recall period still falls in the pre-JSY era. As a result, it is difficult to consistently define pre- and post-treatment periods for these women.

To ensure a clean comparison, I restrict the sample to DHS Wave 2 (1998–99), which

[10]The premise is based on the assumption articulated by Altonji et al. (2005) and Oster (2019), that changes in unobservable characteristics are likely to be correlated with changes in observable ones.

Figure 3: Compositional changes in mothers, post JSY



Note: This figure plots estimates of the effect of JSY exposure on maternal characteristics, by age group. Each coefficient corresponds to the interaction between treatment status and the post-treatment period. All regressions include birth year, birth order, interview year, and state fixed effects as in the main analysis. Standard errors are clustered at the state level.

predates JSY, and Wave 4 (2015–16), where the entire five-year exposure window falls within the post-JSY period.

Table 16 reports results from a robustness check using the full sample of ever-married women, including those who did not give birth during the five-year recall period. In Column (2), the estimated effect among younger women is positive but statistically insignificant. This attenuation is likely due to dilution, as many women in the broader sample were not directly exposed to JSY during a pregnancy.

To probe this further, Columns (3) and (4) restrict the sample to younger women with plausibly lower intrahousehold bargaining power—those who married before age 16 and those with more daughters than sons.[11] In both subgroups, JSY exposure leads to a sta-

[11]Evidence shows that early marriage and having less sons reduce women's bargaining power within

tistically significant increase in unplanned births. These findings are consistent with the mechanism presented in Section 9.1, which shows that JSY increased discordance in fertility preferences between husbands and wives. When such discordance arises, women with limited bargaining power may be less able to act on their own fertility preferences, increasing the likelihood that unintended pregnancies are carried to term. The recovery of the treatment effect in these mechanism-relevant subgroups strengthens confidence that the main findings are not an artifact of conditioning on childbirth.

Table 16: The Impact of JSY on Unplanned Births: Results from Full Sample

	Unplanned birth			
	(1)	(2)	(3)	(4)
	All	Younger	Younger & Early marriage	Younger & More daughters
Treat × Post	-0.0109	0.0127	0.0477*	0.0529***
	(0.012)	(0.014)	(0.026)	(0.019)
Control mean (pre)	0.139	0.149	0.243	0.252
Observations	122002	61151	11094	17466
Year-of-interview FE	Yes	Yes	Yes	Yes
State FE	Yes	Yes	Yes	Yes
Controls	Yes	Yes	Yes	Yes

Note: The dependent variable is an indicator for whether a woman's most recent birth in the past five years was unplanned. The sample includes all ever-married women from NFHS Waves 2 (1998–99) and 4 (2015–16), including both ever-mothers and never-mothers. Regressions control for the woman's age, the household head's age and an indicator for whether the head's age is missing, the woman's years of education, her partner's education level, the number of children, indicators for Muslim and Hindu religion, infecundity status, and whether the household is female-headed. All models include fixed effects for interview year and state. Column (1) reports estimates for the full sample; column (2) restricts to younger women; column (3) further restricts to younger women who married before age 16; and column (4) restricts to younger women whose daughters outnumber sons. Standard errors are clustered at the state level and reported in parentheses. Significance is indicated as follows: * p<0.1, ** p<0.05, *** p<0.01.

households (Li and Wu, 2011; Tauseef and Sufian, 2024).

11 Conclusion

This paper documents an unintended consequence of expanding maternal health services on unplanned fertility, using evidence from India's Janani Suraksha Yojana (JSY). While the program reduced fertility among older women, it simultaneously increased unplanned births among younger women in rural areas. Mechanism analysis shows that improved access to community health workers in the program is a key channel. These workers shift women's own fertility preferences toward wanting no additional children, without changing their husbands' preferences. They also reduce women's willingness to seek abortion, increasing the likelihood that unintended pregnancies are carried to term. These findings show that health system interventions that expand institutional deliveries and antenatal care can unintentionally change reproductive behavior.

This paper has several limitations. First, the mechanism analysis uses a different subsample from the main effect estimation. The main difference-in-differences design focuses on women above the poverty line and outside lower-caste groups. In contrast, the mechanism analysis uses birth histories from below-poverty-line or lower-caste women. The robustness checks replicate the main outcome by restricting the above-poverty-line, higher-caste sample to its poorest subgroup to make it as close as possible to the mechanism sample. However, the inability to observe mechanisms within a single consistent sample limits the strength of causal claims about channels.

Second, the design does not isolate the impact of the JSY cash transfer to mothers, which is conditional on institutional delivery. Because of the policy's structure, this paper can only separately identify the role of increased access to community health workers. This leaves open the question of whether the conditional cash payment itself also contributes to unintended births.

Third, restricting the sample to recent mothers can introduce selection bias if the composition of who becomes a mother changes with program exposure. This risk is partly mitigated by the absence of any program effect on overall fertility among younger women, the group where unplanned births increased. Robustness checks also help address the concerns about selection. Observable maternal characteristics remain stable

post-treatment, and results using the full sample of ever-married women—including those without recent births—show similar patterns. However, the latter analysis relies on a more limited set of fixed effects due to ambiguity in treatment timing.

These findings have important implications for policy design. Maternal and child health interventions aim to improve maternal survival by promoting institutional delivery and antenatal care. However, their incentive structure can unintentionally increase unplanned births. Shifting from payment-per-delivery incentives for health workers to incentive designs that also support women's reproductive autonomy may help limit these unintended effects while maintaining health gains. In addition, providing services such as maternal mental health care and early childhood support may help mitigate the negative impacts of unplanned births.

Future research should aim to disentangle the separate effects of conditional cash transfers to mothers and improved access to health workers on fertility intentions and unplanned births. It should also examine longer-term consequences of unplanned births, including maternal mental health, child health, and human capital accumulation. This would help clarify the full welfare implications of maternal health interventions in low-income settings.

References

Jonathan Bearak, Anna Popinchalk, Bela Ganatra, Ann Beth Moller, Özge Tunçalp, Cynthia Beavin, Lorraine Kwok, and Leontine Alkema. Unintended pregnancy and abortion by income, region, and the legal status of abortion: estimates from a comprehensive model for 1990–2019. *The Lancet Global Health*, 8, 2020. ISSN 2214109X. doi: 10.1016/S2214-109X(20)30315-6.

I Mcfarlane, R Zerzan, D Baker, S Keogh, G Luchsinger, M Roseman, G Sedgh, and J Solo. State of the world population: Seeing the unseen. the case for action in the neglected crisis of unintended pregnancy. *Unfpa*, 2022.

Yohannes Dibaba Wado, Mesganaw Fantahun Afework, and Michelle J. Hindin. Unintended pregnancies and the use of maternal health services in southwestern ethiopia. *BMC International Health and Human Rights*, 13, 2013. ISSN 1472698X. doi: 10.1186/1472-698X-13-36.

Jinwook Bahk, Sung Cheol Yun, Yu mi Kim, and Young Ho Khang. Impact of unintended pregnancy on maternal mental health: A causal analysis using follow up data of the panel study on korean children (pskc). *BMC Pregnancy and Childbirth*, 15, 4 2015. ISSN 14712393. doi: 10.1186/s12884-015-0505-4.

Heidi D. Nelson, Blair G. Darney, Katherine Ahrens, Amanda Burgess, Rebecca M. Jungbauer, Amy Cantor, Chandler Atchison, Karen B. Eden, Rose Goueth, and Rongwei Fu. Associations of unintended pregnancy with maternal and infant health outcomes: A systematic review and meta-analysis, 11 2022. ISSN 15383598.

Abhishek Singh, Satvika Chalasani, Michael A. Koenig, and Bidhubhusan Mahapatra. The consequences of unintended births for maternal and child health in india. *Population Studies*, 66:223–239, 2012. ISSN 14774747. doi: 10.1080/00324728.2012.697568.

Cicely Marston and John Cleland. Relationships between contraception and abortion: A review of the evidence. *International Family Planning Perspectives*, 29, 2003. ISSN 01622749. doi: 10.2307/3180995.

Carrie K. Shapiro-Mendoza, Kay M. Tomashek, Robert N. Anderson, and Jennifer Wingo. Recent national trends in sudden, unexpected infant deaths: More evidence supporting a change in classification or reporting. *American Journal of Epidemiology*, 163, 2006. ISSN 00029262. doi: 10.1093/aje/kwj117.

Diana Greene Foster, Sarah E Raifman, Jessica D Gipson, Corinne H Rocca, and M Antonia Biggs. Effects of carrying an unwanted pregnancy to term on women's existing children the journal of pediatrics • www.jpeds.com. 2018. doi: 10.1016/j.jpeds. URL http://creativecommons.org/licenses/by-nc-nd/4.0/.

Stephen S. Lim, Lalit Dandona, Joseph A. Hoisington, Spencer L. James, Margaret C. Hogan, and Emmanuela Gakidou. India's janani suraksha yojana, a conditional cash transfer programme to increase births in health facilities: an impact evaluation. *The Lancet*, 375:2009–2023, 2010. ISSN 01406736. doi: 10.1016/S0140-6736(10)60744-1.

Timothy Powell-Jackson, Sumit Mazumdar, and Anne Mills. Financial incentives in health: New evidence from india's janani suraksha yojana. *Journal of Health Economics*, 43:154–169, 9 2015. ISSN 18791646. doi: 10.1016/j.jhealeco.2015.07.001.

Arindam Nandi and Ramanan Laxminarayan. The unintended effects of cash transfers on fertility: evidence from the safe motherhood scheme in india. *Journal of Population Economics*, 29, 2016. ISSN 09331433. doi: 10.1007/s00148-015-0576-6.

Elizabeth Oltmans Ananat, Jonathan Gruber, Phillip B. Levine, and Douglas Staiger. Abortion and selection. *Review of Economics and Statistics*, 91, 2009. ISSN 00346535. doi: 10.1162/rest.91.1.124.

Christine Valente. Access to abortion, investments in neonatal health, and sex-selection: Evidence from nepal. *Journal of Development Economics*, 107, 2014. ISSN 03043878. doi: 10.1016/j.jdeveco.2013.12.002.

José Ignacio Antón, Zuleika Ferre, and Patricia Triunfo. The impact of the legalisation of abortion on birth outcomes in uruguay. *Health Economics (United Kingdom)*, 27, 2018. ISSN 10991050. doi: 10.1002/hec.3659.

Mizuki Komura. Fertility and endogenous gender bargaining power. *Journal of Population Economics*, 26, 2013. ISSN 09331433. doi: 10.1007/s00148-012-0460-6.

Matthias Doepke and Michèle Tertilt. Women's empowerment, the gender gap in desired fertility, and fertility outcomes in developing countries. *AEA Papers and Proceedings*, 108, 2018. ISSN 2574-0768. doi: 10.1257/pandp.20181085.

Ankita Mishra and Jaai Parasnis. Husband, sons and the fertility gap: evidence from india. *Journal of Population Research*, 38, 2021. ISSN 18359469. doi: 10.1007/s12546-021-09254-4.

Elizabeth Thomson. Couple childbearlng desires, intentions, and births. *Demography*, 34, 1997. ISSN 00703370. doi: 10.2307/3038288.

Rishita Nandagiri. "like a mother-daughter relationship": Community health intermediaries' knowledge of and attitudes to abortion in karnataka, india. *Social Science and Medicine*, 239, 2019. ISSN 18735347. doi: 10.1016/j.socscimed.2019.112525.

Claire Glenton, Annik M. Sorhaindo, Bela Ganatra, and Simon Lewin. Implementation considerations when expanding health worker roles to include safe abortion care: A five-country case study synthesis. *BMC Public Health*, 17, 2017. ISSN 14712458. doi: 10.1186/s12889-017-4764-z.

Pallavi Gupta, Sharad D. Iyengar, Bela Ganatra, Heidi Bart Johnston, and Kirti Iyengar. Can community health workers play a greater role in increasing access to medical abortion services? a qualitative study. *BMC Women's Health*, 17, 2017. ISSN 14726874. doi: 10.1186/s12905-017-0391-1.

Sayli Javadekar, Kritika Saxena, Christelle Dumas, Eliana La Ferrara, Jaya Krishnakumar, Travis Lybbert, Tobias Mueller, Dilip Mukherjee, Michele Pellizzari, Debraj Ray, Alessandro Tarozzi, and Aleksey Tetenov. The seen and unseen: The unintended impact of a conditional cash transfer program on prenatal sex selection. Technical report, 2025. URL http://mofapp.nic.in:8080/economicsurvey/pdf/102-118_Chapter_07_ENGLISH_.

John Bongaarts. The measurement of wanted fertility. Technical report, 1990.

Martha J. Bailey. "momma's got the pill": How anthony comstock and griswold v. connecticut shaped us childbearing. *American Economic Review*, 100:98–129, 3 2010. ISSN 00028282. doi: 10.1257/aer.100.1.98.

Grant Miller. Contraception as development? new evidence from family planning in colombia. *Economic Journal*, 120:709–736, 6 2010. ISSN 00130133. doi: 10.1111/j.1468-0297.2009.02306.x.

Martina Björkman and Jakob Svensson. Power to the people: Evidence from a randomized field experiment on community-based monitoring in uganda. *The Quarterly Journal of Economics*, 124(2):735–769, 2009. doi: 10.1162/qjec.2009.124.2.735. URL https://doi.org/10.1162/qjec.2009.124.2.735.

Pascaline Dupas. Health behavior in developing countries. Technical report, 2011.

Paul Gertler and Christel Vermeersch. Using performance incentives to improve medical care productivity and health outcomes. *NBER Working Paper Series*, 2013. ISSN 08982937.

Prakarsh Singh and William A. Masters. Impact of caregiver incentives on child health: Evidence from an experiment with anganwadi workers in india. *Journal of Health Economics*, 55, 2017. ISSN 18791646. doi: 10.1016/j.jhealeco.2017.07.005.

Aaron Mendelson, Karli Kondo, Cheryl Damberg, Allison Low, Makalapua Motuapuaka, Michele Freeman, Maya O'Neil, Rose Relevo, and Devan Kansagara. The effects of pay-for-performance programs on health, health care use, and processes of care: A systematic review. *Annals of Internal Medicine*, 166, 2017. ISSN 15393704. doi: 10.7326/M16-1881.

Thomas Gadsden, Sikhumbuzo A. Mabunda, Anna Palagyi, Asri Maharani, Sujarwoto Sujarwoto, Michelle Baddeley, and Stephen Jan. Performance-based incentives and community health workers' outputs, a systematic review, 2021. ISSN 15640604.

Susheela Singh, Chander Shekhar, Rajib Acharya, Ann M. Moore, Melissa Stillman, Manas R. Pradhan, Jennifer J. Frost, Harihar Sahoo, Manoj Alagarajan, Rubina Hussain, Aparna Sundaram, Michael Vlassoff, Shveta Kalyanwala, and Alyssa Browne. The incidence of abortion and unintended pregnancy in india, 2015. *The Lancet Global Health*, 6:e111–e120, 1 2018. ISSN 2214109X. doi: 10.1016/S2214-109X(17)30453-9.

Melissa Stillman, Jennifer J Frost, Susheela Singh, Shveta Kalyanwala, and Ann Moore. Abortion in india: A literature review. *Guttmacher Institute*, 2014.

Sneha Kumari and Jugal Kishore. Medical termination of pregnancy (amendment bill, 2021): Is it enough for indian women regarding comprehensive abortion care, 2021. ISSN 19983581.

World Bank. World development indicators: Gdp per capita (current us$) for india. https://data.worldbank.org/indicator/NY.GDP.PCAP.CD?locations=IN, 2023. Accessed: 2024-07-09.

Nava Ashraf, Erica Field, and Jean Lee. Household bargaining and excess fertility: An experimental study in zambia. *American Economic Review*, 104, 2014. ISSN 00028282. doi: 10.1257/aer.104.7.2210.

Gary S. Becker. A theory of marriage: Part i. *Journal of Political Economy*, 81, 1973. ISSN 0022-3808. doi: 10.1086/260084.

Oded Galor and David N. Weil. Population, technology, and growth: From malthusian stagnation to the demographic transition and beyond. *American Economic Review*, 90, 2000. ISSN 00028282. doi: 10.1257/aer.90.4.806.

Petra E. Todd and Kenneth I. Wolpin. Structural estimation and policy evaluation in developing countries. *Annual Review of Economics*, 2, 2010. ISSN 19411383. doi: 10.1146/annurev.economics.102308.124345.

Sumit Saxena, Sonam Maheshwari, and Anju Saxena. Evaluation of knowledge of asha regarding family planning services provided under nrhm in bhojipura block, district bareilly. *Religion*, 3, 2018.

Sumit Saxena, Sonam Maheshwari, Anju Saxena, and Cum Statistician. Evaluation of knowledge of asha regarding family planning services provided under nrhm in bhojipura block, district bareilly. *Journal of Preventive Medicine and Holistic Health*, 3:56–61, 2021. doi: 10.18231/2454-6712.2017.0012.

Catherine Moughalian, Josué Almansa, Tobias Vogt, Regien Biesma, Susanne Täuber, Arathi Rao, Ashish Srivastava, and Jelle Stekelenburg. The impact of accredited social health activists in india on uptake of modern contraception: A nationally representative multilevel modelling study. *Global Public Health*, 19, 2024. ISSN 17441706. doi: 10.1080/17441692.2024.2329216.

Jessica D. Gipson, Michael A. Koenig, and Michelle J. Hindin. The effects of unintended pregnancy on infant, child, and parental health: A review of the literature, 3 2008. ISSN 00393665.

C F Westoff and D Koffman. Birth spacing and limiting connections. Technical report, 2010.

Ian M. Timæus and Tom A. Moultrie. Pathways to low fertility: 50 years of limitation, curtailment, and postponement of childbearing. *Demography*, 57, 2020. ISSN 15337790. doi: 10.1007/s13524-019-00848-5.

Laurent Bossavie, Yoonyoung Cho, and Rachel Heath. The effects of international scrutiny on manufacturing workers: Evidence from the rana plaza collapse in bangladesh. *Journal of Development Economics*, 163, 2023. ISSN 03043878. doi: 10.1016/j.jdeveco.2023.103107.

Alan Griffith and Thomas Noonen. The effects of public campaign funding: Evidence from seattle's democracy voucher program. *Journal of Public Economics*, 211, 2022. ISSN 00472727. doi: 10.1016/j.jpubeco.2022.104676.

Ariella Kahn-Lang and Kevin Lang. The promise and pitfalls of differences-in-differences: Reflections on 16 and pregnant and other applications. *Journal of Business and Economic Statistics*, 38:613–620, 7 2020. ISSN 15372707. doi: 10.1080/07350015.2018.1546591.

David H. Autor. Outsourcing at will: The contribution of unjust dismissal doctrine to the growth of employment outsourcing, 2003. ISSN 0734306X.

Kirill Borusyak, Xavier Jaravel, and Jann Spiess. Revisiting event-study designs: Robust and efficient estimation. *Review of Economic Studies*, 91, 2024. ISSN 1467937X. doi: 10.1093/restud/rdae007.

Colette Salemi. Refugee camps and deforestation in sub-saharan africa. *Journal of Development Economics*, 152, 9 2021. ISSN 03043878. doi: 10.1016/j.jdeveco.2021.102682.

Ang Sun and Yaohui Zhao. Divorce, abortion, and the child sex ratio: The impact of divorce reform in china. *Journal of Development Economics*, 120:53–69, 5 2016. ISSN 03043878. doi: 10.1016/j.jdeveco.2015.11.006.

Sebastian Calonico, Matias D. Cattaneo, and Rocio Titiunik. Robust nonparametric confidence intervals for regression-discontinuity designs. *Econometrica*, 82, 2014. ISSN 14680262. doi: 10.3982/ecta11757.

Matias D. Cattaneo, Rocío Titiunik, and Gonzalo Vazquez-Bare. *The Regression Discontinuity Design*, pages 835–857. SAGE Publications Ltd, 2020. doi: 10.4135/9781526486387.n47. URL https://sk.sagepub.com/reference/the-sage-handbook-of-research-methods-in-political-science-and-ir/i6901.xml.

Susannah E. Gibbs and Caroline Moreau. Perceived partner fertility desires and influence on contraceptive use*. *European Journal of Contraception and Reproductive Health Care*, 22, 2017. ISSN 14730782. doi: 10.1080/13625187.2017.1361529.

Isaac Yeboah, Joshua Okyere, Henry Ofori Duah, Andrew Kweku Conduah, and Mary Naana Essiaw. Analysis of couples' discordance on fertility desire in ghana. *Genealogy*, 7, 2023. ISSN 23135778. doi: 10.3390/genealogy7030048.

Joseph G. Altonji, Todd E. Elder, and Christopher R. Taber. Selection on observed and unobserved variables: Assessing the effectiveness of catholic schools. *Journal of Political Economy*, 113, 2005. ISSN 00223808. doi: 10.1086/426036.

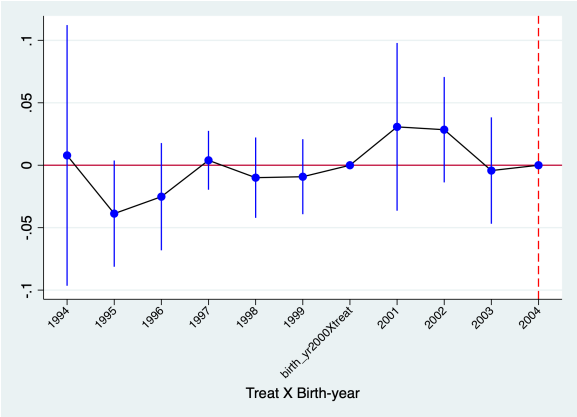
Emily Oster. Unobservable selection and coefficient stability: Theory and evidence. *Journal of Business and Economic Statistics*, 37, 2019. ISSN 15372707. doi: 10.1080/07350015.2016.1227711.

Lixing Li and Xiaoyu Wu. Gender of children, bargaining power, and intrahousehold resource allocation in china. *Journal of Human Resources*, 46, 2011. ISSN 0022166X. doi: 10.3368/jhr.46.2.295.

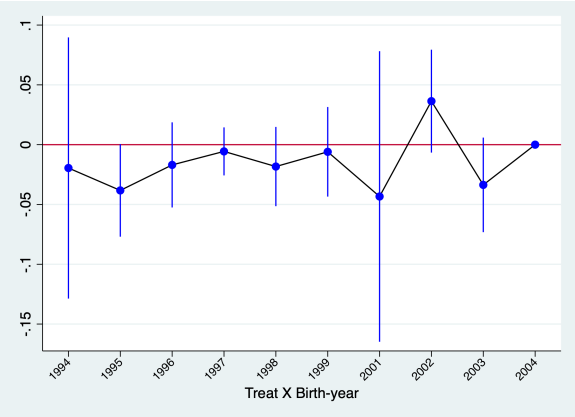
Salauddin Tauseef and Farha Deba Sufian. The causal effect of early marriage on women's bargaining power: Evidence from bangladesh. *World Bank Economic Review*, 38, 2024. ISSN 1564698X. doi: 10.1093/wber/lhad046.

Appendix

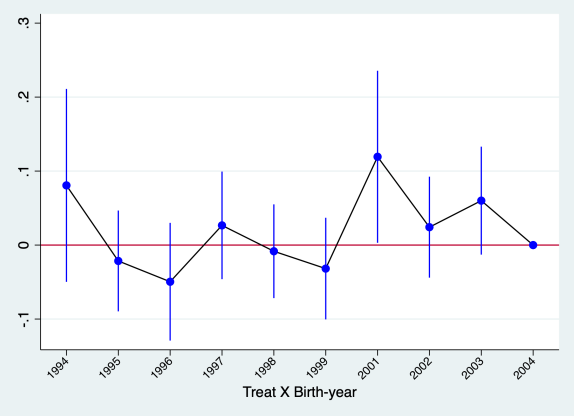
Figure A.1: Event-study for pre-treatment trends



Panel A: PTA - All women



Panel B: PTA - Younger women



Panel C: PTA - Older women

Table A.1: Summary Statistics for Regression Discontinuity Sample from DLHS-4

Variable	N	Mean	SD
Total live births	21315	1.74	.897
Mother's age in completed years	21614	24.3	2.82
Years of Education	21307	6.47	4.6
Has fridge	21614	.176	.38
Own house	21614	.939	.238
ASHA encouraged facility delivery	21614	.225	.417
Any ASHA engagement	21614	.354	.478

The sample is from DLHS-4 (2012–13) and includes JSY-eligible women aged 19–40 residing in high-performing states (HPS), with no more than two previous live births. The sample includes births conceived before and after the 2009 reform, and is used in the health worker channel analysis (H3)