# Financial incentives in health to improve childhood vaccination: Evidence from India

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**Abstract**

This paper examines the impact of the Janani Suraksha Yojana (JSY), a large scale conditional cash transfer program in India, on childhood immunization. Using variation in eligibility across low performing and high performing states and differences in the expansion of community health workers, the analysis studies vaccination outcomes along three dimensions: coverage, age at vaccination, and adherence to recommended schedules. The results show that JSY increased vaccination coverage and reduced the age at vaccination, indicating earlier uptake among eligible households, but had limited effects on adherence to vaccination schedules. Within high performing states, where eligible mothers already received financial incentives, the expansion of community health workers has modest and inconsistent effects. These findings suggest that while financial incentives improve access and early uptake, they are less effective in ensuring timely completion of immunization, highlighting the importance of policies that strengthen continuity of care.

**Keywords:** Childhood immunization; conditional cash transfers; JSY; ASHA; vaccination timing; India
**JEL Codes:** I10, I38, I150

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# 1 Introduction

Childhood immunization is one of the most cost effective public health interventions for reducing infant mortality and preventing communicable diseases. Despite substantial global progress, vaccination coverage in many low and middle income countries has historically remained below recommended levels. In the early 2000s, India lagged behind comparable countries in both vaccination coverage and disease burden, with less than half of children below the age of two fully immunized. These gaps reflect persistent barriers to health care access, including limited infrastructure, shortages of health care workers, and low awareness about preventive care.

To address these challenges, the Government of India launched the Janani Suraksha Yojana (JSY) in 2005, a large scale conditional cash transfer program aimed at improving maternal health outcomes. The program provides financial incentives to encourage institutional deliveries and is complemented by the involvement of community health workers, known as Accredited Social Health Activists (ASHAs), who facilitate access to health services. While JSY was designed to promote safe childbirth, it may also influence postnatal health behaviors through increased interaction with the health system.

A large empirical literature shows that JSY increased maternal health care utilization, particularly institutional delivery and antenatal care use (Lim et al., 2010; Powell-Jackson et al., 2015). However, much less is known about whether these improvements translated into sustained investments in child health, such as vaccination. Since childhood immunization requires continued engagement with the health system beyond delivery, it provides a useful setting to evaluate whether maternal health interventions generate downstream benefits.

This paper examines the impact of JSY on childhood immunization along three dimensions: vaccination coverage, age at vaccination, and adherence to recommended vaccination schedules. Exploiting variation in eligibility across low performing and high performing states, and differences in the expansion of ASHAs, the analysis isolates both the role of financial incentives and the contribution of community health workers.

The results show that JSY significantly increased vaccination coverage and reduced the age at vaccination, indicating earlier uptake of vaccines among eligible households. However, the program had limited effects on adherence to recommended vaccination schedules. Within high performing states, where eligible mothers already received cash incentives, the additional presence of ASHAs has modest and inconsistent effects. These findings suggest that while JSY improved access and initial uptake, ensuring timely completion of vaccinations remains a challenge.

By jointly examining coverage, timing, and adherence, this paper contributes to a broader understanding of how conditional cash transfer programs and community health workers influence child health investments. The results highlight the importance of complementary interventions that improve not only access but also continuity of care.

# 2 Policy Background

## 2.1 The Janani Suraksha Yojana (JSY)

The poor maternal and neonatal health outcomes are attributed to high indirect costs, the practice of informal payments, socio-cultural norms, gender inequality and broadly prevalent economic inequality. The low number of institutional deliveries among rural disadvantaged women has been one of the main causes of maternal and neonatal deaths. To counter this and encourage women to opt for child birth at a health facility, the government of India introduced a conditional cash transfer scheme under the National Rural Health Mission in April, 2005. It intended to increase the demand for maternal and neonatal healthcare by giving cash assistance to mothers for institutional delivery, and also, aimed to improve the healthcare service delivery to the poor by engaging Accredited Social Health Activists (ASHAs) to serve as village-based health workers.

The JSY scheme mainly focused on the low performing states when introduced in 2005, but it soon underwent revisions in the guidelines in October 2006. Initially, the cash incentives to mothers varied between low performing states (LPS) and high

performing states (HPS). In both LPS and HPS, pregnant women above the age of 19, belonging to below-poverty-line families, giving birth in public health care facilities were eligible for the cash assistance for up to two live births. But there was a difference in both the cash amount as well as the area of residence between LPS and HPS. The cash benefit of Rs. 1400 ($92 in PPP) was given to the eligible mothers residing in rural areas in LPS while Rs. 1000 ($66 in PPP) was given to mothers in urban areas in LPS. Eligible mothers only in the rural areas of HPS received a cash benefit of Rs. 700 ($46 in PPP). The guidelines changed in October 2006 where the cash benefits were expanded to every mother of all age, for any number of children, belonging to below and above poverty line families, both in rural and urban areas in the LPS without a change in the cash amount given. On the other hand in the HPS, the guideline was revised to include only urban mothers but other eligibility criteria remained the same. The urban pregnant women in the HPS received a cash benefit of Rs. 600 ($40 in PPP).

## 2.2 Accredited Social Health Activists (ASHAs)

The community health workers called the ASHAs were an integral part of the JSY scheme. The ASHAs were only employed in the LPS, initially, but later in 2009, the ASHAs spread across the HPS too.

An ASHA was a female resident of a village, within the age group of 25-45 years, and with a primary level of education. The norm was to have one ASHA per 1000 population. ASHAs were selected by a committee composed of self-help groups, the village health committee and the village council at the district level. The selected ASHAs were trained in basic health care practices. The ASHAs primary duties regarding maternal and child health were to identify a pregnant woman in the community, register her with the program and counsel her throughout pregnancy. Besides, she was to facilitate prenatal care, to escort her to the health centre for delivery or other pregnancy-related complications that needed medical help, and finally, to ensure postnatal care for the mother as well as the newborn. An Auxiliary Nurse Midwife stationed at health sub-centres and primary health centres was to

supervise an ASHA.

The ASHAs received an incentive package to facilitate ante-natal care, institutional delivery, and post-natal care. The ASHAs did not get any cash benefits in the HPS until 2009, but received an amount of Rs. 600 ($40 in PPP) in the rural areas of LPS, while they received Rs. 200 ($13 in PPP) in the urban areas of LPS only if the delivery took place at a Government health facility. The mother was still eligible for the cash benefit if delivery took place at an accredited private hospital. The ASHA package was introduced in 2009 in HPS when they received Rs. 200 ($13 in PPP) in both rural and urban areas.

# 3 Related Literature

Over the course of years the JSY scheme has been studied by a vast majority of policy makers and empirical researchers. A large empirical literature evaluates the impact of the Janani Suraksha Yojana (JSY) on maternal health care utilization, with particularly strong evidence on short-term outcomes such as institutional delivery, antenatal care visits, and early breastfeeding practices, especially among disadvantaged populations.

Early studies primarily examined whether JSY increased the utilization of maternal health services and reduced mortality. Lim et al. (2010) carried out an impact evaluation of the JSY scheme where they found the policy had a significant effect on increasing antenatal care and institutional delivery especially among women of low socio-economic status. They also looked at maternal mortality and neonatal deaths in which they found that the scheme was successful in reducing perinatal deaths by 3.7 per 1000 pregnancies and 2.3 neonatal deaths per 1000 live births. Another study by Jackson, Mills et. al (2015) exploited the heterogeneity in the implementation of the JSY program across districts, where they found that the cash incentives were associated with increased uptake of maternity services but contrary to the previous findings by Lim et al., this paper finds no strong evidence of the program on neonatal deaths. They also focused on unintended consequences of the scheme like increases in the utilization of services from public health care facilities acting as a substitution

away from the private sector, modest increase in the number of times a woman got pregnant in a given year, and increase in breastfeeding practice soon after childbirth. The literature also shows work where the effects of the policy on maternal health care is very modest. The paper by Joshi and Sivaram (2014) shows that relative to the broader population, the targeted population experienced a 3 percentage point increase in institutional births, but no increase in antenatal or post natal care. However, they find the gains from the policy are significant among rural women and women with no formal education. Among the more recent studies, Debnath (2020) provides empirical evidence that eligibility for JSY significantly increased the use of health care facility for child birth, receiving tetanus injections, and having prenatal care visits. They exploited the difference in the cash incentives given to mothers and community health care workers and found that larger incentives to health care workers increased the probability of institutional delivery by 4.7 percentage points whereas larger incentives to mothers yielded an increase of 2.9 percentage points. Their heterogeneity result is in contrast to the existing literature where they found that the effects of the policy were most pronounced among relatively richer households. The most recent study conducted by Baulia (2023) used variation in mothers' eligibility and differences in the implementation of community health care workers across states on birth related outcomes. Their results show that eligible mothers with both cash transfers and the guidance of a community health care worker outperformed those receiving only cash transfer, in facility birth rate and breast feeding after child birth.

While these findings establish that JSY succeeded in shifting delivery behavior in the short run, much less is known about whether these gains translated into sustained improvements in child health and human capital outcomes. This gap is particularly important given that JSY did not explicitly target postnatal investments, raising the possibility of both dynamic complementarities and unintended spillovers. The study by Carvalho et al. (2014) assess the effect of the receipt of JSY benefits on childhood immunizations, post partum care, and breast feeding practices. They find that the receipt of JSY led to an increase in the overall immunization ranging from 3.1 percentage points for one dose of polio vaccine to 9.1 percentage points of fully

vaccinated children. Since childhood immunization was not the target of JSY, the program could have spillover effects as community health care workers are given incentives to spread awareness about child vaccination. Building on this literature, the present study examines the program's impact on the uptake of childhood vaccinations by exploiting the eligibility criteria of the scheme between low performing and high performing states, and role of community health care workers in improving timeliness of vaccinations, contributing to a growing body of work on the longer-run consequences of conditional cash transfer programs and presence of community health care workers. This paper contributes to the literature in several important ways. First, while existing studies primarily focus on maternal health outcomes or overall vaccination coverage, this paper provides a more comprehensive analysis by examining childhood immunization along three dimensions: coverage, age at vaccination, and adherence to recommended vaccination schedules. This distinction is important because improvements in coverage do not necessarily imply timely or complete immunization, which are critical for realizing the full health benefits of vaccines.

Second, the paper sheds light on the mechanisms through which JSY affects child health outcomes. By exploiting variation in eligibility across low performing and high performing states, the analysis separates the role of financial incentives from the complementary role of community health workers. In particular, the paper evaluates whether the expansion of ASHAs in high performing states generated additional improvements in vaccination outcomes beyond those driven by cash transfers alone.

Third, the paper provides new evidence on the extent to which maternal health interventions generate spillover effects on postnatal investments. Since childhood immunization was not directly incentivized under JSY, any observed improvements in vaccination behavior reflect indirect channels such as increased interaction with the health system, improved awareness, or behavioral changes among mothers.

Finally, by jointly analyzing coverage, timing, and adherence, the paper highlights important limitations of conditional cash transfer programs. While the results show substantial improvements in vaccine uptake and earlier vaccination, the weaker effects on adherence to recommended schedules suggest that improving access to care is not

sufficient to ensure sustained engagement with the health system. These findings have important policy implications for the design of integrated maternal and child health programs in low resource settings.

# 4 Data

The District Level Household Survey (DLHS) is the richest source of information on maternal and child health in India conducted by the Institute for International Population Studies, IIPS (Mumbai, India). This paper uses three rounds of the repeated cross-sectional survey (DLHS 2, 3, and 4) which provide information on births, antenatal care, postnatal care, and vaccination before and after the implementation of the policy. The DLHS 2 covers around 507,622 married women sampled between the period 2002-2004 and DLHS 3 interviewed 643,944 married and unmarried women between 2007-2008. Both of these rounds include all the Low Performing States (LPS) as well as the High Performing States (HPS). The window between 2001-2008 is used to do the analysis to compare outcome differences between LPS and HPS. The DLHS 4 sampled around 100,000 women between 2012-2014 but only in the high performing states. DLHS 4 is combined with the other two rounds to do a separate analysis of differences in the outcome variables only within HPS.

The study sample is ever married women in the age group of 15-45 who have given birth. In the sample live births, still births, spontaneous abortions, and induced abortions are included. Information on any kind of birth or abortion is related to the last pregnancy of the women. Vaccination related information is given for the last child as well as for last to last child. Childhood immunization outcomes include receiving the following vaccines: polio at birth (or "polio zero"), one dose of BCG given at birth, one dose of DPT given at six weeks, and one dose of measles given between 9-12 months of age. Vaccination status of child is determined from immunization cards and reporting by the mothers. The treatment group consists of 10 low performing states (LPS),and the control group has 11 high performing states (HPS). The LPS were selected by the government of India on the basis of high population growth, poorer socioeconomic, demographic, and health indicators

compared to the rest of the country.

The main focus of the paper is on childhood vaccination. This paper tries to see the impact of the cash transfer scheme combined with the presence of ASHAs on the change in uptake of the above mentioned vaccines which are either administered at birth or within the first year of the child's birth. Vaccination outcome comparison between LPS and HPS is based on the eligibility criteria of the JSY scheme. The paper also looks at HPS separately to disentangle the effect of ASHAs from the cash transfer as ASHAs were not present in HPS before 2009. Apart from receipt of vaccines, the paper looks at the timing of the vaccinations. Since these vaccines are critical for child health it is essential to be administered at the appropriate age recommended by health professionals. The timing of vaccines administered can also indicate if ASHAs are effective at spreading awareness.

In the analysis, information on the mothers characteristics which are, her age at child birth, her maximum schooling years, her husband's age, if she was a Hindu or Muslim by religion, if belong to one of the socially disadvantaged castes (Scheduled Caste, Scheduled Tribe or Other Backward Classes), her residential status-rural/urban, and her household wealth status are used as different control variables. All of this information is directly available from the women's questionnaire modules.

# 5 Descriptive Statistics

Table 1 presents summary statistics for vaccination outcomes and maternal characteristics in the pre- and post-policy periods, separately for the treatment and control groups. The table reports vaccination coverage rates for each outcome, along with key maternal and household characteristics.

Maternal characteristics include years of schooling and age at the time of birth. Demographic characteristics include indicators for religion (Hindu and Muslim), caste status (Scheduled Caste/Scheduled Tribe), and household economic status as proxied by Below Poverty Line (BPL) status. These variables provide context for differences in baseline socioeconomic conditions across groups and help assess the comparability of treatment and control samples prior to policy implementation.

The summary statistics highlight substantial baseline differences between treatment and control states. Prior to the introduction of JSY, vaccination coverage was consistently lower in treatment states. For example, BCG coverage in the pre-policy period was 77.9 percent in treatment states compared to 90.8 percent in control states. Similar gaps are observed for Polio 0, DPT1, and Measles vaccinations. These differences reflect the relatively weaker maternal and child health infrastructure in treatment states, which were specifically targeted by the JSY program

Table 1: Summary Statistics by State Group

| | Pre-JSY | | Post-JSY | |
|---|---|---|---|---|
| | Treatment | Control | Treatment | Control |
| **Panel A: Vaccination Outcomes** | | | | |
| BCG (%) | 77.90 | 90.81 | 83.73 | 91.10 |
| Polio 0 (%) | 55.75 | 73.80 | 69.51 | 78.37 |
| DPT 1 (%) | 72.07 | 88.34 | 78.10 | 88.07 |
| Measles (%) | 66.15 | 86.43 | 72.20 | 84.79 |
| **Panel B: Demographics** | | | | |
| Mother's age | 27.46 | 26.49 | 26.09 | 25.89 |
| Education (yrs) | 3.34 | 6.60 | 3.78 | 7.08 |
| Hindu (%) | 81.04 | 61.09 | 79.89 | 60.94 |
| Muslim (%) | 14.62 | 12.74 | 15.28 | 12.79 |
| SC/ST (%) | 38.47 | 31.25 | 39.42 | 31.55 |
| BPL (%) | 38.21 | 16.72 | 37.32 | 15.77 |
| Observations | 55,847 | 22,285 | 164,917 | 65,773 |

Notes: Treatment states correspond to low-performing states (LPS) targeted by the Janani Suraksha Yojana (JSY) program. Pre-JSY births occurred before April 2005 and Post-JSY births occurred after the introduction of the program.

This section also shows the raw means of all the outcome variables considered in the paper to give an idea of how the raw trends looked between the treatment and the control groups in the pre and post policy period.

To further illustrate the evolution of vaccination outcomes over time, Figure 1 plots the average vaccination rates for treatment and control states across the sample

period. The figure shows that vaccination coverage was consistently lower in treatment states prior to the introduction of JSY. Following the policy implementation in April 2005, vaccination rates in treatment states begin to increase, narrowing the gap relative to control states.

Figure 2 plots the raw trends in the age at vaccination across all vaccines. The figure shows a general decline in the age at which children receive vaccinations following the implementation of the policy. While both the treatment and control groups exhibit earlier vaccination over time, the decline is more pronounced among children in the treatment group in the post policy period. As a result, the gap in vaccination timing between the two groups narrows across all vaccines.

Figure 3 presents the raw trends in timely vaccination across vaccine types. Timely vaccination is defined relative to recommended schedules, with BCG and Polio 0 administered at birth, DPT1 at six weeks, and measles between nine and twelve months. The figure shows an upward trend in timely vaccination rates for both treatment and control groups over time. However, there is no clear evidence of a differential increase in timely vaccination among treatment states relative to control states following the implementation of the policy. The gap between the two groups remains broadly similar over time across most vaccines.

# 6 Empirical Strategy

This paper uses a two way fixed effect difference-in-difference framework to evaluate the impact of the policy on childhood vaccinations along three dimensions: vaccination coverage (extensive margin), age at vaccination (intensive margin), and adherence to recommended vaccination schedules (timeliness). Together, these outcomes allow for a comprehensive assessment of both access to and quality of preventive healthcare.

## 6.1 Strategy 1: Coverage of vaccination

The first empirical strategy evaluates the average effect of the policy on the coverage of the following four vaccines administered either at birth or shortly after birth: BCG at birth, Polio at birth (Polio zero), DPT at six weeks, and measles within one year of age. The paper uses the variation in the eligibility criteria to see the differential impact of the policy between different treatment and control groups. At the time of the reform, states were divided between low performing and high performing states and within those states some women became eligible for the scheme. According to the guideline every pregnant woman in the low performing states (LPS) were eligible for the cash transfer as well as the guidance of ASHAs. On the other hand, pregnant women between the age of 19-45, who were below the poverty line or belonged to the SC/ST caste category were eligible for only the cash transfer. The ASHAs were eventually introduced in the HPS in 2009. Considering this variation, the treatment group is all the women who were eligible in both LPS and HPS while the control group is the ineligible women in the HPS.

The mandatory identifying assumption for a traditional DiD approach is to test whether the outcome variables follow a parallel trend between the treatment and control group in the absence of the intervention. The formal event study specification to test the parallel trends is given as follows:

$$Y_{isd\tau} = \alpha + \text{Elig}_{is} + \sum_{\tau \neq 0} \beta_\tau \left(\text{Elig}_{is} \times \mathbf{1}\{RelMonth_i = \tau\}\right) + \gamma X_{is} + \mu_m + \delta_s + \varepsilon_{is\tau} \quad (1)$$

where $Y_{isd\tau}$ is an indicator equal to one if child $i$ residing in state–district $sd$ received the vaccine and was born $\tau$ months relative to March 2005. Event time is defined relative to March 2005 ($\tau = 0$), the month immediately preceding program implementation. The indicator $\mathbf{1}RelMonth_i = \tau$ equals one if child $i$ was born $\tau$ months from this reference month. The omitted category is $\tau = 0$, so each coefficient $\beta_\tau$ measures the difference in vaccination rates between eligible and non-eligible children born $\tau$ months from implementation, relative to the pre-policy baseline month.

$\text{Elig}_{is}$ is an indicator for program eligibility. The vector $X_{is}$ includes maternal education, maternal age, household wealth quintile, caste, and religion. The specification includes relative-month fixed effects ($\mu_\tau$) and state–district fixed effects ($\delta_{sd}$). Standard errors are clustered at the state–district level.

Considering the variation in the eligibility criteria and to estimate the average effect of the policy on the treatment group, the formal two way fixed effects difference-in-difference is given as:

$$Y_{isdm} = \alpha + \alpha_1 Treat_i + \beta(Treat_i \times Post_m) + \gamma X_{is} + \delta_{sd} + \mu_m + \varepsilon_{isdm} \qquad (2)$$

The outcome variable $Y_{isdm}$ is an indicator equal to one if child $i$, residing in state–district $sd$ and born in month $m$, received the relevant vaccination. The treatment indicator $\text{Treat}_i$ equals one for children whose mothers were eligible for JSY namely, all pregnant women in low-performing states (LPS) and eligible mothers in high-performing states (HPS). The comparison group consists of ineligible mothers in HPS. The post indicator $\text{Post}_m$ equals one for births occurring in April 2005 or later.

## 6.2 Strategy 2: Age at vaccination

In addition to examining vaccination coverage, the paper studies the intensive margin of the policy by analyzing the timing of vaccination. While increases in the receipt of childhood vaccines are important, the age at which vaccines are administered is equally critical for effective immunization. Community health workers, who are central to the implementation of the scheme, are expected to play a key role in ensuring that children receive vaccinations at the recommended ages.

To assess the effect of the policy on vaccination timing, age at vaccination (in months) is examined. The analysis is conducted conditional on children having received the vaccine, thereby isolating changes in timing from changes in overall coverage.

The identifying assumption mirrors that of the baseline difference-in-differences specification: in the absence of the policy, trends in the age at vaccination would

have evolved similarly for eligible and comparison children. The empirical strategy therefore replaces the coverage indicator with age at vaccination in months as the outcome variable.

$$Age_{is\tau} = \alpha + \text{Elig}_{is} + \sum_{\tau \neq 0} \beta_\tau \left(\text{Elig}_{is} \times \mathbf{1}\{RelMonth_i = \tau\}\right) + \gamma X_{is} + \mu_\tau + \delta_{sd} + \varepsilon_{is\tau}. \quad (3)$$

The outcome variable $Age_{is\tau}$ denotes the age (in months) at which child $i$ received the vaccine, conditional on having been vaccinated. Event time is defined relative to March 2005 ($\tau = 0$), the month immediately preceding policy implementation. The omitted category is $\tau = 0$, so each coefficient $\beta_\tau$ measures the difference in vaccination timing between eligible and comparison children born $\tau$ months from implementation, relative to the baseline month. A negative post-policy coefficient indicates that eligible children received vaccinations at younger ages relative to the comparison group.

To examine the intensive margin, an analogous specification is estimated in which the outcome variable is the age at vaccination (in months), conditional on the child having received the vaccine:

$$Age_{ism} = \alpha + \alpha_1 Treat_i + \beta \left(\text{Treat}_i \times \text{Post}_m\right) + \gamma X_{is} + \delta_{sd} + \mu_m + \varepsilon_{ism} \quad (4)$$

This specification mirrors equation (2), with the sample restricted to vaccinated children. The coefficient $\beta$ captures the differential change in the timing of vaccination among eligible children following program implementation.

## 6.3 Strategy 3: Adherence to vaccine schedule

Although changes in age at vaccination capture shifts in average timing, such effects may partly reflect catch-up vaccination among older, previously unvaccinated children. From a health production perspective, however, the effectiveness of im-

munization depends not only on whether a child is vaccinated, but also on whether vaccines are administered at the recommended ages. Delayed vaccination can leave children vulnerable during critical periods of exposure, reducing the protective benefits of the immunization schedule.

To assess whether the policy improved adherence to recommended schedules, the analysis examines vaccination timeliness. Timeliness is defined conditional on vaccination and measures whether a child received the vaccine within the age window prescribed by national immunization guidelines. Specifically:

- **BCG**: vaccinated at birth,
- **Polio 0**: vaccinated at birth,
- **DPT 1**: vaccinated at 6 weeks,
- **Measles**: vaccinated between 9 and 12 months of age.

For each vaccine, an indicator variable is constructed equal to one if the child was vaccinated within the recommended age window. The same two-way fixed effects difference-in-differences specification as in equation (2) is then applied, replacing the outcome variable with the timeliness indicator. The coefficient on the interaction term captures the differential change in the probability of receiving vaccinations on schedule among eligible children following policy implementation.

# 7 Results

## 7.1 Receipt of vaccine by vaccine type

To examine the dynamics of the policy effect and assess the validity of the identifying assumption, this section first presents event-study estimates for the three sets of outcomes considered in the paper: vaccination coverage, age at vaccination, and adherence to the recommended vaccination schedule. The event study specification shows the dynamic effects on these outcomes in treatment states relative to control

states around the introduction of the JSY program in April 2005. Each coefficient represents the difference between treatment and control states in a given period relative to the omitted base period immediately before the policy.

Across outcomes, the coefficients in the pre-policy periods remain close to zero and statistically indistinguishable from zero. This suggests that treatment and control states exhibited broadly similar trends prior to the introduction of JSY. The vertical line in the figures marks the introduction of the JSY program in April 2005.The absence of systematic differences before the policy provides support for the parallel trends assumption underlying the difference-in-differences framework.

For vaccination coverage in figure 4, the event-study estimates show that the coefficients become positive following the policy implementation. The magnitude of the estimates increases gradually over time, indicating improvements in vaccination coverage in treatment states relative to control states after the introduction of the program. From the event estimates we can see that the increase is most prominent in receipt of BCG and Polio 0 since these are the vaccines that are administered at birth which implies, closer connection to the health system leads to increases in receipt of at birth vaccines.

Table 2 presents the difference-in-differences estimates of the effect of the JSY scheme on vaccination coverage. The results indicate a statistically significant increase in the receipt of all vaccines among eligible mothers relative to ineligible mothers following the implementation of the policy. In particular, coverage of birth dose vaccines such as BCG and Polio 0 increased by 2.84 and 5.99 percentage points, respectively. For vaccines that require subsequent contact with the healthcare system, such as DPT1 and measles, coverage increased by 3.04 and 3.93 percentage points, respectively.

These findings suggest that the JSY scheme was effective in improving vaccination uptake, both at birth and through follow up visits, likely reflecting the combined role of financial incentives and support from community health workers (ASHAs).

## 7.2 Age at vaccinaton by vaccine type

Figure 5 presents the event study estimates of the effect of JSY on the age at vaccination across different vaccines. The coefficients before the policy are small and statistically indistinguishable from zero, which supports the parallel trends assumption. After the implementation of the policy, the coefficients become negative for all vaccines, indicating that children in treatment states begin receiving vaccinations at earlier ages relative to those in control states.

Table 3 reports the corresponding difference in differences estimates. The results show a statistically significant reduction in the age at vaccination across all vaccines. For birth dose vaccines such as BCG and Polio 0, the average age of vaccination in the treatment group before the policy was approximately 3.6 and 2.9 months, respectively. Following the implementation of JSY, the age at vaccination declines by 1.42 months for BCG and 0.97 months for Polio 0, which correspond to reductions of approximately 38.8 percent and 31 percent.

For vaccines that require follow up interactions with the health care system, such as DPT1 and measles, the age at vaccination declines by 1.45 and 0.91 months, respectively. These correspond to reductions of roughly 32 percent for DPT1 and 7.3 percent for measles.

## 7.3 Scheduled vaccination uptake

Figure 6 presents the event study estimates of the effect of the policy on timely vaccination across different vaccines. In contrast to the results for vaccination coverage and age at vaccination, the estimates remain centered around zero in the post policy period across all vaccines, indicating no clear evidence of a differential improvement in timely vaccination among treatment states relative to control states.

This pattern is consistent with the raw trends, which show that timely vaccination rates increase over time for both treatment and control groups. However, the similarity in these trends suggests that the improvements are not driven by the policy. Taken together, the results indicate that while JSY was effective in increasing vaccination coverage and reducing delays in vaccination, it did not lead to meaningful

changes in adherence to recommended vaccination schedules.

# 8 Within HPS analysis

This section restricts the analysis to high performing states (HPS) to disentangle the effects of ASHAs from the cash transfer component of the JSY scheme on vaccination outcomes. At the time of the scheme's rollout, ASHAs were deployed primarily in low-performing states (LPS), where maternal and child health indicators were relatively poor. Consequently, in LPS, both the cash transfer and the presence of ASHAs were introduced simultaneously, making it difficult to separately identify their individual contributions.

From a policy perspective, isolating these effects is important. It informs whether improvements in vaccination outcomes are driven primarily by financial incentives to mothers or by the presence of community health workers. This distinction has direct implications for resource allocation decisions, including the optimal balance between incentive payments and investments in frontline health workers. Additionally, since ASHAs represent a large-scale rural employment program, understanding their independent impact is also relevant from a labor supply perspective.

The staggered introduction of ASHAs in HPS in 2009 provides a useful source of variation to address this issue. Prior to 2009, eligible mothers in HPS had access to the JSY cash transfer but were not supported by ASHAs. The expansion of ASHAs into HPS therefore creates a second policy shock, allowing for the identification of the incremental effect of ASHAs, conditional on the presence of the cash transfer. Accordingly, 2009 is treated as an additional event year in the empirical analysis.

The within-HPS analysis uses data from DLHS-4, which covers only high-performing states. The sample includes both the last and second-to-last child born between January 2008 and December 2012, providing variation around the introduction of ASHAs in HPS in 2009.

For the empirical strategy, the treatment group consists of eligible mothers in HPS—those aged 19–45 who belong to below poverty line (BPL) households or disadvantaged caste groups such as Scheduled Castes (SC) or Scheduled Tribes (ST).

The control group comprises ineligible mothers in the same age range who belong to above poverty line households and non-SC/ST groups. The outcome variables are identical to those used in the previous analysis comparing LPS and HPS. The event study specification in this analysis is given as follows:

$$Y_{isd\tau} = \alpha + \text{EligHPS}_{is} + \sum_{\tau \neq 0} \beta_\tau \left(\text{EligHPS}_{is} \times \mathbf{1}\{RelMonth_i = \tau\}\right) + \gamma X_{is} + \mu_m + \delta_s + \varepsilon_{is\tau} \tag{5}$$

where $Y_{isd\tau}$ is an indicator equal to one if child $i$ residing in state–district $sd$ received the vaccine and was born $\tau$ months relative to December 2008. Event time is defined relative to December 2008 ($\tau = 0$), the month immediately preceding the introduction of ASHAs. The indicator $\mathbf{1}RelMonth_i = \tau$ equals one if child $i$ was born $\tau$ months from this reference month. The omitted category is $\tau = 0$, so each coefficient $\beta_\tau$ measures the difference in vaccination rates between eligible and non-eligible children born $\tau$ months from implementation, relative to the pre-policy baseline month.

$\text{EligHPS}_{is}$ is an indicator for program eligibility. The vector $X_{is}$ includes maternal education, maternal age, household wealth quintile, caste, and religion. The specification includes relative-month fixed effects ($\mu_\tau$) and state–district fixed effects ($\delta_{sd}$). Standard errors are clustered at the state–district level.

Similarly the two way fixed effects difference-in-difference framework is given as follows:

$$Y_{isd\tau} = \alpha + \alpha_1 TreatHPS_i + \beta(TreatHPS_i \times Post_\tau) + \gamma X_{is} + \delta_{sd} + \mu_\tau + \varepsilon_{isd\tau} \tag{6}$$

The outcome variable $Y_{isd\tau}$ is an indicator equal to one if child $i$, residing in state–district $sd$ and born in month $\tau$, received the relevant vaccination. For age-at-vaccination outcomes, $Y_{isd\tau}$ is measured in months. The treatment indicator $\text{TreatHPS}_i$ equals one for children whose mothers were eligible for JSY in only HPS. The comparison group consists of ineligible mothers in HPS. The post indicator $\text{Post}_\tau$

equals one for births occurring in January 2009 or later. Identification relies on the assumption that, in the absence of the ASHA expansion in 2009, vaccination outcomes for eligible and ineligible mothers in HPS would have evolved similarly over time. Since both groups were already exposed to the JSY cash transfer prior to 2009, the estimates capture the incremental effect of ASHAs on eligible mothers relative to ineligible mothers.

# 9 Descriptive Statistics

Figure 7 shows that vaccination uptake for both the treatment and control groups within HPS follows broadly similar trends in the pre-intervention period. Following the introduction of ASHAs, there is no clear evidence of a differential increase in vaccine uptake among the treatment group relative to the control group. Overall, the raw trends suggest limited divergence between eligible and ineligible mothers after the policy change.

One possible explanation for the muted patterns is the presence of ceiling effects. Vaccination coverage in HPS was already relatively high prior to the expansion of ASHAs, leaving limited scope for further improvements. As a result, even if ASHAs had a positive impact, the magnitude of observable changes in aggregate uptake may be small.

Figure 8 plots the raw trends in age at vaccination by vaccine type for treatment and control groups within HPS. Across all vaccines, the two groups exhibit broadly similar pre-policy trends, with no clear evidence of differential movement prior to the introduction of ASHAs in 2009. This supports the identifying assumption of parallel trends. Following the introduction of ASHAs in 2009, there is no consistent evidence of a differential decline in the age at vaccination among eligible children relative to ineligible children across vaccine types. For BCG and DPT1, both treatment and control groups exhibit gradual declines in the age at vaccination over time, with largely similar trajectories. A similar pattern is observed for Polio 0, where the trends remain relatively flat and closely aligned across groups throughout the post-policy period. For measles vaccination, while there is a slight upward trend in the

age at vaccination, this pattern is common to both groups and does not indicate a differential effect of ASHAs.

Figure 9 plots the raw trends in timely vaccination across different vaccines within high performing states. The figure shows a general upward trend in timely vaccination rates for both the treatment and control groups over time. Although there is some variability in the pre policy period, the two groups move broadly in parallel prior to the introduction of ASHAs. Following the policy, timely vaccination continues to improve for both groups, but there is no clear and sustained divergence between eligible and ineligible mothers. The gap between the two groups remains relatively stable across the period, suggesting that the observed improvements are likely driven by common time trends rather than the expansion of ASHAs. These patterns are consistent with the event study estimates, which show limited and imprecise effects of the policy on timely vaccination outcomes.

# 10 Results

## 10.1 Receipt of vaccine within HPS

Panel A of Figure 10 shows the event study estimates for BCG vaccination coverage. The pre policy coefficients are close to zero and show no systematic trend, supporting the identifying assumption. Following the introduction of ASHAs in 2009, we do not observe consistent evidence of differential changes in vaccination outcomes between eligible and ineligible mothers. In the post policy period, the estimates fluctuate around zero and are not statistically significant, indicating no meaningful change in BCG uptake. Although the estimates are somewhat noisy in the pre policy period, particularly for DPT1, Polio 0, and measles, there is no clear evidence of systematic divergence between treatment and control groups prior to the policy. There is no evidence of a sustained increase in vaccination coverage among eligible mothers relative to ineligible mothers after 2009. Table 5 presents the difference in differences estimates, which are consistent with the event study results. The estimates indicate no meaningful change in vaccination uptake among eligible mothers relative

to ineligible mothers following the introduction of ASHAs in high performing states. These results are consistent with the presence of ceiling effects in HPS, where baseline vaccination coverage was already high, limiting the scope for further improvements.

## 10.2 Age at vaccination within HPS

Figure 11 presents the event-study estimates for age at vaccination. For BCG and DPT1, the pre-policy coefficients are generally stable and centered around zero, with no evidence of differential pre-trends. Following the introduction of ASHAs, the estimated effects remain close to zero and are not statistically significant, suggesting no meaningful improvements in the timing of vaccination. For Polio 0 and measles vaccines, a similar pattern emerges. The coefficients fluctuate around zero both before and after the policy change, with no clear or consistent post-policy decline in the age at vaccination among eligible children relative to the control group. Table 6 presents the difference in differences estimates of the effect of ASHAs on the age at vaccination within high performing states. The estimates show no statistically significant change in the age at vaccination across any of the vaccines considered. The coefficients are small in magnitude and not statistically different from zero for BCG and DPT1, while for Polio 0 and measles the estimates are negative but not significant. In terms of magnitude, the estimated changes are economically small relative to the baseline levels. For example, the pre policy mean age of vaccination in the treatment group is approximately 1.3 months for BCG and 2.7 months for DPT1, and the estimated effects are close to zero. Similarly, for Polio 0 and measles, the estimated reductions of 0.16 and 0.27 months are modest relative to pre policy means of 1.2 and 11.4 months, respectively.

## 10.3 Scheduled vaccination uptake

Figure 12 presents the event study estimates of the effect of the introduction of ASHAs on timely vaccination within high performing states. The coefficients remain close to zero throughout the pre and post periods for most vaccines, with wide confidence intervals, suggesting no clear and consistent change in timely vaccination

behavior following the policy. While there are some small positive deviations after the introduction of ASHAs, these effects are not persistent across time or across vaccines.

Table 7 reports the corresponding difference in differences estimates. The results indicate limited and heterogeneous effects of ASHAs on timely vaccination. For birth dose vaccines, we observe a modest improvement in timely uptake. Timely BCG vaccination increases by about 1.0 percentage point, which is marginally significant, while timely Polio 0 vaccination increases by 1.67 percentage points and is statistically significant. In contrast, for vaccines that require follow up interactions with the health care system, such as DPT1 and measles, the estimates are small and statistically insignificant.

Taken together, these findings suggest that the introduction of ASHAs in high performing states had at best a modest impact on improving adherence to the recommended vaccination schedule. The improvements appear to be concentrated among vaccines administered at or near birth, while there is little evidence of sustained effects on vaccines that require continued engagement with the health system. This pattern indicates that while community health workers may facilitate initial contact with the health system, their role in ensuring timely completion of the vaccination schedule is limited in the absence of stronger incentives.

Overall the results from the within high performing states analysis suggest that the introduction of ASHAs had limited additional effects on vaccination outcomes beyond the existing cash transfer incentives. Since eligible mothers in HPS were already receiving financial incentives prior to the expansion of ASHAs, this setting isolates the incremental contribution of community health workers. Across all three dimensions of vaccination behavior, coverage, age at vaccination, and adherence to the recommended schedule, the estimated effects are generally small and not consistently statistically significant. While there is some evidence of modest improvements in specific cases, such as timely uptake of vaccines administered at birth, these effects are not uniform across vaccines and do not extend to those requiring sustained engagement with the health system.

These findings suggest that while ASHAs may play a supportive role, particularly

in facilitating initial contact with the health system, their marginal impact is limited when financial incentives are already in place. In contrast to the larger effects observed in the combined analysis of low and high performing states, the within HPS results indicate that the primary driver of improvements in vaccination outcomes is likely the cash transfer component of the program, with ASHAs contributing at the margin rather than serving as the main mechanism.

# 11 Conclusion

This paper examines the impact of the Janani Suraksha Yojana (JSY) on childhood immunization in India, focusing on three key dimensions of vaccination behavior: coverage, age at vaccination, and adherence to recommended vaccination schedules. Using variation in program eligibility across low performing and high performing states, and exploiting differences in the expansion of community health workers, the analysis provides new evidence on both the effectiveness of financial incentives and the role of health workers in shaping child health outcomes.

The results show that JSY led to substantial improvements in vaccination coverage and reduced the age at which children receive vaccines, indicating earlier uptake of immunization among eligible households. These findings suggest that the program was successful in increasing access to health services and strengthening initial engagement with the health system. However, the effects on adherence to recommended vaccination schedules are more limited. While vaccination rates increased and children were vaccinated earlier, the evidence does not point to consistent improvements in timely completion of the immunization schedule.

The within high performing states analysis further highlights the mechanisms underlying these effects. Since eligible mothers in these states were already receiving financial incentives prior to the expansion of ASHAs, this setting isolates the additional contribution of community health workers. The results indicate that the introduction of ASHAs had modest and inconsistent effects on vaccination outcomes, with limited improvements in timing and adherence. This suggests that while community health workers may facilitate access and provide information, their marginal

impact is limited in the absence of stronger incentives or complementary interventions.

Taken together, these findings point to an important distinction between increasing access to care and ensuring continuity of care. Financial incentives appear to be effective in encouraging initial uptake of health services, such as institutional delivery and early vaccination, but are less effective in sustaining follow up behaviors that require repeated interaction with the health system. At the same time, supply side interventions in the form of community health workers, while valuable, may not be sufficient on their own to ensure adherence to recommended health practices.

These results have important policy implications for the design of maternal and child health programs. Improving child health outcomes requires not only increasing access to services but also strengthening the mechanisms that promote timely and complete utilization. This may involve designing targeted incentives for postnatal care, improving monitoring and follow up systems, and enhancing the capacity of health workers to ensure continuity of care. More broadly, the findings highlight the need for integrated policy approaches that combine demand side and supply side interventions to achieve sustained improvements in health outcomes in low resource settings.

# 12 Acknowledgements

I thank my advisor Dr. Devon Gorry for her extremely valuable advice since the inception of this project. I would also like to thank my other committee members, Dr. Jonathan Leganza, and Dr. Curtis Simon for their important inputs into this project. I thank the attendees of the Labor workshop in Clemson University for their invaluable feedback. I would like to thank Matthew Eaton, Benji Stalvey, and Chukwuma Nwoye for their contributions throughout the creation of this paper. Lastly, I would like to thank my fiance Alex Kanode for his econometric knowledge and economic intuitions.

# 13 Research Funding

There is no research funding for this project

# 14 Disclosure Statement

I declare that there are no competing interests

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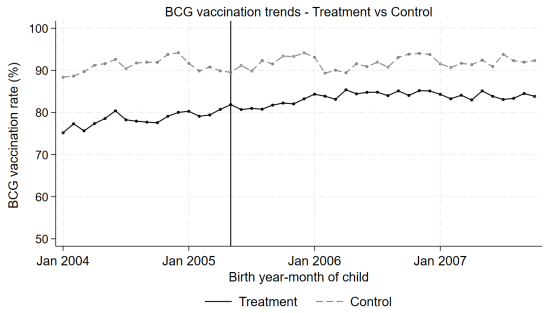
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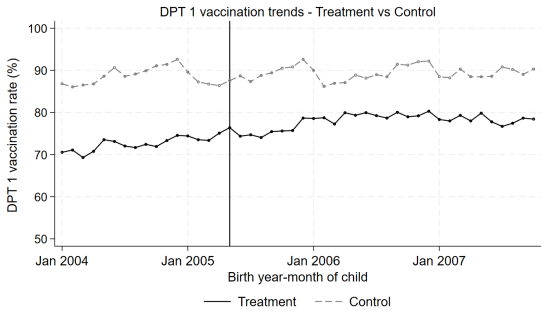
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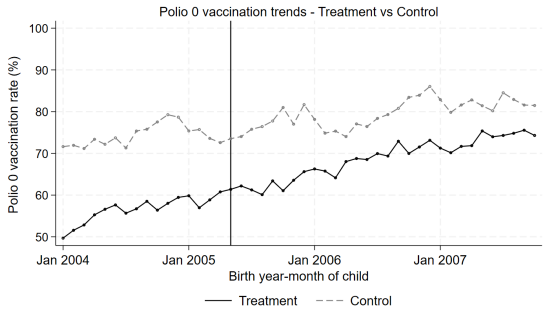
# 16 Tables and figures



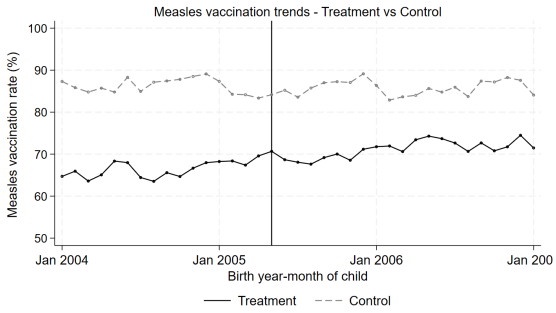

(a): BCG vaccine trend




(b): DPT 1 vaccine trend

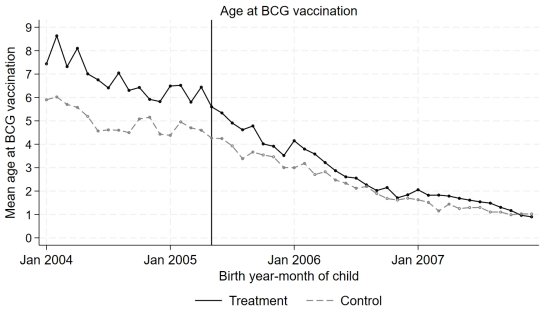



(c): Polio 0 vaccine trend

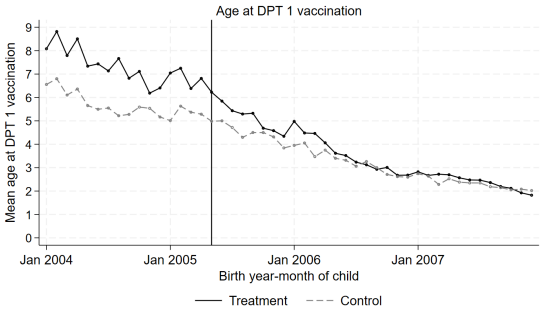



(d): Measles vaccine trend

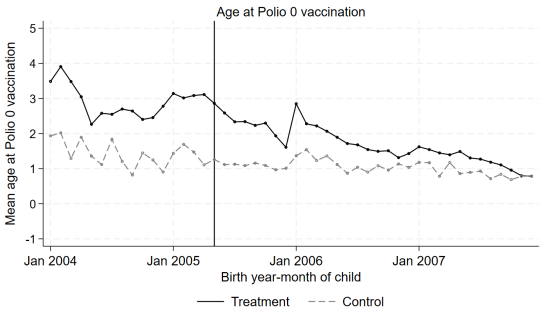
Figure 1: Raw trends of vaccination coverage by vaccine type



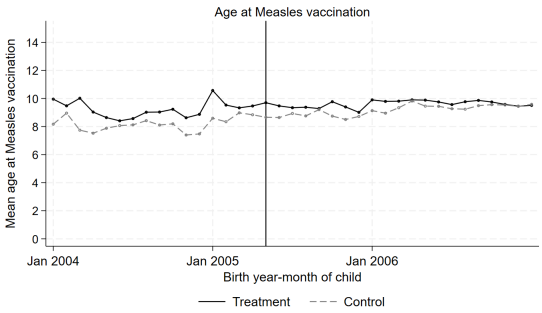

(a): BCG vaccine trend




(b): DPT 1 vaccine trend

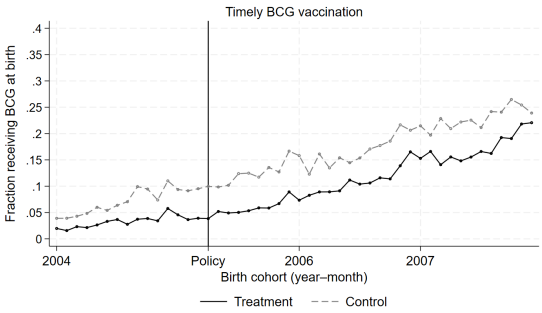



(c): Polio 0 vaccine trend

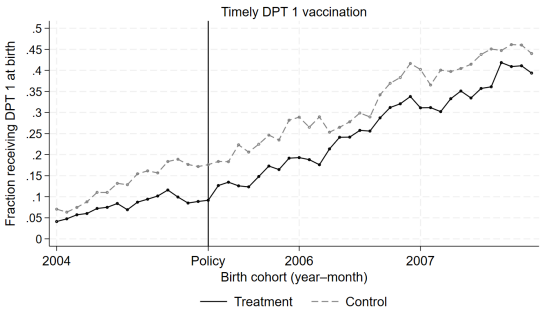



(d): Measles vaccine trend

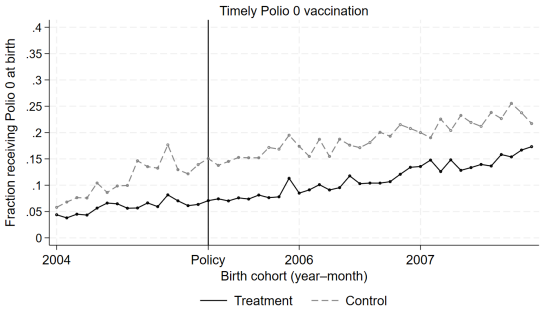
Figure 2: Raw trends of age of vaccination by vaccine type



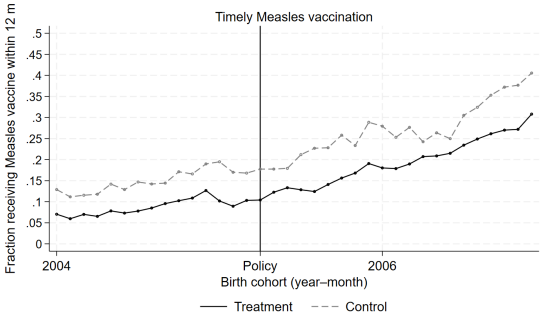

(a): Timely BCG




(b): Timely DPT 1

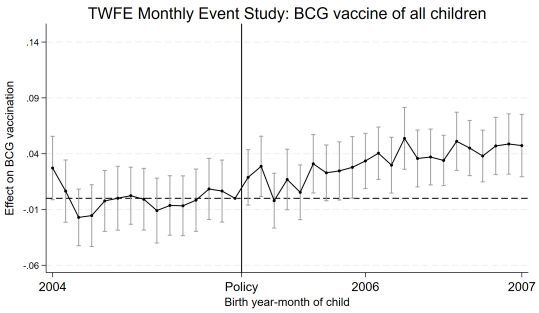



(c): Timely Polio 0

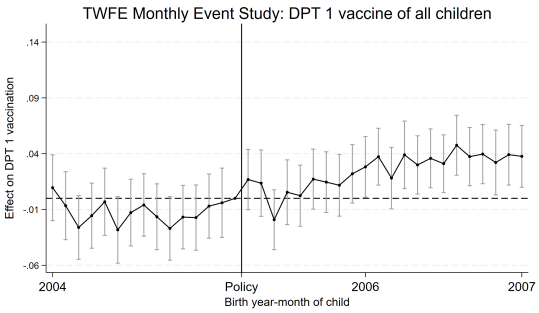



(d): Timely Measles

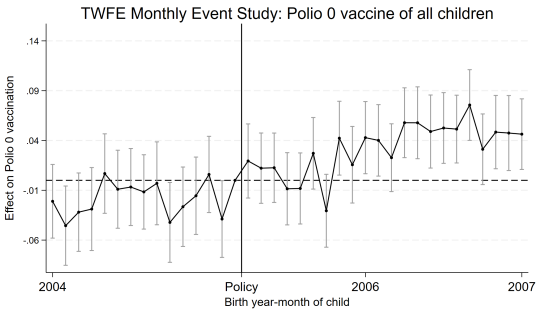
Figure 3: Raw trends of scheduled vaccination uptake by vaccine type



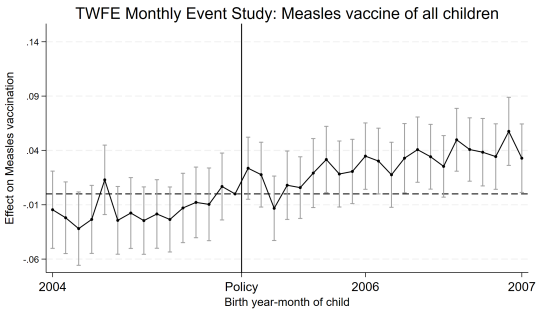

(a): BCG




(b): DPT 1

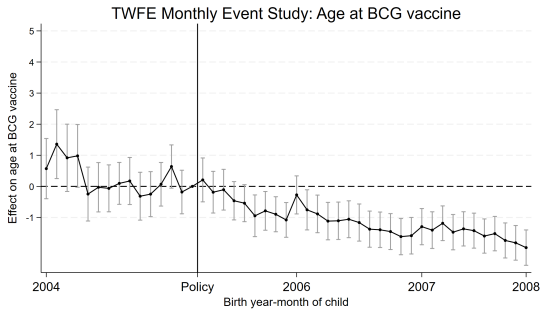



(c): Polio 0

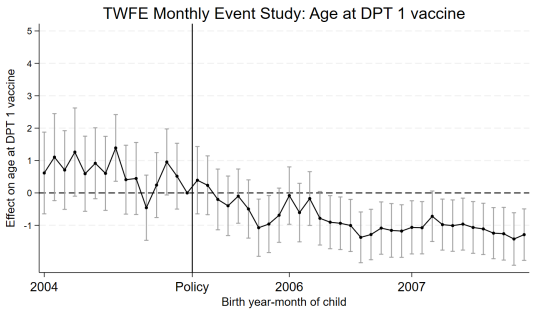



(d): Measles

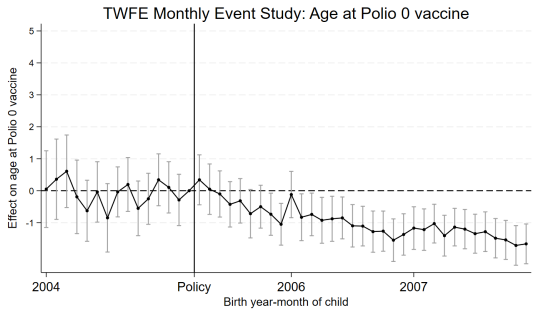
Figure 4: Event-study estimates of the effect of the policy on vaccination coverage by vaccine type.



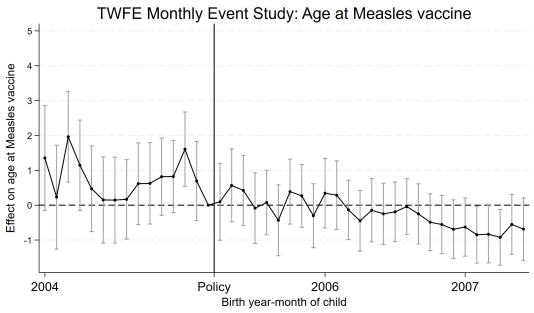

(a): age at BCG vaccine




(b): age at DPT 1 vaccine

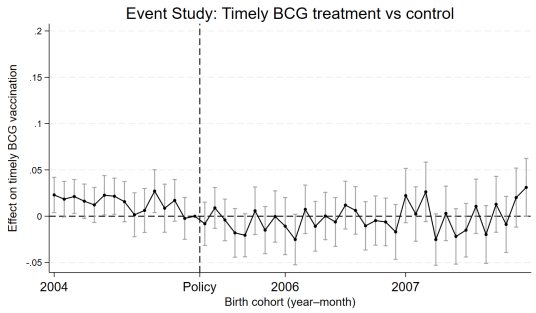



(c): age at Polio 0 vaccine

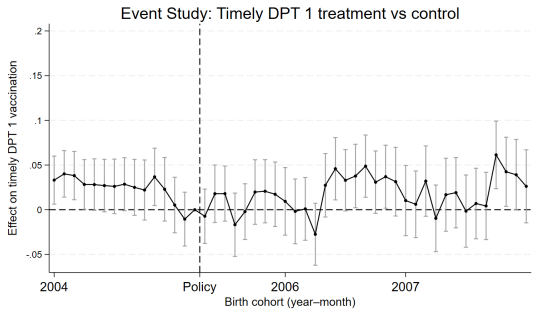



(d): age at Measles vaccines

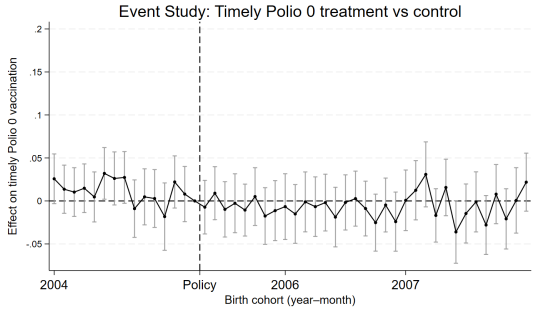
Figure 5: Event-study estimates of the effect of the policy on age at vaccination by vaccine type



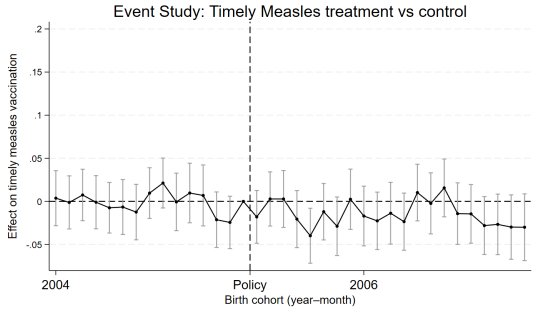

(a): Timely BCG vaccine




(b): Timely DPT 1 vaccine




(c): Timely Polio 0 vaccine




(d): Timely Measles vaccines

Figure 6: Event-study estimates of the effect of the policy on scheduled vaccination uptake by vaccine type

Table 2: Effect of JSY on Vaccination Coverage (LPS vs HPS)

| | **(1)** **BCG** | **(2)** **DPT 1** | **(3)** **Polio 0** | **(4)** **Measles** |
|---|---|---|---|---|
| Eligible × Post | 0.0284*** | 0.0304*** | 0.0599*** | 0.0393*** |
| | (0.0039) | (0.0041) | (0.0061) | (0.0043) |
| Pre-policy mean (treatment group) | 0.77 | 0.72 | 0.55 | 0.66 |
| Controls | Yes | Yes | Yes | Yes |
| State × district FE | Yes | Yes | Yes | Yes |
| Birth year-month FE | Yes | Yes | Yes | Yes |
| Observations | 261,666 | 261,653 | 257,044 | 208,367 |
| F-statistic | 169.73 | 210.93 | 306.74 | 222.08 |

*Notes:* The dependent variables are indicators for whether the child received the respective vaccine. Eligible × Post captures the effect of JSY on eligible mothers relative to ineligible mothers across low-performing (LPS) and high-performing states (HPS). The pre-policy mean is calculated for the treatment group in LPS. Controls include maternal education, age, household wealth quintile, caste, and religion. Standard errors (in parentheses) are clustered at the state–district level. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

Table 3: Impact of JSY on Age at Vaccination (LPS vs HPS)

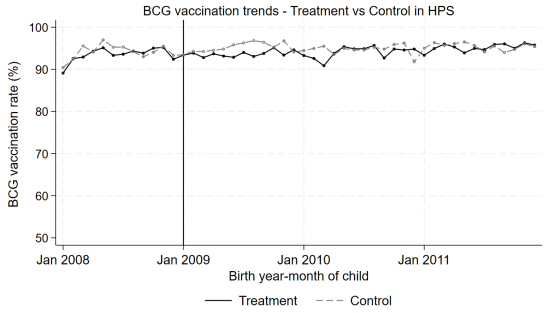
| | **(1)** **BCG** | **(2)** **DPT1** | **(3)** **Polio 0** | **(4)** **Measles** |
|---|---|---|---|---|
| Eligible × Post | -1.4381*** | -1.4803*** | -0.9696*** | -0.8122*** |
| | (0.1827) | (0.1828) | (0.1220) | (0.1644) |
| Pre policy mean (months, treatment group) | 6.7 | 7.3 | 2.8 | 9.1 |
| Controls | Yes | Yes | Yes | Yes |
| State × district FE | Yes | Yes | Yes | Yes |
| Birth year-month FE | Yes | Yes | Yes | Yes |
| Observations | 77,451 | 77,596 | 49,524 | 38,428 |
| F-statistic | 178.50 | 146.57 | 35.95 | 68.37 |

*Notes:* The dependent variables measure the age (in months) at which the child received the respective vaccine. Eligible × Post captures the effect of JSY on eligible mothers relative to ineligible mothers across low-performing (LPS) and high-performing states (HPS). The pre-policy mean is calculated for the treatment group in LPS. Controls include maternal education, age, household wealth quintile, caste, and religion. Standard errors (in parentheses) are clustered at the state–district level. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

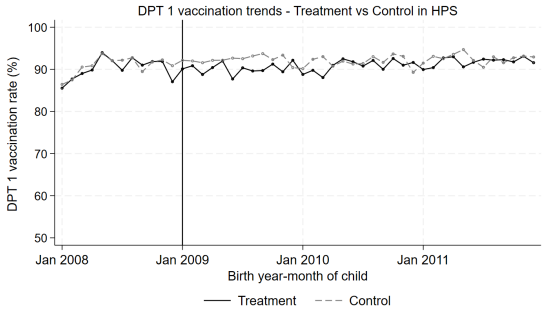
Table 4: Impact of JSY on Timely Vaccination (LPS vs HPS)

| | **(1)** **BCG** | **(2)** **DPT1** | **(3)** **Polio 0** | **(4)** **Measles** |
|---|---|---|---|---|
| Eligible × Post | -0.0222*** | -0.0259*** | -0.0185*** | -0.0288*** |
| | (0.0041) | (0.0055) | (0.0036) | (0.0047) |
| Pre-policy mean (treatment group) | 0.023 | 0.051 | 0.029 | 0.049 |
| Controls | Yes | Yes | Yes | Yes |
| State × district FE | Yes | Yes | Yes | Yes |
| Birth year-month FE | Yes | Yes | Yes | Yes |
| Observations | 272,131 | 272,131 | 272,131 | 194,206 |
| F-statistic | 112.47 | 252.84 | 89.10 | 163.30 |

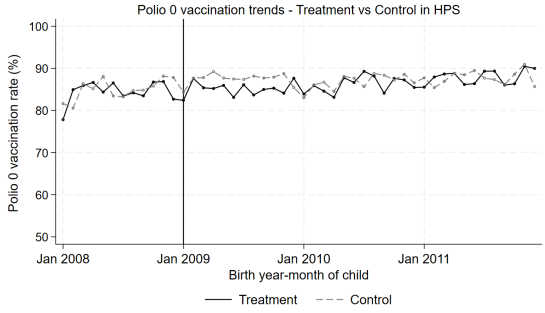
*Notes:* The dependent variables are indicators for whether the child received the respective vaccine within the recommended time window. Treat × Post captures the effect of JSY on eligible mothers relative to ineligible mothers across low-performing (LPS) and high-performing states (HPS). Controls include maternal education, age, household wealth quintile, caste, and religion. Standard errors (in parentheses) are clustered at the state–district level. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.



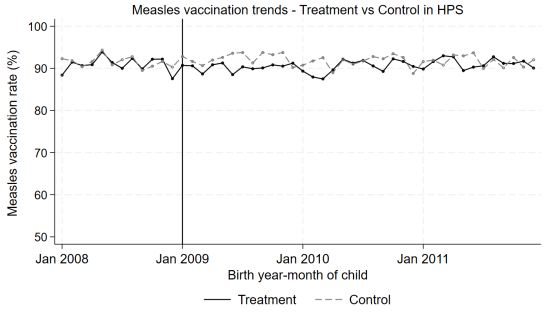

(a): BCG vaccine trend in HPS




(b): DPT 1 vaccine trend in HPS

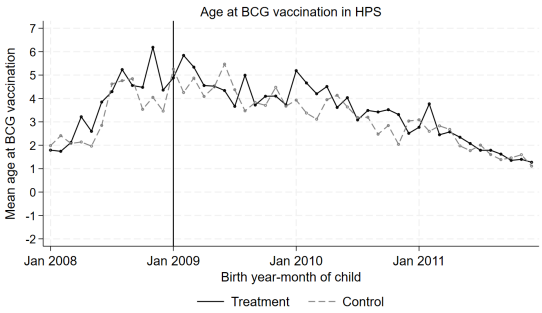



(c): Polio 0 vaccine trend in HPS

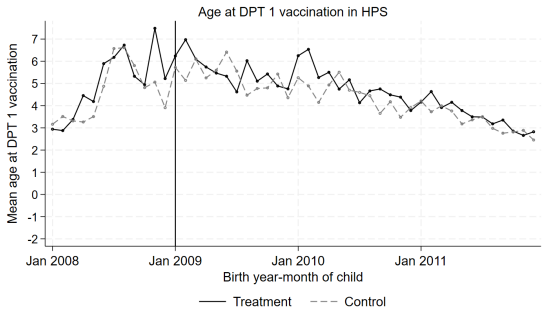



(d): Measles vaccine trend in HPS

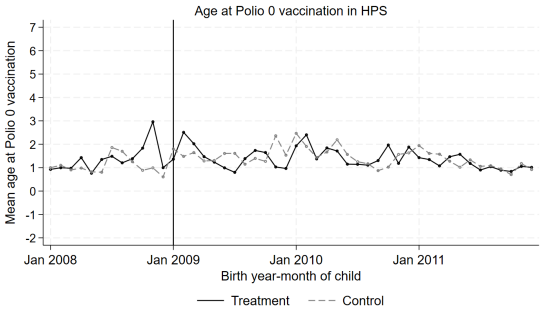
Figure 7: Raw trends of vaccination coverage by vaccine type in HPS



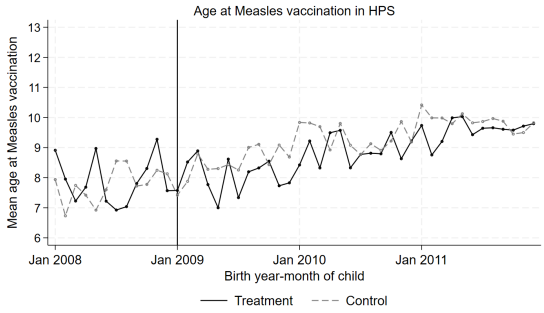

(a): Age at BCG vaccine trend in HPS




(b): Age at DPT 1 vaccine trend in HPS

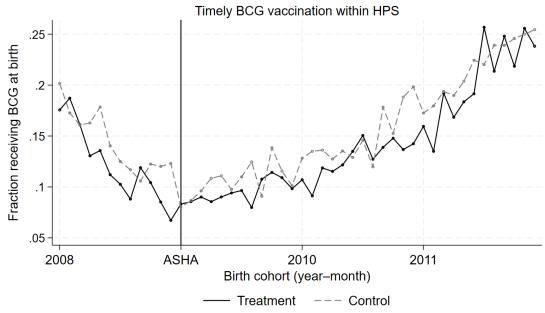



(c): Age at Polio 0 vaccine trend in HPS

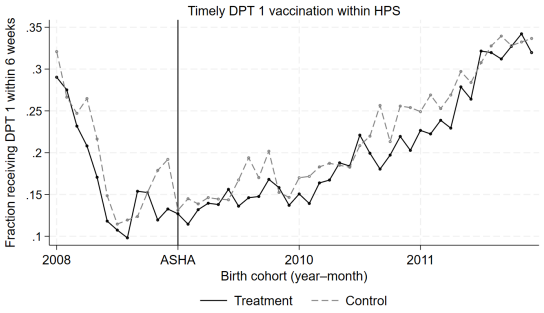



(d): Age at Measles vaccine trend in HPS

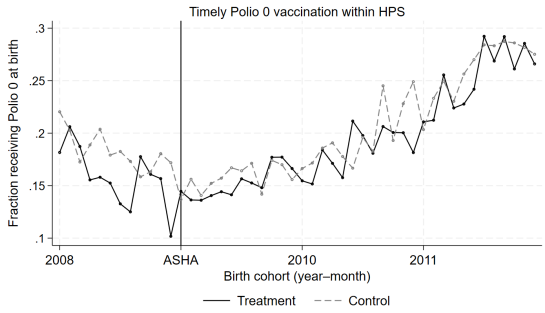
Figure 8: Raw trends of age at vaccination by vaccine type in HPS



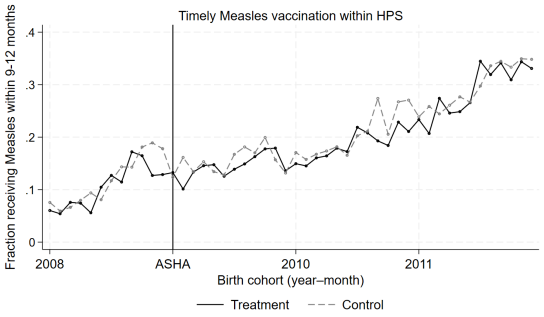

(a): Timely BCG vaccine trend in HPS




(b): Timely DPT 1 vaccine trend in HPS

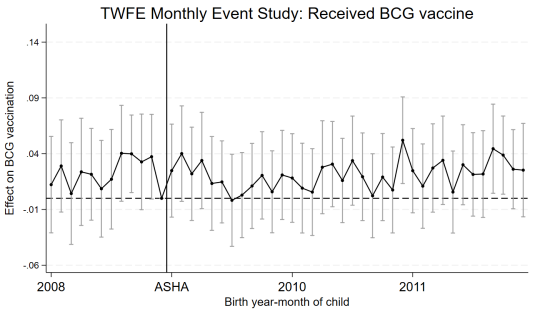



(c): Timely Polio 0 vaccine trend in HPS

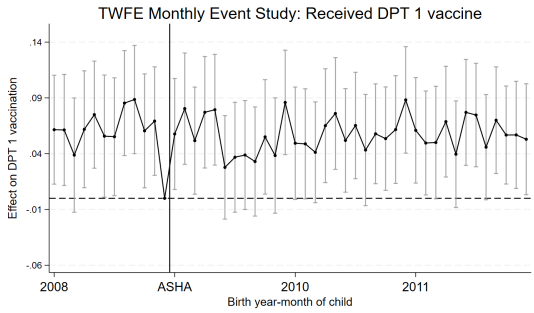



(d): Timely Measles vaccine trend in HPS

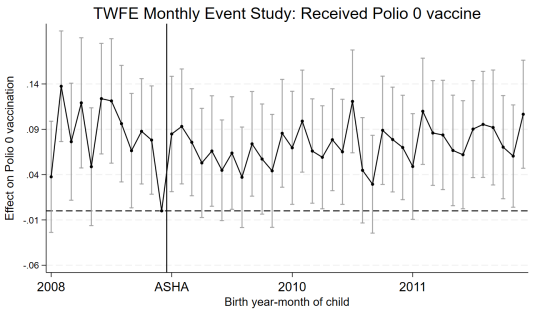
Figure 9: Raw trends of scheduled vaccination by vaccine type in HPS



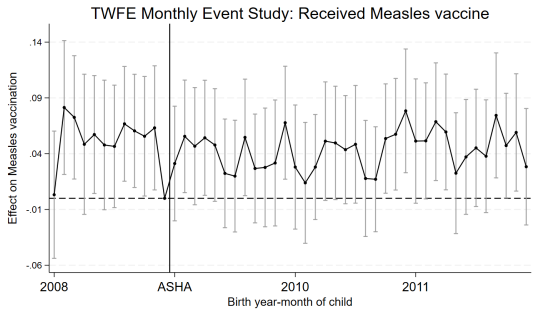

(a): BCG




(b): DPT 1

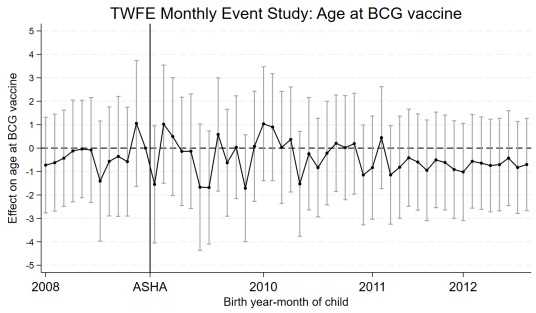



(c): Polio 0

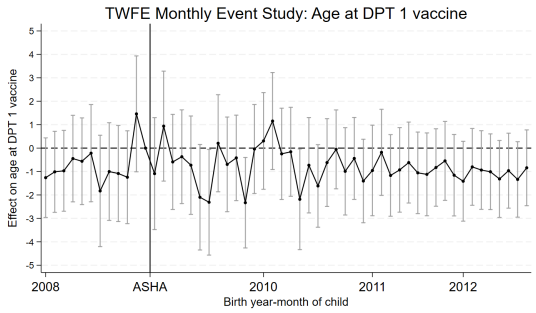



(d): Measles

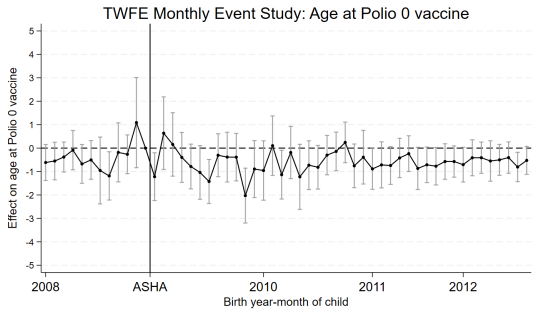
Figure 10: Event-study estimates of the effect of the policy on vaccination coverage by vaccine type within HPS



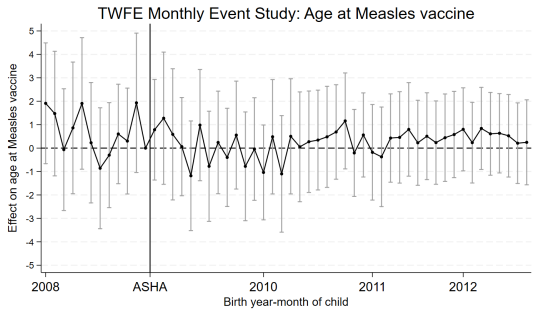

(a): age at BCG vaccine




(b): age at DPT 1 vaccine

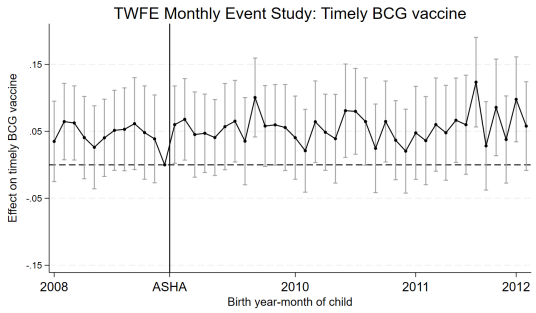



(c): age at Polio 0 vaccine

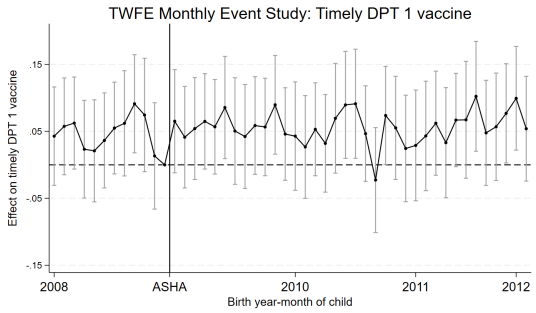



(d): age at Measles vaccines

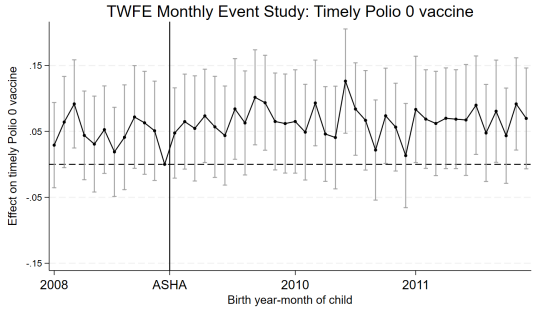
Figure 11: Event-study estimates of the effect of the policy on age at vaccination by vaccine type within HPS



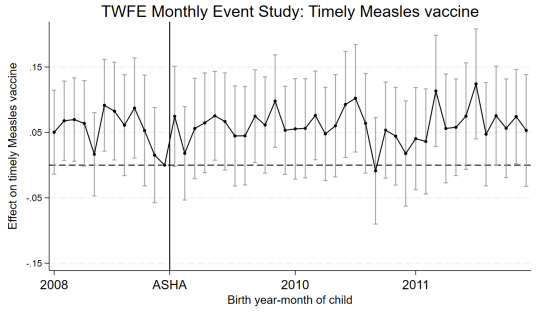

(a): Timely BCG vaccine




(b): Timely DPT 1 vaccine




(c): Timely Polio 0 vaccine




(d): Timely Measles vaccines

Figure 12: Event-study estimates of the effect of the policy on scheduled vaccination by vaccine type within HPS

Table 5: Impact of ASHAs on Vaccination Coverage within High-Performing States (HPS)

| | **(1)** | **(2)** | **(3)** | **(4)** |
|---|---|---|---|---|
| | **BCG** | **DPT1** | **Polio 0** | **Measles** |
| Eligible × Post (HPS) | -0.0010 | -0.0058 | -0.0107* | -0.0086 |
| | (0.0044) | (0.0053) | (0.0061) | (0.0056) |
| Pre policy mean (treatment group) | 0.92 | 0.89 | 0.83 | 0.90 |
| Controls | Yes | Yes | Yes | Yes |
| State × district FE | Yes | Yes | Yes | Yes |
| Birth year-month FE | Yes | Yes | Yes | Yes |
| Observations | 53,205 | 53,214 | 51,291 | 48,202 |
| F-statistic | 34.08 | 39.08 | 37.75 | 12.06 |

*Notes:* The dependent variables are indicators for whether the child received the respective vaccine. Eligible × Post (HPS) captures the effect of the expansion of ASHAs in 2009 on eligible mothers relative to ineligible mothers within high-performing states. Controls include maternal education, age, household wealth quintile, caste, religion, and birth characteristics. Standard errors (in parentheses) are clustered at the state–district level. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

Table 6: Impact of ASHAs on Age at Vaccination within High-Performing States (HPS)

| | **(1)** | **(2)** | **(3)** | **(4)** |
|---|---|---|---|---|
| | **BCG** | **DPT1** | **Polio 0** | **Measles** |
| Eligible × Post (HPS) | 0.0184 | 0.0289 | -0.1562 | -0.2675 |
| | (0.1626) | (0.1707) | (0.1390) | (0.2958) |
| Pre policy mean (months, treatment group) | 1.3 | 2.7 | 1.2 | 11.4 |
| Controls (maternal & household) | Yes | Yes | Yes | Yes |
| State × district FE | Yes | Yes | Yes | Yes |
| Birth year-month FE | Yes | Yes | Yes | Yes |
| Observations | 20,068 | 19,541 | 18,147 | 15,800 |
| F-statistic | 92.61 | 97.27 | 11.73 | 62.78 |

*Notes:* The dependent variables measure the age (in months) at which the child received the respective vaccine. Eligible × Post (HPS) captures the effect of the expansion of ASHAs in 2009 on eligible mothers relative to ineligible mothers within high-performing states. Controls include maternal education, age, household wealth quintile, caste, religion, and birth characteristics. Standard errors (in parentheses) are clustered at the state–district level. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

Table 7: Impact of ASHAs on Timely Vaccination (Within HPS)

| | (1) BCG | (2) DPT1 | (3) Polio 0 | (4) Measles |
|---|---|---|---|---|
| Eligible × Post | 0.0103* | 0.0078 | 0.0167*** | 0.0020 |
| | (0.0060) | (0.0075) | (0.0061) | (0.0056) |
| Pre policy mean (treatment group) | 0.11 | 0.15 | 0.12 | 0.07 |
| Controls | Yes | Yes | Yes | Yes |
| State × district FE | Yes | Yes | Yes | Yes |
| Birth year-month FE | Yes | Yes | Yes | Yes |
| Observations | 53,316 | 53,316 | 53,316 | 53,316 |
| F-statistic | 44.49 | 58.11 | 15.22 | 35.28 |

*Notes:* The dependent variables are indicators for whether the child received the respective vaccine within the recommended time window. Treat × Post captures the effect of the introduction of ASHAs in high-performing states on eligible mothers relative to ineligible mothers. Controls include maternal education, age, household wealth quintile, caste, and religion. Standard errors (in parentheses) are clustered at the state–district level. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.